POLITECNICO DI MILANO

Facoltà di Ingegneria dei Sistemi

Laurea Specialistica in Ingegneria Gestionale

SUSTAINABLE TELEMEDICINE SERVICES: ENABLING FACTORS

Relatore:

Chiar.ma P.ssa Cristina MASELLA

Correlatori:

Ing. Emanuele LETTIERI

Ing. Laura BARTOLI

Tesi di Laurea di:

Federica SEGATO

Matr. n. 733023

Anno Accademico 2009-2010

Alla mia famiglia e

a Giovanni,

che presto lo diventerà.

RINGRAZIAMENTI

Alla P.ssa Masella, per avermi permesso di svolgere questo lavoro.

Al Prof. Lettieri, per avermi seguito attentamente durante lo svolgimento del lavoro con consigli preziosi e per avermi insegnato un'impostazione metodologica e scientifica affascinante al punto da incoraggiarmi a proseguire negli studi.

A Laura, per l'aiuto e per la presenza costante e rassicurante, anche nei momenti più critici del lavoro.

Ai nuovi amici della 0.28, piacevole preambolo dell'avventura che mi aspetta.

Agli amici del Poli e della Bovisa che mi hanno letteralmente preso per mano e accompagnato in questi anni di vita piena e intensa, a voi un grazie sconfinato, nella certezza che la nostra Amicizia dura per sempre.

Prometto di scrivere per voi accurati ringraziamenti personalizzati al più presto!

CONTENTS

TABLE OF FIGURES

ABSTRACT

Among the sectors that seem indifferent toward considering sustainability as a strategy or intent, Health Care was one of the most emblematic cases, even though it is facing great challenges in its structure, organization, service delivery and operations. Within this context, the development of new paradigms of healthcare delivery that may be sustainable over time is becoming an imperative. With this regard, technology has drawn increasing attention as one of the "emerging service delivery vehicles running on the information highway" and its application to healthcare has been denominated E-health.

Despite the enthusiasm, not much is understood about how to make these changes factual and, above all, in line with the challenge of sustainable development. Specialized research provides little insight into why there is so little routine use of technologies in clinical practice: this is the reason why, in recent years, studies on the organizational sustainability have emerged.

Nevertheless, since concentrating on sustainability and technology in health care as a whole may turn out to be an objective out of scale, the aim of the work is to evaluate the organizational sustainability of domiciliary assistance services through telemedicine for patients affected by COPD, as an application of health care service delivered through an e-health application.

The research consists in defining the concept of organizational sustainability of a telemedicine service; secondarily, in defining a conceptual framework of drivers, then applied on 7 out of the 9 selected case studies, chosen within the Italian healthcare context. The observation of the cases allows to create an empirical framework of drivers that, once validated on the other 2 experiences, indicates whether a telemedicine application is organizationally sustainable or not. The work represents an attempt to gather the actual biggest challenge that consists in moving away from funding isolated telemedicine projects and to put successful projects into general clinical practice and routine use.

SOMMARIO

Contesto, obiettivi e metodologia di lavoro (Capitolo 1)

Il dibattito su quando e quanto le azioni dell'uomo possano avere effetti dannosi sulla realtà è ultimamente incrementato, al punto che il termine *sostenibilità*, inteso come capacità di agire in modo non dannoso, è divenuto argomento di discussione nella quasi totalità degli ambienti di studio e non solo. È infatti evidente che le risorse (non solo quelle ambientali) non sono infinite e che un atteggiamento scorretto o disattento nei confronti di queste potrebbe avere conseguenze anche molto gravi sulla qualità della vita, soprattutto per le generazioni future. Tuttavia, i risultati concreti che derivano da questo crescente impegno nella ricerca di soluzioni sostenibili sono al momento piuttosto scarsi, se si considera che persino la definizione del termine sostenibilità non è univocamente condivisa. Nonostante questa indecisione di fondo, complice una martellante insistenza dei media in particolare sul tema della sostenibilità ambientale, alcuni modelli esplicativi si sono affermati in modo più deciso rispetto ad altri, soprattutto per la valutazione del comportamento delle imprese rispetto all'ambiente circostante. Tra i modelli più affermati vi è la Triple Bottom Line (TBL), che considera la sostenibilità non solo dal punto di vista ambientale, ma anche economico e sociale; l'idea di fondo della TBL consiste nel ritenere che il successo di un'Impresa possa e debba essere misurato non solo attraverso i tradizionali indici finanziari, bensì anche attraverso le sue performances sociali ed etiche.

Accanto a questo modello esplicativo ne esistono molti altri; ciononostante lo sforzo di passare dalla teoria alla pratica è ancora una prerogativa per pochi. Infatti, se si esclude il settore industriale e si considera, per esempio, il mondo dei servizi alla persona, l'impegno nella ricerca di modelli sostenibili di conduzione delle attività è soprendentemente scarso. La Sanità è certamente tra i più emblematici esempi di questo ingiustificato scarso interesse. Un'analisi anche superficiale del settore porterebbe, infatti, a notare che al momento i Sistemi Sanitari di tutto il Mondo sono interessati da fenomeni che minano notevolmente la loro stabilità e quindi la loro sostenibilità. Tra questi, certamente il progressivo invecchiamento della popolazione, che a sua volta determina un incremento sensibile dell'incidenza delle patologie croniche e, con esse, il lievitare della spesa legata al loro trattamento (diagnosi, terapia, soccorso d'emergenza per riacutizzazioni). In secondo luogo, i cittadini dispongono di una cultura mediamente più alta rispetto al passato, anche in merito alle pratiche mediche: conoscendo di più, tendono a richiedere un servizio di qualità più elevata. Inoltre, le dinamiche generate dalla globalizzazione e lo sviluppo delle tecnologie mediche stanno

contribuendo ad alimentare il dibattito in merito alla ricerca di forme rinnovate e più efficienti per l'erogazione del servizio.

Infatti, data la complessità del settore sanitario e della sua organizzazione, ogni soluzione che possa risultare utile a sanare le difficoltà intrinseche e a facilitare in qualche modo la ricerca di soluzioni che lo rendano sostenibile viene presa in seria considerazione e lo sviluppo delle tecnologie applicabili in ambito medico si sta affermando come un fattore abilitante degno di nota; a questo proposito risulterebbe interessante comprendere se e come l'impiego di tecnologie all'avanguardia potrebbe effettivamente incrementare il livello di sostenibilità del Servizio Sanitario.

Tuttavia, data la vastità dei temi della sostenibilità e dell'utilizzo delle tecnologie nel Settore Sanitario, risulterebbe del tutto inefficiente focalizzarsi su di essi in modo generico; per questa ragione il presente lavoro intende metterne in luce solo alcuni aspetti. In particolare, l'analisi intende focalizzarsi sulla sostenibilità organizzativa di alcuni esempi di applicazione della tecnologia nel settore sanitario, volta al trattamento delle patologie croniche: la telemedicina.

La telemedicina consiste nello scambio di informazioni a distanza tra medico e paziente, finalizzato al monitoraggio dello stato di salute di quest'ultimo mediante comunicazione elettronica di dati (J.Y. Chang, 2009). Il teleconsulto, la videoconferenza, il telemonitoraggio sono solo alcuni esempi delle molteplici tecnologie attualmente utilizzate per questo scopo.

Sebbene esistano numerosi esempi notevoli di efficienza dell'utilizzo di questi strumenti, in particolare nell'ambito delle patologie cardiologiche, la letteratura specializzata internazionale suggerisce interessanti spunti di discussione in merito alle sperimentazioni attualmente dedicate alla Broncopneumopatia Cronica Ostruttiva (BPCO).

L'interesse verso questo argomento è giustificato dall'incidenza che la BPCO, patologia che determina difficoltà nel respiro accompagnate da un progressivo deterioramento delle capacità funzionali, ha sul bilancio del Sistema Sanitario Mondiale: in Italia, per esempio, la BPCO rappresenta la terza causa di morte dopo le malattie cardiovascolari e i tumori; la spesa media annua per paziente, che è pari a circa 3.000 Euro negli stadi meno severi, raggiunge i 7.000 Euro nei pazienti più gravi; nel solo Regno Unito, inoltre, si stima che gli individui affetti dalla patologia siano attualmente 1,5 milioni (C.Gardiner, 2009), mentre negli Stati Uniti la spesa per i malati di BPCO nel 2002 è stata circa pari a 32,1 milioni di dollari.

La letteratura internazionale a riguardo si focalizza principalmente su tematiche cliniche o tecnologiche, mentre dalle sperimentazioni appare evidente come non sia possibile prescindere da un'adeguata organizzazione delle strutture affinchè il servizio erogato sia valido in termini di efficienza (sostenibilità economica) e di efficacia (effettivamente utile allo scopo per cui è stato

concepito dal punto di vista del paziente e dal punto di vista della struttura sanitaria stessa in situazioni ideali)(C.Domingo, 2008).

Pertanto il presente lavoro propone la definizione di un framework che consenta di valutare il livello di sostenibilità organizzativa delle sperimentazioni, in funzione delle criticità comunemente rilevate nelle applicazioni sperimentali della telemedicina finalizzata al trattamento di pazienti affetti da BPCO. L'obiettivo ultimo dell'analisi è quello di supportare la definizione di un modello di cura condiviso, che sia basato sull'evidenza e che, come tale, costituisca una valida alternativa alle sperimentazioni singole, basate soltanto sul buon senso dei referenti di progetto.

La prima fase del lavoro consiste in un'analisi approfondita della letteratura, volta a definire lo stato dell'arte in merito al concetto di sostenibilità organizzativa e alle sue potenziali applicazioni. In particolare, l'analisi intende definire quali sono le maggiori fonti di criticità percepite e riportate dagli autori. Una volta comprese le criticità, il confronto con alcuni esperti del settore ha consentito la definizione di un framework concettuale, sulla base del quale è stata costruita un'intervista, utilizzata poi come strumento di analisi per lo svolgimento dei casi di studio. L'indagine ha interessato alcune strutture del panorama Italiano, scelte in collaborazione con lo Staff del Progetto Strategico BPCO di Regione Lombardia, che ha messo a disposizione di questo lavoro di tesi le informazioni a riguardo delle 9 sperimentazioni più interessanti contenute nel database di progetto.

I risultati delle interviste condotte in loco per 7 delle 9 esperienze selezionate, opportunamente riordinati e validati, hanno permesso di mettere in discussione il framework concettuale: mentre alcuni drivers sono stati confermati, altri non hanno trovato riscontro nella realtà; alcuni aspetti che non erano stati trattati precedentemente sono stati aggiunti a posteriori.

Il framework empirico, risultante dalle modifiche applicate in seguito all'analisi delle situazioni reali, è stato in seguito testato sulle 2 esperienze escluse in prima battuta, in quanto indicate come le più complete ed efficienti e, come tali, più utili ai fini del test del modello.

La metodologia seguita rispecchia quanto suggerito dall'approccio di Yin (2003) per affrontare casi di studio multipli (replication logic e integrazione con documentazione teorica).

Una rappresentazione del flusso di lavoro è disponibile nella figura seguente.

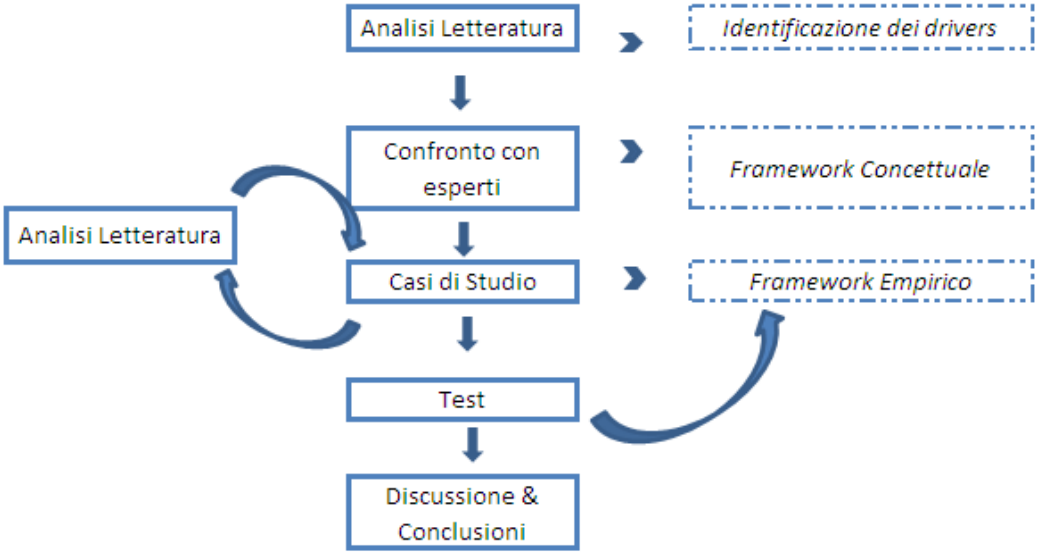

Figura 1 – Rappresentazione del flusso di ricerca

Analisi della letteratura (Capitoli 2 e 3)

Un'analisi preliminare della letteratura ha consentito innanzitutto di definire le principali tipologie di servizio finalizzate al trattamento della BPCO che si servono di soluzioni tecnologiche, tra queste: il *teleconsulto*, che consiste nella consulenza in merito alla situazione di salute di un paziente, mediante l'utilizzo di tecnologie ad hoc (e.g. webcam); il *telemonitoraggio*, che consiste nella trasmissione di dati tramite telefono o internet tra il paziente e la figura clinica che si occupa della sua patologia; l'*home tele-nursing*, che consiste nella trasmissione delle informazioni eseguita dall'infermiere nel corso di una visita domiciliare; l'attività di *tele-education*, che comprende l'insegnamento dell'utilizzo delle apparecchiature, per il pubblico o per le professionalità coinvolte; la *telesurgery*, che consiste nell'esecuzione di operazioni chirurgiche da remoto; la *tele-amministrazione*, che consiste nello svolgimento delle attività amministrative e dell'organizzazione delle attività utilizzando strumenti informatici che le facilitino.

È evidente che questo genere di applicazioni possono consentire un miglioramento sensibile nell'erogazione del servizio sanitario in aree disagiate, difficili da raggiungere; tuttavia, i vantaggi non sono da meno per le aree che non presentano queste caratteristiche, in quanto la telemedicina permette consistenti miglioramenti anche nelle modalità di esecuzione delle attività routinarie.

Tuttavia, nonostante l'evidenza dei vantaggi che la telemedicina può potenzialmente offrire, essa difficilmente viene introdotta nella routine delle strutture sanitarie. La spiegazione generalmente addotta per appianare questa incongruenza tra le intenzioni e la realtà dei fatti è la scarsa attenzione alle caratteristiche dello staff e alle sua capacità e intenzioni di accettare un

cambiamento nella modalità di erogazione del servizio che, da un lato richiede un riallineamento delle competenze, dall'altro l'assunzione di un rischio talvolta percepito come eccessivo.

L'analisi della letteratura ha permesso pertanto di identificare come principale minaccia per la sostenibilità delle sperimentazioni non tanto la mancanza di sostegno economico, quanto piuttosto l'incapacità organizzativa di accettare il cambiamento da esse imposto. In particolare, è stato possibile identificare 7 dimensioni dell'organizzazione dalle quali dipende in modo più evidente il buon funzionamento delle sperimentazioni e, quindi, la loro sostenibilità: le caratteristiche del paziente/caregiver, le caratteristiche delle professionalità coinvolte, le caratteristiche della struttura organizzativa, fattori politici, fattori culturali, attori/reti di persone/alleanze, capacità di gestione del cambiamento e del rischio.

Definizione del framework concettuale e casi di studio (Capitolo 4)

I risultati raggiunti a seguito dell'analisi della letteratura sono stati oggetto del confronto con alcuni esperti dell'argomento, nell'ambito di un Workshop tenutosi a Milano il 26 Novembre 2009. Dall'integrazione di quanto rilevato tramite l'analisi della letteratura con il parere degli esperti, che hanno permesso di calare lo schema teorico nella realtà delle sperimentazioni, è stato possibile definire un framework concettuale, che comprende 6 drivers: l'educazione del paziente, il ruolo dell'infermiere, protocolli e linee guida, continuità della cura, coinvolgimento di fornitori e finanziatori, tecnologia utilizzata. Le dimensioni culturali e politiche non sono state inserite, in quanto l'indagine è stata condotta all'interno di strutture appartenenti al panorama Italiano e, come tali, omogenee da entrambi i punti di vista.

Il framework è stato utilizzato come chiave di lettura per lo studio di 7 delle 9 sperimentazioni, ubicate a Cremona, Torino, Rieti, Roma, Casatenovo, Arenzano e Varese; le ultime due, Mantova e Verona, sono state invece utilizzate solo per la fase di test. Una sintesi delle caratteristiche delle strutture che ospitano i diversi servizi è riportata nella Tabella 1.

	Cremona	Torino	Rieti	Roma	Casatenovo	Arenzano	Varese	Mantova	Verona
Region	Lombardia	Piemonte	Lazio	Lazio	Lombardia	Liguria	Lombardia	Lombardia	Veneto
LHC	Cremona	Torino 2	Rieti	Roma	Lecco	Genova 3	Varese	Mantova	Verona
Name of the structure	Cremona Hospital	C.P.A. of Torino	San Camillo de Lellis Hospital	San Camillo-Forlanini	I.N.R.C.A. di Casatenovo	La Colletta Hospital	Fondazione Macchi	Carlo Poma Hospital	Bussolengo Hospital
Unit description	Complex operative Unit	Complex operative unit	Complex Operative Unit	Complex Operative	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit
Beds	30	-	1	60	5	10	35	20	16

Tabella 1 – Sintesi delle strutture che ospitano i progetti di telemedicina analizzati

L'analisi è stata svolta mediante la somministrazione di un'intervista predefinita (la cui struttura è riportata nell'Appendice A) ai responsabili dei progetti e ad eventuali figure che era opportuno far partecipare all'incontro per l'apporto che esse potevano dare in termini di comprensione dei particolari della sperimentazione. In totale sono state svolte 15 interviste in loco a specialisti ed infermiere. Il vantaggio di svolgere le interviste nel luogo in cui la sperimentazione viene gestita risiede nel fatto che, qualora alcuni aspetti risultassero poco chiari, sarebbe stato possibile domandare chiarimenti, coinvolgere altre figure nell'intervista o eventualmente visionare le modalità di funzionamento del servizio direttamente.

Le caratteristiche fondamentali dei servizi offerti nelle diverse strutture sono sintetizzati nella tabella seguente. Per una descrizione più dettagliata si rimanda al capitolo 4 del presente lavoro di tesi.

	Telemedicine-based services provided	*Telemedicine-based Services Main Goals*	*Patients*		*Main Actors Involved*
			number	*typology*	
1 **CREMONA**	Telemonitoring Teleconsulting Domiciliary Assistance	Home Hospitalization	17	Seriously Severe	Hospital physicians; LHC staff
2 **TORINO**	Telemonitoring	Follow-up of ambulatory patients	15 -> 60	Quite Severe	Hospital physicians; Call center operator
3 **RIETI**	Telemonitoring Teleconsulting	Follow-up of ambulatory patients; overcoming of geographical barriers	29	Severe	Hospital Nurse
4 **ROMA**	Telemonitoring Teleconsulting	Follow-up of ambulatory patients	8	Quite Severe	Hospital physician
5 **CASATENOVO**	Telemonitoring	Follow-up of ambulatory patients; overcoming of geographical barriers	(A) 20	Severe	Hospital physician
			(B) 30	Severe	
			(C) 30	Severe	
			(D) 8	Quite Severe	
6 **ARENZANO**	Telemonitoring	Correct disease diagnosis	-	-	General Practitioners
7 **VARESE**	Telemonitoring Teleconsulting Temporary telemonitoring	Follow-up of ambulatory patients; overcoming of geographical barriers	≈ 300	Severe	Hospital physicians; Call center operator;
8 **MANTOVA**	Teleconsulting Domiciliary Assistance	Follow-up of ambulatory patients; Home Hospitalization	160	Seriously Severe/Severe	Hospital Nurse; LHC staff
9 **VERONA**	Telemonitoring Teleconsulting	Home Hospitalization	240	Seriously Severe/Severe	Hospital physicians; Hospital Nurse

Tabella 2 – Sintesi delle sperimentazioni

Una volta trascritte le interviste, integrate con informazioni provenienti da fonti secondarie e validate dagli intervistati stessi, è stata costruita per ogni caso una riproduzione del framework concettuale, nella quale compaiono le informazioni riguardanti il caso specifico. Nel caso in cui alcuni fattori determinanti non abbiano trovato collocazione in nessuna delle caselle, essi sono stati indicati in un'apposita sezione della tabella.

In questo modo è stato possibile discutere i contenuti del framework e conseguentemente definire il framework empirico.

Definizione del framework empirico (Capitolo 5)

Come esposto nella sezione relativa alla metodologia utilizzata, a seguito delle interviste alcune leve sono state confermate (o parzialmente confermate), mentre altre sono state eliminate. In Tabella 4 sono riportate le variazioni subite dal framework concettuale a seguito delle interviste.

	STATO	MODIFICA
Educazione del paziente	PARZIALMENTE CONFERMATO	*riallineamento delle competenze*
Ruolo dell'infermiere	CONFERMATO	
Protocolli e Linee guida	PARZIALMENTE CONFERMATO	*istituzionalizzazione*
Continuità della cura	PARZIALMENTE CONFERMATO	*coordinamento Spec-Inf* *Coordinamento ASL-AO*
Coinvolgimento fornitori/finanziatori	PARZIALMENTE CONFERMATO	*Stabilità del finanziamento*
Tecnologia utilizzata	NON CONFERMATO	

Tabella 3 – Leve confermate/non confermate

Accanto a queste, è stato possibile identificare tre drivers che non erano stati inizialmente inclusi nel framework, considerando le affinità presenti tra le criticità rilevate nelle diverse sperimentazioni: il *supporto psicologico*, l'*affidabilità della tecnologia* e la *dimostrabilità dei risultati*.

Infine, il framework empirico, risultante dalla revisione di quello concettuale a seguito dell'analisi dei casi di studio e composto dai 9 drivers indicati precedentemente, è stato testato tramite l'analisi degli ultimi due casi (Mantova e Verona). Il motivo che ha spinto a seleziore queste due sperimentazioni è legato al fatto che esse possiedono un grado di maturità, istituzionalizzazione e riconoscimento nel mondo scientifico più significativo rispetto a tutte le altre esperienze analizzate e risultavano pertanto una base interessante per testare l'efficienza del framework.

L'analisi delle ultime due sperimentazioni ha consentito di evidenziare la completezza del modello esplicativo, che permette di descrivere in modo completo ed esaustivo i due servizi e i loro fattori critici di successo.

Implicazioni e conclusioni (Capitoli 6 e 7)

Dal momento che non è stata assegnata nessuna scala di importanza nè di ordinamento dei drivers nel corso dell'analisi dei dati, le considerazioni conclusive del lavoro di tesi non sono volte a stabilire una stima dell'importanza relativa dei drivers, bensì ad evidenziare le implicazioni che il presente lavoro ha per le professionalità coinvolte nel servizio in modo diretto o indiretto: istituzioni e legislatori, professionisti sanitari, fornitori di tecnologia e ricercatori.

Istituzioni e legislatori: i drivers sui quali questi attori possono più direttamente influire sono: il *ruolo dell'infermiere*, in quanto hanno la possibilità di discutere del contenuto del suo percorso formativo e potrebbero pertanto ipotizzare una modalità per permettere di allineare le sue competenze con quanto richiesto dalle sperimentazioni di telemedicina; *l'istituzionalizzazione*, in quanto hanno la possibilità di imporre linee guida operative e condivise; il *coordinamento tra ASL e AO*, in quanto possono favorire la creazione di percorsi di cura trasversali che incrementino la continuità della cura(per esempio finanziandone la messa in opera); la *dimostrabilità dei risultati*, in quanto la loro potenziale insistenza nel tenere sotto controllo l'andamento del progetto potrebbe rivelarsi una costrizione positiva per i soggetti coinvolti nella sperimentazione.

Professionisti Sanitari: i professionisti interessati in modo particolare dalle sperimentazioni di telemedicina sono gli specialisti, gli infermieri e i Medici di Medicina Generale (MMG).

Gli specialisti possono influire in modo particolare su: il *coordinamento tra ASL e AO* e il *coordinamento tra specialisti e infermieri*, in quanto, se correttamente motivati e consapevoli dell'apporto che le sperimentazioni di telemedicina possono dare al loro lavoro, sono in grado di mettere in discussione le loro mansioni e conseguentemente di coinvolgere nel trattamento dei pazienti anche operatori del territorio (MMG, paramedici etc.) e di suddividere in modo più efficiente le mansioni all'interno dell'Unità Operativa.

Gli infermieri influiscono sul *riallineamento delle competenze*, in quanto ricoprendo un ruolo attivo nelle sperimentazioni è chiesto loro di acquisire un'adeguata capacità comunicativa, adeguate competenze in merito alla gestione del paziente cronico e all'utilizzo delle tecnologie. Inoltre, dimostrando buone capacità e una predisposizione all'apprendimento appianerebbero qualsiasi dubbio relativo alla loro adeguatezza nel ricoprire ruoli di responsabilità nell'ambito delle sperimentazioni (*ruolo dell'infermiere*).

Da ultimi, i MMG possono influire significativamente sul livello di *coordinamento tra ASL e AO*; al momento il loro ruolo non è adeguatamente definito all'interno delle loro sperimentazioni e una loro opposizione o scarso impegno può avere conseguenze molto serie sul buon andamento della sperimentazione.

Fornitori di tecnologia: i drivers principali sui quali essi possono determinare effetti significativi sono: *l'affidabilità delle tecnologie*, in quanto essendo responsabili della manutenzione delle apparecchiature da un lato consentono uno svolgimento più efficiente delle operazioni, dall'altro sollevano notevolmente lo staff del servizio dall'onere di responsabilità nei confronti dei pazienti; la *dimostrabilità dei risultati,* in quanto hanno la possibilità di sviluppare software e applicazioni che consentano di elaborare i dati riguardanti i pazienti in modo più semplice; la *stabilità*

del servizio, in quanto, nel caso in cui il loro grado di coinvolgimento risulti adeguato, essi possono condividere l'onere organizzativo delle sperimentazioni con lo staff di progetto.

Ricercatori: quest'ultima categoria di attori coinvolti nelle sperimentazioni non influenza appena alcuni tra i driver identificati nel framework empirico, ma al contrario può determinare effetti notevoli su ciascuno di essi. I ricercatori sono infatti chiamati a guidare il cambiamento strutturale di cui il Servizio Sanitario necessita per definire un modello organizzativo adeguato al trattamento delle patologie croniche, mediante ricerche mirate che consentano di dare un'evidenza sempre maggiore alle best practices. A questo proposito, i drivers proposti nell'ambito del presente lavoro di tesi richiedono una maggiore specificazione e uno studio accurato delle implicazioni o legami che tra di loro sussistono.

Un ulteriore sviluppo possibile per il lavoro riguarda lo studio in merito alla sua generalizzabilità. Sarebbe infatti interessante capire se le caratteristiche evidenziate sono valide soltanto per il trattamento della COPD o se sono adeguate anche per i servizi che si occupano del trattamento di altre patologie croniche. Accanto a questo, un ulteriore sviluppo potrebbe essere quello di comprendere se la dimensione politica e quella culturale influiscono sui drivers e la loro applicazione, al punto da rendere il "modello Italiano" non applicabile altrove.

Pertanto, il lavoro di tesi ha consentito di:

a) Definire il concetto di sostenibilità organizzativa come insieme degli sforzi volti a rendere possibili le complicate interazioni esistenti all'interno delle sperimentazioni di telemedicina tra lo staff tecnico, le infrastrutture, le risorse umane e il contesto socio-politico. Inoltre, la sostenibilità organizzativa consiste nella creazione delle condizioni sia per il paziente che per lo staff clinico e tecnico di accettazione del cambiamento.
b) Identificare i fattori che la letteratura propone come drivers della sostenibilità organizzativa e confrontarli con l'opinione degli esperti e con le sperimentazioni più significative del panorama Italiano.
c) Costruire un framework empirico a partire dalle considerazioni del punto precedente e testarlo su due esempi notevoli di sostenibilità organizzativa, sempre appartenenti al panorama italiano.
d) Valutare le implicazioni che i risultati della ricerca hanno per i principali attori coinvolti nelle sperimentazioni.

1. INTRODUCTION

1.1 The Context

1.1.1 Sustainability: a General Definition

It is a common and easily verifiable statement that every act men put in action, in every contexts and situations of life indifferently, affects in some way the reality around and changes it somehow. This is not intended to be the consciousness raising of a negative condition, as we may affect reality in a countless number of positive ways, but it raises without any doubt a debate about which actions and behaviors turn out to be inadequate to preserve, maintain, keep our World safe for future generations. This last kind of actions may be defined *sustainable*.

The word "sustain" means "to support, hold or bear up from below; to keep up or keep going; to supply the necessities of life", but it is particularly important in this context to understand what is being supported (human life) and what is doing the supporting (the biosphere and a host of human institutions) (Farrel, 1996/1997).

In effects, it is generally agreed that sustainability requires that "the needs of present generations are met without compromising the ability of future generations to meet their own needs" (World Commission on Environment and Development, 1987); nevertheless, while appealing and even noble, this definition is quite vague: what is sustainability? How can sustainability be achieved? How can sustainability be measured? These and more other questions are the aims of researches, studies and projects in many fields and disciplines all over the World. At the core of concern about what is sustainable and what is not are the ideas that this support for human life should last indefinitely, while current human activities may prevent the biosphere from doing so (Farrel, 1996/1997). In fact, the central concern motivating interest in sustainable development is that current human activities may degrade the environment to the point that serious negative consequences emerge, until worsen overall quality of life. As a consequence, we assist to a widespread awareness that human, social and natural resources are finite and that we need to develop towards less consuming but still competitive production forms (Docherty, P. and Forslin, J., 2002).

Though in the recent past this increased attention on sustainability may has been considered as a paranoia, it is nowadays turning out to be not a fad but, on the contrary, a long-term trend that will require every organization to invest strategically and programmatically to preserve natural resources and create healthy environment for industries, customers and employees. The main factors driving to this statement are the increasing concern of media about the theme, the increasing consumer interest, the attention to the relationships with supplier (more Companies use to make sure that

their suppliers operate in a green responsible way), the regulatory scrutiny, the scientific focus on green solutions and the increasing access to capital for greening efforts.

Literature is unanimous in assessing that sustainability cannot be considered through a unique key of lecture, since it is affected by different drivers and presents several facets. The most common model and outline generally applied in its study is the Triple Bottom Line Model (TBL), that considers sustainability as having a triple facet: environmental, economic and social.

In order to explain the significance and importance of this explanatory model, one of the studious that coined it, John Elkington, assessed: "In the simplest terms, the Triple Bottom Line agenda focuses Corporations not just on the economic value that they add, but also on the environmental and social value that they add – or destroy" (Elkington, 2004).

In particular, the author underlines seven closely linked "revolutions" driven by the TBL, to prove the wideness, centrality and decisiveness of the theme of sustainability, that is being responsible for a concrete global culture revolution. The first driver is *market*, since business and services will operate in markets that are more open to competition, both domestic and international; therefore, a growing number of Companies and Work Systems is already finding itself challenged by customers and financial markets about aspects of their TBL commitment. The second driver is represented by *values*, since most business people took values as a given and felt themselves standing on solid ground for decades but then found that the word as they knew it is being turned upside down. The third lever is *transparency,* since businesses find their thinking, priorities, commitment and activities under increasingly intense scrutiny worldwide: this phenomenon pushes to the spread of many forms of voluntary and mandatory mechanisms of disclosure, in order to diffuse information about what business they are going and planning to do. The fourth driver, which actually guides the previous one, is *life-cycle technology,* since Companies are being challenged either about the TBL implications of both the industrial and agricultural activities far back down to the supply chain, and about the implications of their products in transit, in use and after their useful life has ended. The fifth driver concerns *partners*, since organizations that once found themselves as sworn enemies will increasingly flirt with and propose new forms of relationships to opponents, who are seen to hold some of the keys to success in the new order. Again, *time* is doubtless included among the main drivers of change: given that most politicians and business leaders find it hard to think even two or three years ahead, the emerging agenda requires thinking across decades, sometimes even generations. The last driver deals with the responsibility of the corporate board (*corporate governance*): experience suggests that the best way to ensure that a given corporation fully addresses the TBL agenda is to build the relevant requirements into its corporate DNA from the very outset and into the parameters of the markets he seeks to serve (Elkington, 2004).

Therefore, given the correspondence of these drivers with the present reality and the large amount of studies and researches on the topic, it is doubtless that the notion of the TBL accounting has become increasingly fashionable in management, consulting, investing and Non Governative Organizations (NGO) circles over the last few years. To summarize, the idea behind the TBL paradigm is that the ultimate success or health of a Corporate can and should be measured not just by the traditional financial bottom line, but also by its social/ethical and environmental performances (Norman et al., 2004).

1.1.2 Sustainability in Business

In this changing scenario, the quest for sustainable solutions turns out to be a definitely good business; however, the returns are often long-term and, in some cases, customers are still unaware or insensitive to this effort. It is, nonetheless, a strategic foundation upon which many industries leaders (broadly speaking) are betting their future (Keckley, P. H. and Fam, M., 2008).

The industrial sector is unquestionably the most committed in focusing on the theme, at least on including in its agenda not only the financial, but also the environmental facet of sustainability, since it has been (and still is) the target of a strict and severe campaign against its negative impact on environment in terms of water, air and ground pollution. Nevertheless, the sustainability concept has not to deal with the environmental preservation only. In fact, the need to invest in researching and taking up new work protocols and guidelines to modify their practices, in order to put them in accord with the natural environment, crashes against the lack in resources that industries face: this is a typical example of the TBL model, since the triple facets of sustainability emerge at the same time.

Accordingly, in the business world, sustainability denotes a powerful and defining idea: a sustainable corporation is one that creates profit for its shareholders while protecting the environment and improving the lives of those with whom it interacts. It operates so that its business interests and the interests of the environment and society interact (Savitz,A.W. and Weber, 2006). Moreover, a sustainable business stands an excellent chance of being more successful tomorrow than it is today, remaining successful not just for months or even years, but for decades or generations using its capital properly. Capital, in this context, includes natural resources, such as water, air, sources of energy and foodstuffs; it also includes human and social assets – from worker commitment to community support – as well as economic resources, such as licenses to operate, a receptive marketplace, legal and economic infrastructure (Savitz,A.W. and Weber, 2006). Therefore, though the relations among the three cited dimensions (environmental, economic and social) are deductible, this statements result still broad and cannot be sufficient to support Companies, Boards and Institutions in selecting specific strategies; this is the reason why the development of guidelines,

theoretical models, standards, tools and monitoring instruments is now widely under discussion (Arena, 2009).

1.1.2 Sustainability in Service Delivery

1.1.3.1 An Embryonic Example: Tourism

Although the theme of sustainability has lately been highly debated, the attempt to create sustainable models of action is still a prerogative of few; in fact, excluding the industrial field, only few others had shown serious commitment in catching the challenge.

Inside the word of services delivery, for example, the almost unique sector actually and evidently investing in this direction is the tourism industry, though focusing mainly on the environmental matter: while stations and airports have been lately equipped with waste recycle containers, hotels and holiday villages ask their customers to choose conscientiously whether to change sheets and towels or not, in order to reduce water pollution caused by the washing powders. These examples, though positive, are still too occasional since - being tourism one of the World's largest industries - it is expected to pay a more decisive part in encouraging more sustainable lifestyles (Hunter, 2002).

1.1.3.2 A serious concern: Health Care

On the contrary, some sectors seem inexplicably indifferent toward considering sustainability as a strategy or intent, although they should actually take it in serious consideration. Health Care is among the most emblematic cases.

Nevertheless, the study of the existing links between sustainability in all its facets and health care delivery and the attempt to create a model of care able to heal the relationship between the two are the topics of numerous researches and many authors are committed in revealing factors that enable or obstruct it. For example, while Mohrman et al. (2004) suggest that sustainable health delivery depends on becoming more *effective at preventing disease* and *minimizing disease impact*, depending not only on the health and wellness activities that occur in the structures, but also on raising the health status of the entire community, other authors suggest different definition and levers for health care sustainability.

Some claim that a "sustainable system must both *control costs* and *provide appropriate health care*" (Fruitman, 2004), while others put deeper remarks on the capacity of the system to literally sustain itself, claiming that sustainability in health care is the capacity to *maintain* services at a level that will provide ongoing prevention and treatment for a health problem after termination of major financial, managerial and technical assistance from an external donor (La Pelle, N. and Zapka, J, 2006). Again, health delivery is considered sustainable if it is ultimately able to involve the local and

national populations in its programs and to enable the programs to expand to a national wide scale through a multisectoral approach, involving public health, medicine, engineering, education and community engagement (Bloom, 2007). Finally, in J.P. Ulhoi et al.'s opinion, an *interdisciplinary dialogue* is required to create a sustainable system, against a highly specialized approach that would allow to intervene in isolated and unconnected subfields only (Ulhoi, John P. and Ulhoi, Benedict P. , 2009).

More in general, the concept of sustainable development, which was fiercely debated during the late 1980s and throughout the 1990s, refers to the capacity of ecological, economic and social systems to preserve vital processes, functions, productivity and diversity for future generations, as mentioned in the previous paragraph. However, little attention has been paid so far to explore the existing relationship between environmental change and human health, or between professional organization, such as hospitals, and their roles and responsibilities in relation to sustainable development (Ulhoi, John P. and Ulhoi, Benedict P. , 2009), although a simple analysis shows that evident links exist. In fact, Health care systems all over the World share common challenges, whose effects threaten their level of sustainability: throughout the Developed World population is aging and age progressing has been identified as the main threat to the sustainability of healthcare (Forget et al., 2008) (Whitten et al., 2010), whilst the growing relevance of chronic pathologies increases its organizational and economic burden.

Meanwhile, citizens as a whole are getting better information about health care issues, indirectly pushing national health systems to provide them with better quality and safety. These challenges do not come without financial implications, since they affect healthcare resource utilization and expenditure with direct impact on general funding (Valeri et al., 2010). As an example, the service providing must face many challenges in terms of sustainability under the economic dimension since demand for rescue and acute treatment is neither stable over the year nor equally distributed throughout the day: it thus follows that productive capacity of a hospital requires a high degree of flexibility and a buffer capacity (Ulhoi, John P. and Ulhoi, Benedict P. , 2009). Some attempts have been put in practice to solve this difficulty; among them a phenomenon lately affecting health care systems is the general growing interest in shifting health care delivery from costly secondary care hospitals to community settings bringing care 'closer to home' for patients.

Furthermore, the dynamics generated by globalisation, deregulation, harmonisation and medical technology development have spurred the quest for new paradigms of delivery: future health systems must balance stakeholders' interests over the long term, and have a capacity for ongoing improvement, innovation and development (Lifvergren et al., 2009).

Moreover, leaving the economical facet of sustainability aside and considering its environmental dimension, hospitals are generally regarded as organizations whose main mission is to help human beings in need of surgery or in all facets of medical assistance and it may therefore results difficult to justify any behavior that may threaten human health, contribute to the growing depletion of natural resources or to the inefficient energy and resource management. Nevertheless, their activities and buildings affect the environmental through their use of energy and resources (including non-renewable ones) as well as waste (often toxic) production and handling.

Lastly, considering the social dimension of sustainability, hospitals and health providing structures are typically large employers and spenders of public resources, since they often dominate local environment in terms of employment: their impact even on this facet of sustainability is not negligible.

In conclusion, hospitals and care providers are affected by considerations about sustainability not only in an active way but passively too since it is attested that climate change (a typically mentioned effect of unsustainable behaviors) can have damaging effects on human health, thus influencing their core mission and services.

1.2 Objectives and Focus of the Analysis

As it has been assessed in the previous paragraph, Healthcare is a complex industry that is facing great challenges in its structure, organization, service delivery and operations. Within this context, the development of new paradigms of healthcare delivery that may be sustainable over time has become an imperative (Forbes and While, 2009).

With this regard, technology has drawn increasing attention as one of the "emerging service delivery vehicles running on the information highway" (Zajtchuk, 2004), being the innovative use of information commonly considered a major enabler for the innovation of healthcare delivery. Despite this enthusiasm, not much is understood about how to make these changes factual and, above all, in line with the challenge of sustainable development.

Therefore, although technological applications have been indicated as a possible solution to health care systems criticalities, the scenery is intricate to the point of pushing to circumscribe the research field, so that the analysis may result more efficient and may bring to more valid conclusions. The following paragraphs explicate the boundaries and objectives of the study.

A summarized exposition of the focus of the analysis is available in paragraph 2.3.

1.2.1 Sustainability and e-Health

Once pointed out the spread and urgent need for a sustainable health care delivery planning and the positive contribution that technology could bring, every sensible solution aimed at reaching this scope is lately taken in high consideration, considering the context of scarce human and economic resources availability.

A currently diffused approach to the matter derives from the observation that information pays a key role in the provision of health care and that being able to manage it properly may lead to the creation of more sustainable health care systems. In particular, this approach requires the use of some tools, including information networks, electronic health records, telemedicine services, wearable and portable monitoring systems and health portals; the term commonly employed to indicate all these functionalities is e-Health (Valeri et al., 2010).

Providers such as hospital and doctors generate and process information as they attend to patients. At the same time, patients themselves create, access, process and exchange information about their health situation. Therefore, health-related information and communication technologies (ICTs) can pay a significant role in the overall management of these data, in terms of potential gains in efficiency, financial savings, quality of care and patients' safety. In addition, this use of technology can play a pivotal role in the move towards patient-centric care, an approach aimed at building a treatment regime tailored to the individual patient, with much of this delivered outside the traditional hospital context. In fact, one of the core elements of patient-centric care is medical professionals' ability to interact with individual patients irrespective of their geographical location, cutting the economic and operational costs of face-to-face meetings (Valeri et al., 2010).

The use of technological applications (Biotech and IT in particular) have undoubtedly improved the quality of health care, allowing it to pursue at least four major goals: inform clinical practice, interconnect clinicians, personalize care and, finally, improve population health through the collection of timely, accurate and detailed clinical information (Thompson, T.G. and Brailer, D.J., 2004). Moreover, e-Health is increasingly valued for supporting access to quality health care services for all citizens, information flow and exchange, integrated health care services and inter-professional collaboration (Gagnon et al., 2008). To achieve these goals, e-Health involves the use of distant monitoring devices to be implemented at patients' premises. The same technologies can foster healthy lifestyle approaches, where the focus is not exclusively on curing but also on preventing the development of diseases.

Technology may therefore be considered as a basilar driver for the assessment of a sustainable health care system. Nevertheless, many authors agree about the fact that the employ of technological solutions alone is not enough to assure an effective radical change in actions, even if

these required changes are neither really detected nor investigated. Moreover, focusing on evaluating the impact of technology on the sustainability of health care would turn out to be too broad and consequently inefficient. For this and more other reasons it makes more sense to shrink the focus of the analysis: the aim of the work is in fact to evaluate the sustainability of domiciliary assistance services through telemedicine for patients affected by COPD, as an application of health care service delivered through an e-health application. The motives of this choice are detailed in the following paragraphs.

1.1.2 Why Telemedicine and Sustainability

E-Health includes telemonitoring, telecare or, more in general, telemedicine, which are terms used to describe the employ of technologies along with local clinical protocols to monitor remotely a patient's medical condition in his own home (Smith et al., 2009). Telemedicine is generally described as the use of medical information exchanged from one site to another via electronic communications to improve patients' health status, as the transmission of information and communication over geographic distances enables enhanced care coordination and promotes informed autonomous care on the part of the patients and their family members (Chang et al., 2009). It may be defined as "distance medicine" since it uses information and communication technology (ICT) to examine, monitor, treat and care for patients over a distance. Different applications are employed both within and between all kind of health care institutions as well as to monitor and provide support to patients living at home. Telemedicine can also be used to improve the chain of care and many experimentations of its use involve complex delivery systems that employ a mix of technologies in addition to innovative clinical processes. These technologies can take any number of forms such as web-based applications, mobile phone and alert systems, telephone and video conferencing with patients as well as any combination of these applications (Smith et al., 2009).

In a context of scarce human and economic resources availability in health care systems, telemedicine appears as an interesting opportunity for a better and more efficient employ of professionals and founds, at least because technology permits to avoid a considerable number of hospital admissions, whose costs and resources demand are considerably high. Furthermore, there is growing interest in shifting health care delivery from costly secondary care hospitals to community settings, bringing care "closer to home" for patients: telemedicine has been advocated as an effective means to deliver health service to remote communities (Bergmo, 2009).

Moreover, as it has been mentioned in the previous paragraph, policy makers and health services researches foretell that the current hospital-centric paradigm will be replaced by home-based

paradigms and the shrinking of financial resources for health care is promoting a general sense of urgency about this transition.

Cost reduction is a potential telemedicine advantage, beyond facilitating patients' education and increasing patients' responsibility: this is the reason why a link exists between creating a sustainable health care delivery model (economically, socially and ethically) and the use of these technologies, especially if adopted in chronic illnesses treatment, being them degenerative and increasingly care demanding.

The use of telemedicine has spread in virtually all areas of health care delivery; despite this, there is only a small amount of evidence that interventions provided by telemedicine result in clinical outcomes, comparable to face-to-face care or even better than it. In fact, though it has been speculated that the adoption of telemedicine reduces costs, enhances health care quality and assuages institutional stress on personnel requirements, there is still little objective data to validate these statements, as the majority of studies concluded at the moment have not consistently evaluated its real impact on health care delivery (Chang et al., 2009).

The best evidence of it comes from home-based telemedicine, where modest benefits have been shown for patients with chronic disease, AIDS, and Alzheimer's Disease, although Telemedicine applications encompass activities such as remote consultations in a wide range of specialties ranging from dermatology and cardiology to psychiatry (Bergmo, 2009). The most studied area in home-based telemedicine is monitoring of blood sugar in patients with diabetes mellitus (W.R. Hersh, et al. , 2001). A commitment in increasing evidence on the topic is therefore required.

Moreover, since telemedicine has been indicated as effective in the treatment of chronic pathologies in general, the aim of the present work is to focus on telemedicine for COPD, because of its diffusion and impact on sustainability of the Health Care Systems, as detailed in the following paragraph.

1.2.3 Why COPD

Chronic Obstructive Pulmonary Disease (COPD) is a long-term illness characterized by breathing difficulties that are accompanied by a progressive deterioration of functional capacity (Paré et al., 2006). The pathology is commonly perceived to be associated with a high symptom burden and distress, the predominant and most troublesome of which is breathlessness. In some cases breathlessness is accompanied by fear, anxiety and panic, thirst, depression, weight loss, cough, constipation and incontinence; fatigue or weakness is commonly reported too, often as consequences of breathlessness (Gardiner et al., 2009). These comorbidities may contribute to the

severity of the disease in individual patients. Death can occur either from respiratory failure or from frequently associated comorbilities such as heart disease and lung cancer.

Table 1.1 reports the GOLD classification of the stages of COPD. The values reported in the 4th column (FEV1) are expressed as a percent of predicted; any value over 80% is considered normal.

STAGE	DENOMINATION	SYMPTOMS	Pulmonary Function Test (PFT) with a FEV1 result of:
STAGE I	*Mild*	Often minimal shortness of breath with or without cough or sputum. Usually goes unrecognized that lung function is abnormal.	FEV1<0.70 FEV1>80% predicted
STAGE II	*Moderate*	Often moderate or severe shortness of breath or exertion, with or without cough, sputum or dyspnea. Often the first stage at which medical attention is sought due to chronic respiratory symptoms or exacerbations.	FEV1<0.70 50%<FEV1<80% predicted
STAGE III	*Severe*	More severe shortness of breath, with or without cough, sputum or dyspnea. Often with repeated exacerbations which usually impact quality of life, reduced exercise capacity, fatigue.	FEV1<0.70 30%<FEV1<50% predicted
STAGE IV	*Very Severe*	Appreciably impaired quality of life due to shortness of breath. Possible exacerbations which may even be life threatening at times.	FEV1<0.70 FEV1<30% predicted or FEV1<50% predicted plus the presence of chronic respiratory failure

Table 1.1 - Classification of COPD stages *[Source: GOLD]*

Worldwide, cigarette smoking is the most commonly encountered risk factor for COPD, although in many Countries air pollution resulting from the burning of wood or other biomass fuel has also been identified as a COPD risk factor (GOLD guidelines, 2007).

Conservative estimations (considering the lowest prevalence rates) calculate the total number of COPD cases in approximately 280 million around the world (Organisation for Economic Cooperation and Development - Health Data , 2008).

In addition to its gravity and diffusion (Figure 1.1 shows its prevalence in Europe), COPD has remarkable impact on World Health System budget: in Italy, for example, COPD represents the third cause of death, after cardiovascular diseases and cancers and the average annual cost for patient,

which is around 3.000 Euros in moderate cases, reaches 7.000 Euros in severe cases; in the United Kingdom, moreover, people affected by COPD are assessed to be 1,5 million (Gardiner et al., 2009), while in the United States the amount spent by National Health System for care delivery connected with COPD in 2002 has been around 32,1 million Dollars.

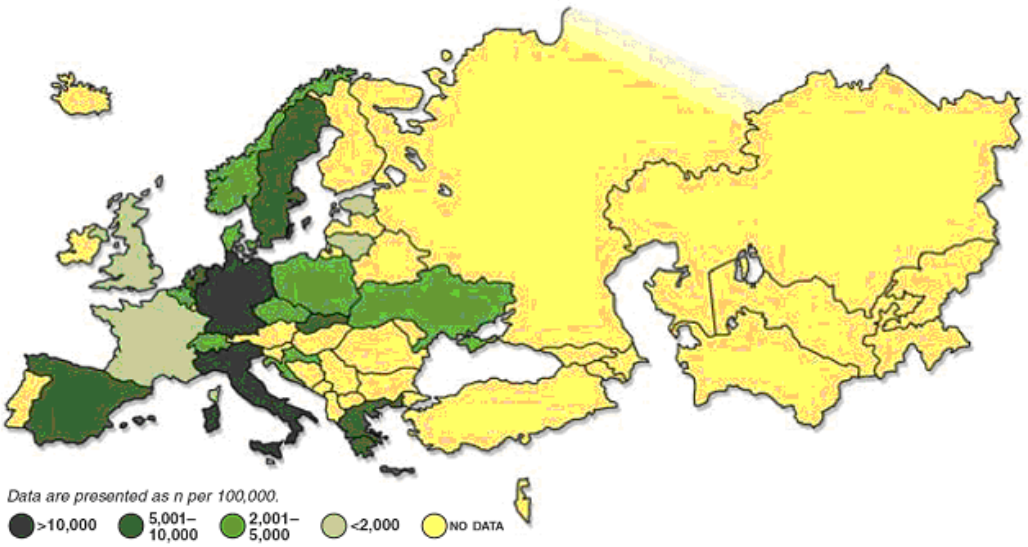

Fig. 1.1 - Prevalence of COPD in Europe *[Source: OECD]*

Acute exacerbations during the course of COPD are one of the most important causes of hospital admissions in Western Countries, mainly during winter period. Exacerbations and, specially, admissions due to exacerbation, have a large impact on patient's quality of life, increase mortality and involve a consistent economic cost (Aymerich et al., 2005).

These and other reasons bring to take in serious consideration every possible sharp solution against expensive and inefficient hospitalization, in order to create a system of health care delivery sustainable in all its dimensions; since testing experiences of home care for patients with COPD seems to ensure a better quality of life and prevent hospitalizations (Paré et al., 2006), the aim of the present work is to evaluate the real consistence of this statements in terms of sustainability.

1.2.4 Why Organizational Sustainability

Despite the cited commitment about all facets of sustainability, the current work is not aimed at focusing on all its different aspects, but on conceptualizing and conceiving one of them: concentrating on sustainability as a whole may in fact turn out to be an objective out of scale because of the wideness and scarce ease of definition of the theme. Furthermore, the environmental

sphere is generally almost totally ignored and the condition of limited resources tends to cause a general concentration on the economical facet of sustainability.

Nevertheless, many cases reported in literature show that economic sustainability is not enough to make the experimentations work: many projects have presented evidence of clinical and cost effectiveness and high levels of patient satisfaction, but these same projects often failed to become part of everyday clinical routines (De Bont, A. and Bal, R., 2008).

It is commonly suggested that the main reason for the low routine clinical use of telemedicine applications is the insufficient evidence of its efficacy, in terms of both clinical and organizational impact on the health care sector. In fact, the availability of new technologies alone do not create change: without evidence of any effect, professional and political support for telemedicine cannot be sustained (Obstfelder et al., 2007). Accordingly, many authors agree in assessing that it is the interplay of technical and organizational factors in designing and implementing technologies that leads to positive outcomes (Obstfelder et al., 2007). That is, a sustainable technology-based service, which entails the effective introduction of the innovation into the routine processes, is mainly underpinned by human and organizational issues and their deep interrelation with technical aspects (Gagnon et al., 2005; Aas, 2001). Actually, this assessment nowadays remains quite vaguely taken in consideration and specialized telemedicine research provides little insight into why there is so little routine use of telemedicine in clinical practice: this is the reason why, in recent years, studies on the *organizational issue* have emerged (Obstfelder et al., 2007).

Another reason of the low routine clinical use is the fact that telemedicine-based services have been seldom considered as a “black box”, which moves on a linear trajectory from design to diffusion (Timmermans, 2003), rather than a system in which human participants and/or machines perform work using information, technology, and other resources (namely “work systems”). This assessment grounds into the largely acknowledged literature of Socio Technical Systems, which assumes that scientific knowledge and technology do not evolve in a vacuum. Rather, they should be seen as parts of the social world, being shaped by it, and simultaneously shaping it (Obstfelder et al., 2007).

Despite the recognized potential impact of telemedicine in healthcare delivery and the political will to promote it in public healthcare, the previous telemedicine projects did not communicate the whole story about what is needed to make telemedicine-based services effective (Obstfelder et al., 2007). On the contrary, they mainly focused on the outcomes of clinical trials, posing a limited attention on the conditions operating within the work system, which are important for the enhancement of these outcomes. This work is an attempt to create evidence in this direction, as it is aimed at investigating the organizational sustainability of service delivery, defined as the “collection of factors that should support a decision maker on how to structure the best telemedicine program

within an organization" (Whitten et al., 2010). In fact, beyond fragmented and diversified opinions and observations, its aim is to find and expose some common guidelines and enabling factors, deducted both from literature and the most virtuous observed Italian experiences, following whom the service would reach the capacity to sustain itself in absence of conflicts among the actors involved (Montelpare et al., 2008), (Whitten et al., 2010).

1.3 Rationale

Today the biggest challenge is to move away from funding isolated telemedicine projects and to put successful projects into general clinical practice and routine use by understanding the main factors affecting the real success of a telemedicine application. Accordingly, this work would contribute to the understanding of the complex organizational issues associated to telemedicine applications since, although few studies had focused on it by now, it is a common evidence that without a correct organization the telemedicine services are difficultly going to become a routine, even if a rich financial aid is available (De Bont, A. and Bal, R., 2008).

The need for major theoretical evidence is also witnessed by the fact that many decisions regarding e-Health applications are not evidence-based and this factor can lead to a suboptimal use of technologies. As a consequence, the experimentation would miss in providing a sufficient evidence of its efficacy, in terms of both clinical and organizational impact on the health care sector, making telemedicine difficult to be accepted as a routine by the professionals involved in the service delivery (Obstfelder et al., 2007). Since a well-founded acceptance of the staff involved in the service delivery is an unquestionable enabling factor for organizational sustainability, if it misses the service is going to fail.

Besides, organizational sustainability is highly connected with financial effectiveness. Therefore, evaluating the impact of e-Health applications at the organizational level constitutes an essential step to understand its associated risks and benefits. To this extent, literature is unanimous in assessing that a good organization of the implementation of e-Health, based on the best level of evidence, is necessary in order to avoid expensive pitfalls (De Bont, A. and Bal, R., 2008).

Moreover, many studies show that an effective organization is able to create a positive mood among the staff and this is strongly connected to the possibility for the service to last for a long period: for example, a positive correlation exists between senior management helpfulness and programs that have been in place for ten years or longer, whereas programs that have only been operating for 1 to 5 years reported a negative correlation between senior management helpfulness and length of program operation (Whitten et al., 2010).

Therefore, the aim of the work is to detect and investigate the factors enabling organizational sustainability of home care treatment of COPD through telemedicine, in order to give evidence on the most effective way to organize the service, making it effective for the treatment of the pathology and able to last in time.

1.4 Workflow

The work approaches its objective with a literature review on telemedicine services and issues regarding sustainability (especially the organizational ones), aimed at defining the state-of-the-art of the topic. In particular, this analysis has the purpose to discover and analyze the dynamics perceived as more troublesome by the authors concerning the organizational sustainability of telemedicine projects. Then, the conclusions drawn from literature are collected in order to build a conceptual framework.

The framework is the basis on which the most virtuous Italian experiences of care delivery through telemedicine are analyzed, as it is the support on which structured interviews to professionals directly responsible for telemedicine experiences have been built and conducted. The focus is on the Italian experiences of the employ of telemedicine technologies for care of Chronic Obstructive Pulmonary Disease (COPD).

With the aid of the panel of experts involved and interviewed, it is possible to confirm some of the factors reported in literature, to deny some of them and to underline some unexpected factors. On these last, an ulterior and more specific analysis of literature is conducted, in order to correct the possible omissions of a not exhaustive preliminary search and to eventually find confirmations of them.

The empirical framework resulting from the match with the experts, completed with evidence coming from literature, is lastly tested on the two most virtuous Italian experiences, left aside from the preliminary analysis on purpose, to test the consistency of the model.

Finally, some conclusive considerations and implications for the professionals involved in the service are reported.

2. LITERATURE REVIEW

2.1 Bodies of Literature and State-of-the-art

2.1.1 E-Health and Telemedicine

The word telemedicine literally signifies “medicine delivered over a distance”, as it is composed by *medicine* and the prefix *tele*, which derives from the Greek meaning “far” or “at a distance” or “remote”. Many other definitions about telemedicine are given in literature and a more accurate, complete and informative definition is “the use of advanced telecommunication technologies to exchange health information and provide health care services across geographic, time, social and cultural barriers” (Reid, 1996). Telemedicine devices allow, furthermore, the transmission of medical expertise and information essential not only for project management, but also for the practice of medicine and administration, education of medical staff and patients and research into medicine (Masella et al., 2008).

More recently, other health professionals have been involved and the term *telehealth* is now used to describe this expansion beyond the confines of clinical medicine. In this way, *telehealth* can be defined as “the use of information and communication technologies to transfer healthcare information for the delivery of clinical, administrative and educational services” (Norris, 2001).

In addition, the term *telecare* can be defined as the use of “information and communication technologies to transfer medical information for the diagnosis and the therapy of patients in their place of domicile” (Norris, 2001). *Telecare* is regarded as distinct from telemedicine, because it is especially important for a specific group of patients with long term chronic conditions such as mental illness, disability or simply old age, which reduce their freedom of movement (Masella et al., 2008). *Health Informatics* is an evolving scientific discipline that deals with the collection, storage, retrieval, communication and optimal use of health related data, information and knowledge. Both groups are embraced by *e-Health* which can be considered the health industry’s equivalent of e-commerce. It describes the use of electronic communication and information technology in the health sector, both at the local site and at a distance (Mitchell, 1999).

Today, the rapid use of Information and Communication Technologies (ICT) within healthcare organizations and differentiation of health services enables a wide variety of combination of the telemedicine applications. Moreover, every application may involve different kinds of devices: some of them allow audio e visual relation, some just the visual one or audio and data transfer (Bergmo, 2009). These technologies can take any number of forms such as web-based applications, mobile phone and alert systems, telephone and video conferencing with patients, as well as any

combination of these applications (Smith et al., 2009). The Table 2.1 reports some of the most common telemedicine applications.

Classification by type of service	
Teleconsulting	A teleconsultation is a consult regarding the health status of a patient that happens through the use of technology (webcam, internet…). It can take place between two or more care givers without patient's involvement or between one or more care givers and a patient.
Telemonitoring	It consists of routine data transmission between the patient's home and a nurse/technician/specialist located in the hospital.
Home tele-nursing	Nurses go the patient's house to monitor the clinical status and to transmit data to a healthcare center.
Tele-education	It includes clinical education from teleconsultation, clinical education via the Internet, academic study via the Internet or public education via telemedicine.
Telesurgery	It understands remote mentoring given by specialists to surgeons carrying out a surgical procedure at a remote location or use of mechanical and electronic surgical instruments at a short o long distance.
Teleadministration	Booking of appointments, scheduling of waiting list, budget control, payroll administration, electronic registration of patients.

Table 2.1 - Telemedicine applications classified by the type of service

As previously assessed, the technology may comprise several different functions, such as detecting problems as they arise and proposing palliative solutions. Moreover, electronic data transmission can reduce measurement detection and transmission errors in comparison with paper-based methods.

Telemonitoring has other potential advantages: being installed in the residence of patients, it make them more responsible in the management of their disease and it helps in the process of educating them, thorough a model of care that may contain costs (Ohinmaa et al., 2002). Improving the integration of care provided from a variety of service points, making the introduction of preventive medical practices and effective and continuous remote monitoring possible, telemedicine may also alleviate crowding in emergency rooms. Finally, telehomecare can prevent hospitalization or even extend life, increasing the efficacy of the interventions (Paré et al., 2006).

Some exemplifications of these potential advantages are provided by scientific literature: Dale et al. (2003) remotely monitored 55 patients with COPD over a 3-month period and noted 36 escalations, of which 29 (81%) were remotely managed in the home while other 7 required patient hospitalization. The actual number of hospitalization was 50% less than what had been predicted for this cohort of patients. In a study based on pre-post assessment, Miaolo et al. (2003) followed a cohort of 23 patients with COPD for 24 months. Hospitalizations and acute attacks decreased 50% and 55%, respectively, over the 24 months of home monitoring using telemedicine. Telemedicine therefore offers attractive advantages in terms of improved accessibility and superior care (Paré et al., 2006).

Besides, telemedicine has been advocated as an effective means to deliver health services to remote communities (Bergmo, 2009): many studies are focused on applications in rural areas, characterized by short distances and long travel times between patient home and all the healthcare providers. In effect, access to healthcare services has been widely regarded as a key problem, above all for these areas (Reif et al., 1999), since the major difficulties concern, from one side, the problems related to the cost and maintenance of sophisticated equipment and facilities with a low utilization rate; from the other side problems are related to the scarce availability of professionals and the limited accessibility of health service and providers. In addition to these complications linked with the possibility to receive adequate health care delivery, other causes of difficulties dealing with the rural areas include inhospitable communities, limited social activities, difficult working conditions and isolation. These issues damage the concept of the equity of access, which concerns the assurance that a service is uniformly accessible to diverse population groups, in relation to different variables. Equity of access in health care does not correspond to equity of treatment, but is purely related to the supply side consideration. Equity of access refers to three assumptions: 1) health care is a right; 2) the resources for allocating healthcare are finite; 3) health policy should be concerned with the design of just mechanisms for allocating scarce healthcare resources (Masella et al., 2008). Telemedicine may represent a means to assure this equity of access, bringing the same level of care even in areas where this was not possible before. Moreover, by improving communication between the periphery and the tertiary hospitals, telemedicine facilitates higher quality medicine: for example, early advice from a neurosurgical centre, based on tele-radiology, from the peripheral hospital improved the care of head injured patients; advice and counseling from a national center for fetal medicine via a telemedicine link with a peripheral hospital improved the hospital's interpretation of antenatal ultrasound scan (Woottoon, 1996).

Significant benefits are also expected for urban areas, since telemedicine applications represent a powerful tool for the improvement of the management of daily practice, of the waiting list and for the creation of integrated networks of healthcare structures and services (Masella et al., 2008).

Being responsible for these changes, Telemedicine, rather than a technology, is primarily seen as a process: in fact, it significantly renews the whole healthcare process in question in a change management view, due to the interaction of the equipment and the information transmitted with the activities of the healthcare professionals, who use them, bringing evident consequences for patients (Hailey et al., 1999).

The raise in the use of these new technologies suits perfectly the recent need, common in all national health systems, to keep health costs under control and to have an efficient welfare system with high quality standards, which has led to new clinical management approaches, shifting the attention from hospital structures, better appointed for acute pathology treatment, to primary care territorial structures and patient's home (Wootton, 1998) and encouraging the development of health care integrated networks (Wagner, 2001). In fact, telemedicine represents a strong feature to satisfy these needs of new clinical management approaches. Moreover, beside the opportunity to create benefits for long term conditions, telemedicine also represents a potential mean to powerfully support and improve the management of emergency care and acute episodes. This is the reason why it is an important component of ongoing health care systems reforms, due to its potential to support clinical information sharing (Lamothe et al., 2006) through the wide adoption of electronic patient records and to promote close collaboration between different specialties and levels of care (Wagner et al., 2001).

Therefore, telemedicine can be used to improve the chain of care too and may involve complex delivery systems that employ a mix of technologies in addition to innovative clinical processes. Recent telemedicine encompass activities such as remote consultations in a wide range of specialties ranging from dermatology and cardiology to psychiatry. Other examples are transmission of echocardiograms, blood glucose levels and x-rays; provision of accident and emergency expertise to remote locations; remote support and monitoring of patients undergoing dialysis; remote fatal monitoring; support and care to elderly people or to patients with chronic conditions living at home (Bergmo, 2009).

The intuition about the innovative content of the employment of technologies aimed solving health care criticalities, make telemedicine nowadays increasingly attracting the attention of policymakers, payers, healthcare professionals and patients. As a consequence, the field is very attractive for the scientific community, as shown by the relevant increase in publications in the last decade (Wootton, 2004).

This increased attention explains the reason why in the last years there has been a rapid increase in the use of monitoring technology as a management toll for long-term conditions, despite a lack of robust evidence of clinical benefit to patients. Telemedicine as a method of providing healthcare to remote areas is not lacking in evidence of benefit, especially for consultation saved, journeys avoided and diagnosis changed, but the situation regarding its more general use for monitoring purposes is much less clear (Smith et al., 2009).

Since the 1990s, many telemedicine projects have been realized all over the world thanks to the recent technological advances which have made the equipment less expensive and simpler to use. The variety of application is very wide in terms of participants, exchanged information and transmission ways. Nonetheless, many of these projects failed after a limited lifetime, reflecting the complexity of the process of introduction. As a consequence, decision makers today have the responsibility to assess the application, the feasibility and the impact of telemedicine on the healthcare system and organizations (Ohinmaa et al., 2001).

Pressure for the adoption of telemedicine increased the demand to assess these applications, although different approaches are employed in this process. During the past few years, scientific literature had presented many studies focused mainly on a single issue, above all on technical feasibility (such as network performance, image quality, etc.). Research had also focused on the clinical effectiveness of telehealth, medical performance and implications, patient satisfaction and economic consequences, like cost saving or cost comparisons between telehealth and the traditional forms of care. Finally, other study efforts include cost-effectiveness, ethical consequences, data security and confidentiality and healthcare policy implications. Nevertheless, these studies generally considered only a single evaluation perspective, even though telemedicine often requires the creation of healthcare networks which involve governments, healthcare providers, general practitioners and patients in a multidisciplinary and cooperative context, implying different points of view.

Given the high diversification of interests and natures of the actors involved, assessment of telemedicine applications is therefore required to assist, in particular in the process of decision making, together with the planning and the monitoring of future health services. Given this need, it is relevant to provide shared assessment framework that might be used by those intending to introduce telemedicine applications into routine healthcare (Masella et al., 2008).

2.1.2 The Organizational Sustainability of Telemedicine Applications

According to this aspect, today the biggest challenge is to move away from funding isolated telemedicine projects and to put successful projects into general clinical practice and routine use, by

understanding the main factors affecting the real success of a telemedicine application. The assessment of telemedicine applications should not only examine the effects of these new technologies on quality, accessibility and services costs, but should also seize the interactions between technical equipment and infrastructure, humans, and the socio-political context. Decisions regarding their implementation are thus likely to be influenced by various types of knowledge and elements of context that are important to consider for an optimal integration of these technologies in the health-care systems (Gagnon et al., 2008). This complex interactions need an organizational effort to make them cohabit: in fact, although few studies had focused on it by now, it is a common evidence that without a correct organization the telemedicine services are difficultly going to become a routine, even if rich financial aid is available (De Bont, A. and Bal, R., 2008).

The considerable attention focused on telemedicine applications during the last decade has been accompanied by a lack of validated or well-demonstrated approaches for evaluating the organizational burden connected with the applications of telemedicine (Masella et al., 2008). Evaluating the impact of these applications at various levels constitutes an essential step to understand their associated risks and benefits. In turn, the production and utilization of scientific evidence is essential in order to legitimate e-health investments. It is thus essential that e-health applications are rigorously evaluated for their effectiveness, efficiency and impact on equity before promoting their widespread dissemination (Gagnon et al., 2008).

The organizational impact is particularly important because, though the successful delivery of a telemedicine service depends on its clinical effectiveness, it is vital that all users accept it. The use of a telemedicine application depends, from one side, on acceptance of patients and their families and, on the other side, on acceptance of staff. Additionally, acceptance represents a key issue, due to its influence both on quality of care and on health outcomes (Fitzpatrick, 1991).

Telemedicine literature is characterized by many studies about patient satisfaction that report pleasure with healthcare delivered through telemedicine, even if some studies report that patients could prefer face-to-face encounters. In fact, though telemedicine services are replacing traditional in-person encounters between patients and health care personnel, actually, in a real clinical situation, it seems unlikely that telemedicine could be a complete substitute for in-person encounters: some combination of the two will be probably required (Bergmo, 2009). In assessing this statement concerning patient's satisfaction, a limitation concerns the fact that many of the publications do not come from experimental studies and generally consists of a small sample, often less than 50 participants (Mair and Whitten, 2000). Therefore, this body of work may not offer results that may be generalized. Besides, complementary to the patients' perspective, few researchers also considered the acceptance of their caregivers (Weatherburn et al., 2006).

Other studies also focused on the level of acceptance of health care professionals. Like patients, the majority of physicians and clinical staff showed a positive approval (Larsen et al., 2003). Anyway, further research is needed to determine the factors associated with physicians who use telemedicine and to draw distinction with those physicians who do not (Hicks et al., 2003). Methodologically, while few studies have been conducted through qualitative methods or combined methodologies, the majority of researches on the acceptance issue consists of quantitative research done through surveys based on questionnaires (Whitten and Love, 2005), but many of them present limitations. Ways to measure satisfaction need to be standardized and not simply applied to specific context. In addition, surveys based on representative samples would lead to more effective, accurate and generalizable results (Whitten and Mair, 2000). On the contrary, survey instruments are often characterized by a lack of construct development and almost half the studies measured only one or two dimensions of acceptance (Williams et al., 2001), while a rigorous design constructed around more key dimensions is needed. A last issue is the lack of theoretical definition of acceptance, which usually embraces the effectiveness/efficiency, utilization/adoption, perception and satisfaction categories (Whitten and Richardson, 2002).

Although the assessment of its impact, it is doubtless that, as an innovative form of healthcare delivery, telemedicine involves technology and process changes that will profoundly affect the organizations into which it is introduced (Bangert et al., 1999). In this way the assessment of the impact on the organization requires the identification of the organizational factors influencing the telemedicine adoption process, in order to minimize resistance and maximize the acceptance and utilization of the telemedicine technology (organizational readiness). Furthermore, decisions made at each level are interdependent, since a decision made at one level can impact on the other levels. For instance, the decision to invest in a particular technology made at the health policy level could influence resources allocation at the organizational level and health care professionals' involvement at the clinical level. A multidimensional analysis would be thus necessary in order to draw an overall picture of the factors influencing knowledge application to support the implementation of e-health (Gagnon et al., 2008).

Few comprehensive and well-designed studies have been conducted to determine the organizational impact of the implementation of telemedicine and how an organization readiness can be systematically assessed (Bangert and Doctor, 2005). Anyway, in literature, more general studies tried to understand the organizational factors influencing administrative and clinical innovations adopted by healthcare organizations. At least three organizational impacts have been identified as relevant from the analysis of literature: 1) the need for a redistribution of roles and duties, 2) changes in processes and procedures, 3) variation in productivity and performances (particularly

related to nurses or equivalent professionals). The three organizational impacts may be better explained by a more significant number of variables. Table 2.2 includes a short list of the main organizational drivers related to this issue found in literature. Their evaluation allows the identification of the additional variables which have the greatest potential impact in ensuring the success of the implementation of future telemedicine programs (Masella et al., 2008). The literature analysis on the main organizational variables is conducted in the paragraph 2.1.5.

Main organizational drivers
1. Patient/care giver characteristics
2.Professional characteristics
3.Organization characteristics
4.Political factors
5.Cultural factors
6. Actors, network and alliances
7.Change management and responsibilities

Table 2.2 – Main organizational drivers

As shown in the list in Table 2.2, this literature review supports the idea that telemedicine assumes and entails some significant changes in work processes. Its adoption inevitably results in the reconfiguration of the existing practices and social relationships. To this extent, a recent European Communication (Commission of the European Community, 2008) states that one of the main characteristics of telemonitoring consists in the contribution to re-organization and re-deployment of health care resources. This new way of working, in fact, triggers a variety of shifts in coordination mechanism, work processes and power relationships in the health care sector (Nicolini, 2006).

2.1.3 Telemedicine Applications for COPD

Before proceeding in the specification of the previously mentioned organizational drivers a sharper definition of the focus of the present analysis is needed, since it is not is not going to extend to all types of telemedicine applications and disease treatments, but – as assessed in the previous chapter – it intends to concentrate on chronic diseases and COPD in particular. This further specification helps in exemplifying and defining more in deep the characteristics of each driver, that would remain otherwise broader and therefore less explanatory. Moreover, the introduction of telemedicine-based services into practices varies over specialties, depending on the type of information and the

particular routines involved (Lehoux et al., 2002): this aspects supports the choice to limit the research to a single pathology. The reason of the choice to concentrate on chronic diseases is not accidental too.

Chronic diseases are “illnesses that are prolonged, do not resolve spontaneously and are rarely cured completely” (US Center for Disease Control and Prevention, 2004). Their prevalence is raising, driven by increasing obesity, smoking and the growing number of older people (Forbes, A. and While, A., 2008). The WHO (2006) projected that by 2010, 75% of all deaths in Europe will be the consequence of chronic disease, since they are already the main cause of death in almost every Country: deaths for chronic respiratory diseases are second only to those from cardiovascular diseases.

Among the most spread chronic diseases, like diabetes mellitus, rheumatoid arthritis, renal failure, hepatitis, ulcerative colitis, heart failure, ischemic cardiopathy, osteoporosis and many others, Chronic Obstructive Pulmonary Disease (COPD) is among the ones that count the major prevalence.

COPD is not one single disease, but an umbrella term used to describe all chronic lung diseases that cause limitations in lung airflow. According to the latest World Health Organization (WHO) estimates, 210 million people currently have COPD and 3 million people died of COPD annually from 2005 on. WHO has also predicted that COPD will become the third leading cause of death throughout the World by 2030 (World Health Organization - COPD), though the awareness about COPD guidelines is low and pessimisms regarding the benefits of treating it is very high; moreover, the infrequent use of reversibility testing for COPD diagnosis and the unsuspected number of professionals that are not even aware of COPD guidelines (B.P.Yawn, 2008) attest the lack in awareness of the seriousness of the matter. A part from the problem of under-diagnosing, even when the diagnosis and the treatment are correct, literature states that from 40% to 50% of patients with COPD discharged from hospitals after an exacerbation are readmitted the following year, and 17% of patients discharged from emergency departments require hospitalization.

Moreover, COPD does not create a serious burden only on the health care systems and providers, but also on the patients themselves. In fact, despite optimal pharmacological therapy, patients with COPD often have severe symptoms that limit normal daily activities and affect quality of life. In fact, they seldom report high symptom burden with poor control of symptoms as being a central feature of their condition. The predominant and most troublesome symptom experienced by the majority of patients is breathlessness, that may vary in severity but inevitably affects multiple aspects of patient’s life (Gardiner et al., 2009). Jones (2004) explored the needs of 16 patients dying from COPD and reported that breathlessness had significant negative effects on lifestyle including a

frustrating lack of mobility and consequent difficulties around the house and with social contacts. In some cases breathlessness is accompanied by fear, anxiety and panic, weakness, difficulty sleeping, thirst, anxiety and depression, weight loss, cough, constipation and incontinence; sometimes, the sole fear of being unable to breath is as disabling as the actual effects of breathlessness and can decrease a patient level of functioning still further to the point that, for example, some patients are reluctant to leave their homes due to fears about the onset of breathlessness (Gardiner et al., 2009).

Furthermore, being a degenerative disease, as time passes, patient affected by COPD are interested by exacerbations requiring hospital admissions. An exacerbation of COPD is defined as an event in the natural course of the disease characterized by a change in the patient's baseline dyspnea, cough and/or sputum that is beyond normal day-to-day variations, is acute in onset and may warrant a change in regular medication in a patient with underlying COPD (GOLD guidelines, 2007). The impact of exacerbations is significant and a patient's symptoms and lung function may both take several weeks to recover to the baseline values. The most common causes of an exacerbation are infection of the tracheobronchial tree and air pollution, but the cause of approximately one-third of severe exacerbations cannot be identified. Exacerbations are associated with impaired quality of life, increased mortality, limitations of daily activities, disease progression, poor lung function, previous admissions, under prescription of oxygen, increased risk of readmission and low physical capacity (Emtner et al., 2009). They are a major problem because of their negative impact not only on quality of life, but also on prognosis and costs of care, since an emergency intervention tends to be less adequate and therefore more resource consumpting. The risk of dying of an exacerbation of COPD is closely related to the development of respiratory acidosis, the presence of significant comorbilities and the need for ventilator support. Patients lacking these features are not at high risk of dying, but those with severe underlying COPD often require hospitalization in any case (GOLD guidelines, 2007).

In addition to symptoms related to the disease and exacerbations, COPD presents a significant amount of possible comorbilities, such as airflow obstruction, ischemic heart failure, strokes, pneumonia and lung cancer (Akazawa, M. et al., 2008).

The need to reduce the burden to treat these complications both for patients and for the health care system, in the context of a general concern about chronic disease management, has prompted the development of new management strategies for COPD (Garcia-Aymerich, J. et al., 2007), since a burden for patients results irreparably in a burden for the health care system itself. To exemplify the overload of the health care system, an Australian study conducted by Zwar, N. et al. (2008) revealed that COPD poses a significant stress on the Australian health care system through hospitalizations of COPD patients with complications. In 2001-02 - he explains – COPD led to 51.621 admissions

Australia-wide, with an average stay of 7.5 days. Nationwide, cost of COPD including hospitalization, together with related community medical care, pharmaceutical services and indirect costs such as lost productivity are estimated to be in the range of 820-900 million Australian dollars annually (Zwar et al., 2008). Moreover, Garcia-Aymerich et al. (2005) observed that acute exacerbations during the course of COPD are one of the most important causes of hospital admission in western countries, especially during the winter period. A part from the large economic cost involved, exacerbations and, specially, admissions due to exacerbations, have a large impact on quality life, increase the mortality. Exacerbations of COPD are considered to be responsible of more than 35% of the global cost of health care. Furthermore, increased winter emergency admissions disrupt elective admissions directly affecting waiting lists, saturating emergency rooms (ERs) and do not uncommonly induce episodes of social concern with high echoing in the media (Aymerich et al., 2005). Additional studies provide evidence on the fact that a third of the patients hospitalized for COPD exacerbations will be seen again or admitted again to hospital within the subsequent eight weeks.

Needless to say that this would be an area where good studies are needed to determine whether technology can aid identification of those making a delayed recovery and to prompt identification of those needing further treatment or readmission (Smith et al., 2009).

The urgency to find more suitable solutions is even more pressing, if it is considered that Health care systems have recently been further overburdened by factors not directly connected with COPD, such as the progressive aging of the population, the lack in resources availability and the concomitant increased incidence of other chronic illnesses. All these aspects further suggest a heightened need to optimize health care coordination (Chang et al., 2009). Moreover, facing with a continually growing demand for care of COPD and with a serious shortage of professional staff (Paré et al., 2006), added to the importance of the economic and clinical consequences of COPD, health care managers have fostered the research of new modalities of clinical management of COPD exacerbations, chiefly home delivered (Aymerich et al., 2005).

Home based programs offering nurses care or pulmonary rehabilitation appear as suitable candidates in providing possible alternatives to hospital admission with lower costs for some patients. Hospital-at-home has been shown to be a practical alternative to emergency admission for some selected patients with exacerbations of COPD (Mair, F. et al., 2002), it ensures a better quality of life and prevents hospitalizations (Paré et al., 2006). This apparently suitable solution would not be possible in absence of significant progresses in technologies, that give to the assistants the possibility to control patients in remote, as if they were still hospitalized.

2.1.4 Organizational Criticalities about Sustainability of COPD Through Telemedicine

COPD, characterized by chronic airflow limitation and a range of pathological changes in the lung, has many significant extra-pulmonary effects and important comorbilities, which may contribute to the severity of the disease in individual patients, compromising his ability to conduct a normal life. Unfortunately, a part from the disease itself, its exacerbations and its comorbidities, many other criticalities exist in the diagnosis and treatment of this pathology.

Firstly, though the treatment of COPD is codified by national and international guidelines, that have been widely disseminated, they do not seem to have an impact on clinician behavior and evidence suggests that COPD still remains an under-diagnosed and undertreated disease worldwide. Some of the factors contributing to this are a poor knowledge and low adherence to guideline recommendation on the part of some health care professionals, and a lack of understanding of the significance and severity of the disease, on the part of patients (Cazzola et al., 2008).

Moreover, an American study on the topic, showed that about half of the physicians expressed concern that their patients failed to report COPD-related symptoms while, on the other hand, primary care physicians often report cases of patients diagnosed with COPD whom the physician was unable to help except with terminal illness planning (B.P.Yawn, 2008), even though primary care clinicians should play a crucial role in early diagnosis of at-risk subjects. In fact, they have a unique opportunity to identify patients at risk through directed screening, to implement primary and secondary prevention strategies and to provide care that encompasses a holistic approach to management. Nonetheless, even after the publishing and distributing of guidelines documents and recommendations for COPD diagnosis, there is still a very poor understanding of this disease in primary care (Cazzola et al., 2008).

This context of absence of specialist care services in advanced COPD highlights the need for new models of care, which take into account the burden of living with COPD and address unmet needs in symptom management, quality of life, information provision, social support and ultimately end of life care (Gardiner et al., 2009).

A part from the criticalities related to its diagnosis and treatment, COPD care represents a serious threat to the financial balance of health care systems in general; in fact, acute exacerbations during the course of the disease are among the most important causes of hospital admission in western countries, mainly during the winter period and it has been calculated that exacerbations and admissions due to exacerbations have a large impact on quality of life, increase the mortality and involve a large economic cost (Aymerich et al., 2005). Moreover, hospitals have to face this increasing burden in a situation of limited resources and serious shortage of professional staff. This

factor enhance further their desire to find new models that could really reduce resource consumption (i.e. staffs' hours per patients) and increase their effectiveness (Paré et al., 2006).

In this context, a debate around the current ways adopted to manage the chronic illnesses, COPD in particular, has arisen. Some claims that clinicians should combine both a pharmacologic approach to prevention and treatment, as well as strategies aimed at behavior modification, in order to improve patient confidence in their ability to make life-improving changes, as, for example, training the patient to make him able to self-treat his pathology or involve the health community in the diagnosis and treatment (Decramer et al., 2008).

Despite these occasional suggestions, given that current models of care for patients affected by COPD are neither cost saving nor suitable for their needs (Luck et al., 2006), literature is unanimous in assessing that finding a different, more efficient and shared paradigm of care is unavoidable.

Technology or, more in general, e-Health (term gathering telehealth and electronic health record) appears as an enabling factor in the path to a more sustainable and closer to home health care delivery, allowing, for example, a progressive shift of health care delivery from costly secondary care hospital to community settings bringing care "closer to home" for patients (Bergmo, 2009). In fact, telemonitoring, telemedicine, clinical and medical electronic information medicine, or telecare, are terms used to describe the use of technology along with clinical protocols to monitor remotely a patient's medical condition in their own home (Smith et al., 2009). Furthermore, many articles assess that the solutions involving telemedicine for the treatment of COPD ensures a better quality of life and prevents hospitalizations (Paré et al., 2006).

Nevertheless, though these technologies promise positive impacts for patients, health care professionals, health care organizations, as well as for the health care system and the population as a whole, several questions remain with respect to the potential implications of e-Health on safety and quality of health care services, security and confidentiality of data and costs (Gagnon et al., 2008).

Moreover, international literature focuses mainly on clinical or technological themes, while reports about operative experimentations show that it is not possible to leave aside an adequate organization of structures, so that the delivery of the service may become the most valid in terms of efficiency and effectiveness, being useful to reach the prefixed scope, from the patient's and health care systems point of view (Domingo, 2008).

2.1.5 Analysis of Organizational Sustainability Drivers

1. Patient/care giver characteristics

Although COPD is commonly perceived to be associated with high symptom burden, distress and impaired functional status, few empirical studies have examined the disease from the perspective of the patient and their caregivers.

Concerning these last figures, for example, whilst the majority of care for patients with COPD is provided by them, it is worth nothing that caregivers are generally the spouses of patients, that therefore are typically elderly themselves and may suffer from health conditions of their own, giving rise to an increased burden on the family (Gardiner et al., 2009). While literature on the impact of COPD on the family or carer is sparse, some studies exploring patient issues recognize the importance of family and carers and discuss some central issues. Barnett (2005) studied the effects of COPD on family and care givers, noting that the effects of the patients enforced inactivity reduce the ability of the family to engage in social activities, take holidays and enjoy a normal life. Carers expressed similar losses in a study by Seamark (2004), that reported the effects in terms of impaired social life, restricted shared experiences and a future change from the active, unrestricted future they had previously expected. A study by Robinson (2005) explores the physical and emotional effects of COPD on family relationships and reports varying levels of support from family. In this study, some patients described how their condition led to friction in family relationships and other patients described how high levels of dependency were problematic for both patient and care givers, though family support is a central feature of the lives of many patients living with COPD (Gardiner et al., 2009). Given the high symptom burden borne by patients with COPD and their care givers it is not surprising that patients have a high level of contact with health services. This contact predominantly consists of visits to primary care to see either the GP or nurse, or emergency admissions to hospitals for exacerbations. Additional services, such as specialist respiratory nursing, district nursing and specialist palliative care are often limited or unavailable for patients with COPD (Gardiner et al., 2009).

To solve this set of problems, patients' education may play a crucial role, since a patient-centered approach would lead to promote a self-management policy. In recent years, it has become common for patients with COPD to be given an expanded role in their own treatment: this therapeutic approach generally consists of patients managing the use of prophylactic medication and following personalized treatment plans in the home. Clinical studies have shown that this therapeutic strategy is associated with significant improvements seen in both clinical results and quality of life. Recent studies nevertheless report that patients do not always follow their personalized treatment plans. Information technologies now provide an opportunity to address this problem through remote

monitoring of the home patient's clinical conditions. In fact, Telehomecare (or telemonitoring) allows to remotely monitoring the health status of patients through information and communication technologies, detecting problems as they arrive and proposing palliative solutions in time. Moreover, electronic data transmission can reduce measurement detection and transmission errors. Telemonitoring has other potential advantages in patients' education, as it make them more responsible in the management of their care. Better integration of care provided from a variety of service points, the introduction of preventive medical practices and effective and continuous remote monitoring may also alleviate crowding in emergency rooms, decreasing costs of healthcare. Finally, telehomecare can prevent hospitalization or even extend life (Paré et al., 2006).

Nowadays, patients are becoming step by step able to take care of themselves in a more aware way through the adoption of telemedicine services. Nevertheless, many studies demonstrate that technology alone is not enough for concern and worries about telemedicine raise, in particular for caregivers, on items including poor hardware quality, poor security, confidentiality and reliability, inconvenience to patients, associated moral and ethical issues and uncertainty about responsibility (Chang et al., 2009). Moreover, although patient's education is generally regarded as an essential component of care of any chronic disease, assessment of the value of education in COPD may be difficult because of the relatively long time required to achieve improvements in objective measurements of lung function. In effects, patient education alone does not improve exercise performance or lung function, but it can play a role in improving skills, ability to cope with illness and health status (GOLD guidelines, 2007).

Patients' education regarding smoking cessation has the greatest capacity to influence the natural history of COPD. Education also improves patient response to exacerbations. Some studies showed that in asthma, for example, education improved patient knowledge, but did not have an impact on health outcomes, whereas education programs including self management strategies (i.e. aiming at lifestyle change) could reduce hospitalization and ER visits. In COPD, a Cochrane review found that self-management education had no effects on hospital admissions, ER visits, days lost from work and lung function, whereas a Canadian study reported that hospitalization and ER visits could be reduced with self-management strategies (Emtner et al., 2009). Other studies reported in the COPD update 4 (Respiratory Medicine, 2008) showed that an intermediate care package incorporating pulmonary rehabilitation, self-management education and the receipt of a written COPD action plan, together with regular nurse contact, is associated with a reduced need for unscheduled primary care consultations and a reduction in deaths due to COPD but did not affect the hospital readmission rate. Other approaches promoting self-management programs, focus in

particular on the active role of individuals aimed at avoiding the rigidity and fragmentation of traditional health care systems.

Ideally, educational messages should be incorporated into all aspects of care for COPD and may take place in many settings: consultations with physicians or other health care workers, home care or outreach programs and comprehensive pulmonary rehabilitation programs. Moreover, education should be tailored to the needs and environment of the individual patient, interactive, directed at improving quality of life, simple to follow, practical and appropriate to the intellectual and social skills of the patient and the caregivers (GOLD guidelines, 2007). The topics that seem the most appropriate for an education program include the following: smoking cessation, basic information about COPD and patho-physiology of the disease, general approach to therapy and specific aspects of medical treatment, self-management skills, strategies to help minimize dyspnea, advice about when to seek help, self management and decision making during exacerbations and advance directives and end-of-life issues.

In any case, once defined the educational path and created a trustworthy relationship with the patient/caregivers that make them confident about the technology employ and able to manage the devices and the pathology itself, professionals involved should still pay great attention in understanding any emotional impact. This is, in fact, particularly important for any COPD population as co-morbid conditions such as anxiety and depression are already well documented in this patient group (Smith et al., 2009).

2. Professional characteristics

With the adoption of technological solutions, specialists have the possibility to delegate part of their own responsibilities and mansions to nurses, to primary care physicians and sometimes even to patient, intervening anyway in case of unpredictable occurrence.

In most countries nurses form the largest component of the healthcare workforce and as such have the potential to make a significant contribution in chronic disease management, both at the individual patient and care system levels (Forbes, A. and While, A., 2008). Nevertheless, defining the contribution of nurses to chronic disease is challenging because nursing activities in chronic disease management are very broad, poorly defined and multifaceted. The nursing contribution may be viewed both horizontally (managing patients through and between care systems) and vertically (providing preventive health care; providing self-care support and education; identifying problems and complications; managing problems and optimizing therapies; providing case-management in more complex cases with multiple needs). Nursing activities are also often associated with attempts to increase patient participation through: the adoption of a more “holistic” approach; services

targeted at marginalized or excluded groups and the introduction of nurses-led patient education or psychological interventions (Forbes, A. and While, A., 2008). However, while nursing activities are incorporated into a range of different chronic disease management systems, the way in which the activities work and what they contribute specifically for is not well articulated either theoretically or empirically. There is much emphasis on a holistic perspective but its constituents and impact upon the patient is not well demonstrated. Furthermore, the nursing contribution cannot be isolated from the wider multidisciplinary team, as the disease management often involves the crossing of strong organizational and professional boundaries in complex patient journeys. Therefore, it is difficult to distinguish between: the independent contribution of nurses to patient care; the shared contribution within the multidisciplinary team; the independent contribution of other team members (Forbes, A. and While, A., 2008). In addition, as the qualified nurse workforce has become more specialized (While, 2005) and sometimes fragmented, there is the added dimension of intra-professional working with different groups of nurses contributing to patients during the disease process.

Further variation is evident among different countries. While there has been a common trend in developed countries towards more advanced practice roles for nurses (Wilson-Barnette et al. ,2001), different terms and labels are used to describe the role, with little evidence of the principles upon which these roles are based. Current development in chronic disease management raise some important questions about the nature of nursing in the 21st century. A. Forbes et al. (2009) assess that nursing has evolved from a discipline concerned with managing the care system in the form of the hospital ward environment, through a period where nurses were viewed largely as doctor's "handmaiden" prior to the current diversification of nursing roles. However, this was not a linear evolution as these different constructions of nursing still have currency both at the level of the individual patient and the care system.

The contribution of nurses to chronic disease management can be expressed as: 1) nurse-led care: the nurse identifies the needs and then organizes a care package or refers to others; 2) nurse-led and nurse-delivered care: the nurse identifies the needs and manages the problem herself; 3) nurse-delivered care: the nurse provides care under the direction of others, a more advanced nurse or a doctor (Forbes, A. and While, A., 2008). However, the challenge is to identify the distinctive elements that form the nursing contribution.

A review of the roles of specialized nurses in care of patients with diabetes or COPD found evidence that they improve patient self care quality of life and satisfaction. A Cochrane review revealed that a nurse outreach program involving nurse home visits to COPD patients providing support and education, monitoring health status and providing liaison with physicians resulted in improved quality of life and reduced mortality (Zwar et al., 2008). A new Zealand study that involved

practice nurses and General Practitioner's (GP) implementing a care plan with advice from a respiratory nurse and specialist physician, resulted in reduced hospital admissions and reduced hospital bed days and showed significant improvements in spirometry (Rea et al. 2004).

In terms of service structures, the most common effect of nurses was on improving access to services, particularly for vulnerable or difficult to reach groups. For care processes, the strongest evidence of impact was on the "care experience" with evidence suggesting beneficial effect on patient satisfaction and care quality. The strongest and most consistent impact relating to clinical outcome was on patient behaviors (Forbes, A. and While, A., 2008).

Forbes et al. (2009) identifies four models expressing the relationship among nurses and technology: 1) nurse as technology: in this model nurse functions as a technical interface feeding the system with the information required for others to interpret; 2) nurse as technologist: in this model the nurse acts as an output analyst, monitoring patients' progress through determining, directing and meeting care needs; 3) nurse as a system engineer: in this model the nurse acts as the system manager and contributes to the way that the care is organized to fulfill the overall purpose of the care system thereby shaping the care system to improve its efficiency; 4) nurse as an architect: in this model the nurse contributes to the primary system design by deciding factors such as inclusion criteria for the service, treatment processes and other structural components that define the care system.

Moreover, Telemedicine and its application may result useful in reducing the cost of care, for example by reducing the burden of nurses in care delivery. In fact, the cost of nurses services may be calculated on the mean hourly rate set by collective agreement for graduate nurses multiplied by the time they spend caring for each patient, both in the home and over the phone; a further cost is the travel cost, that take into account the actual time nurses spend traveling; finally, there are the costs of hospitalization, estimated on a patient-by-patient basis, and the costs of the technology estimated on the basis of the current price of device used in the experiment at the time that experiment took place.

Given the central role of nurses in treating chronic illnesses, it is important to recognize that nursing cannot be isolated from the wider health care team; nursing needs to continue to contribute to the collective mission of chronic disease management (Forbes, A. and While, A., 2008).

Moreover, despite the unquestionable importance and responsibility in managing the pathology attributed their role, nurses are not actually supported by an adequate training path, that would lead them to achieve the appropriate competences and skills. The necessity to define a specific formative path, that can help them to acquire competences that support them in the welfare commitment required for the applications of telemedicine, is stated in many studies analyzed in literature.

Nevertheless, the potential contents of the training are neither univocally accepted nor shared, though some hypothesis have been promoted: in particular, the transmission of specific knowledge concerning the care of patients and the management of exacerbations are perceived as basilar (Zwar et al., 2008).

Primary prevention and case-finding are also important elements in the treatment of chronic illnesses (Forbes, A. and While, A., 2008). Professionals that may intervene more easily at this level are General Practitioners (GP), as they are (or should be) the most common point of contact in the health system, as a considerable percentage of people visit their GPs at least once a year (Zwar et al., 2008). GPs can play a crucial role in early diagnosis of at-risk subjects, since they have the opportunity to identify patients at risk through directed screening, to implement primary and secondary prevention strategies and to provide care that encompasses an holistic approach to management; nevertheless, even after the publishing and distributing of guidelines documents, they show a very poor understanding of COPD. In the Italian context, for example, important deviations from guidelines are a highly diffused sign of these misunderstanding (Cazzola et al., 2008). This is the reason why research to date suggests that GPs experience difficulties providing care for patients with chronic illness under the current model of care: there is a need for more structured systems to implement chronic illness care such as a multidisciplinary care plan. COPD patients, in fact, have complex needs and general guidelines recommend the use of multidisciplinary care plans; however, GPs seem to need more external support to develop and implement multidisciplinary care plans for these patients (Zwar et al., 2008). This is witnessed also by the fact that patients controlled by GPs, even when COPD has been already diagnosed for them, had a higher number of annual control visits than those controlled by lung specialists (Aymerich et al., 2005).

3. Organization characteristics

In the management of COPD, literature is unanimous in assessing that it is important to strengthen collaboration within clinical teams. The organizational studies listed a series of coordination mechanisms: the most famous ones are the mutual adaptation, the direct supervision and the standardization of processes, results or competences. At the moment, it is not possible to decide the most appropriate one and a contingent evaluation is needed. Notwithstanding, it is relevant to know that this kind of effort has to be faced in order to identify the most appropriate solution (Obstfelder et al., 2007).

In fact, technology implementation presumes a style of project management that carefully balances between initiating organizational change and drawing upon technologies as change agent without attempting to pre-specify and control this process. This style of project management is not

explicitly described in the studies of successful implemented telemedical applications, but many studies in literature assume that it has been present, because of the close collaboration and dialogue between clinicians and people with technical competence. The local clinical context in which the service has to function should form the point of departure for the dialogue and the telemedical applications need to be adjusted to local clinical needs. Generally, nothing completely new is created, but parts of the activities and general technological possibilities of the local context are mutually formed and reformed in an open and dynamic teamwork relationship. This applies to the problem to be solved, as well as to the methods of solving it. For example, in several of the studies telemedicine application has been integrated and adapted to established telemedicine networks, or it is a further development of an established service. This type of integration can be seen as a criterion for success and it requires adequate cooperation between those involved. Cooperation and dialogue promote integration of the technology, but also user acceptance and familiarity with the technology (Obstfelder et al., 2007).

Some studies call this level of integration *vertical integration*, recognizing that patients with differing levels of severity or disease progression will need different approaches to their care (Forbes, A. and While, A., 2008).

One of the most widely adopted vertically integrated models is that of the US health provider Kaiser Permanente (Ham et al., 2003). The model proposes three vertically integrated levels: 1) Self-care support (70-80% of patients), which focuses on screening, education, and patient empowerment; 2) Assisted care (15% of patients), which focuses on high risk patients needing active clinical management; 3) Intensive management (5% of patients), which focuses on patients with complex needs, often accompanied by multiple-pathology.

As an example of the effectiveness of clinical collaboration, H. Pinnock et al. (2009) conducted a study aimed at understanding how Primary Care Organizations in UK are reconfiguring their workforces to develop an appropriate framework for respiratory services with a focus on different professional roles and detected teamwork between managers and representatives from primary and secondary sectors as a key factor in the effective development of services. In particular, managers were seen as having an important facilitating role, providing, for example, an essential drive at the start of the program; clinicians from primary or secondary care sometimes fulfilled the role of champion, being described as “very committed to developing the service” and knowledgeable, visionary, enthusiastic and tenacious. In fact, many studies shows that a positive organizational mood is strongly connected to the possibility for the service to last for a long period: for example, a positive correlation exists between senior management helpfulness and programs that have been in place for ten years or longer (Whitten et al., 2010).

An unresolved question is the organizational level at which teamwork operates most effectively (Pinnock et al., 2009).

Moreover, according to the IOM, the fundamental problem is the design of a system that suits the needs of this changing scenario, but improvements in care "cannot be achieved by further stressing current systems of care. The current systems cannot do the job. Trying harder will not do work. Changing systems of care will"[1]. Improvements in the quality of chronic illness care require more than evidence about efficacious tests and treatments: they also require evidence about the system changes that produce better care and quality improvement methods to implement such changes (Wagner et al., 2001) .

4. Political factors

This driver deals with the possibility for policymakers to define common and shared ways of actions concerning telemedicine and its applications. It remains to be demonstrated whether the organizational impacts identified in telemedicine services for patients affected by COPD can be generalized. In fact, most of the studies concerning the successful telemedical applications have described how the applications are used to solve specific local problems of medical, technical or organizational type. As the types of problems in which telemedicine is seen as a solution vary greatly, it is a common belief that telemedical applications may be of use in many, if not all, medical specialties. However, it seems to be a requirement for success that clinicians have recognized and identified a problem that should be addressed, and that they work together with information technology specialists in integrating the new technology in the established clinical, organizational and technological systems (Obstfelder et al., 2007).

A factor that may promote a shared and generalized employ of technologies for COPD treatment is the definition and codification of common guidelines. These guidelines exist and have been widely disseminated but, unfortunately, they do not seem to have an impact on clinician behavior and evidence suggest that COPD still remains an underdiagnosed and undertreated disease worldwide (Decramer et al., 2003). Some of the factors contributing to this are a poor knowledge and low adherence to guideline recommendation, on the part of some health care professionals and a lack of understanding of the significance and severity of the disease on the part of patients (Bellamy et al., 2007). However COPD is both preventable and treatable when diagnosed early and treated effectively.

[1] IOM, *Crossing the Quality Chasm*, 4.

Guidelines in some practice settings have progressed from passively diffused documents published in professional journals to more active implementation. Despite these efforts, physicians and organizational practice patterns keep on resisting to change and are reluctant to adopt guideline recommendations, because of multiple barriers that are only beginning to be understood (Heffner et al., 2003). The three-part mission of COPD guidelines includes systematic development, dissemination and implementation (Cazzola et al., 2008). However, until recently, most COPD guideline developers have created hard-to-adopt, non explicit recommendations using informal consensus methods or expert opinion. Most have only disseminated their guidelines through publication in subspecialty journals rather than reaching frontline physicians through multiple media and forums; most guideline developers have not created effective implementation strategies. Consequently little evidence has shown that COPD guidelines have affected health care processes or improved respiratory health (Heffner et al., 2003).

Other barriers should also be considered. It has been suggested that many GPs are not fully aware of the importance of symptoms and risk factors for COPD. Moreover, only few GPs use spirometric criteria to define COPD, although multiple international guidelines that have addressed the diagnosis of COPD recognize spirometry as the "gold standard" for confirming the presence of irreversible airflow limitation. As a result, only one third of the COPD patients were referred to a pulmonary disease specialist because of COPD (Cazzola et al., 2008). Moreover, most patients are not diagnosed until they are in their fifties and the prevalence increases with advancing age with the average age of death from COPD being 76 (Gardiner et al., 2009).

The path to the definition of a shared model seems to be long still and an effort to help policy makers is missing and required.

5. Cultural factors

The literature analysis conducted showed that the re-distribution of tasks has to be accompanied with a cultural change: nurses and primary care physicians need to get aware of the important benefit that technologies might introduce in terms of quality of care, cost-effectiveness and productivity. When individual and organizational objectives are aligned, an organization increases its success in changes. This scenario may be reached not only through economic incentives, but even with cultural interventions, such as course of training and initiative of networking with nurses who have already conducted a successful telemedicine experimentation (Masella et al., 2008).

Nevertheless, organizational structure underlying telemedicine applications cannot disregard the national culture in which the organization is embedded. In fact, many studies assess that in different cultures around the globe a successful adoption of an e-health strategy requires an organic

and not mechanistic organizational culture and structure. For health care organizations of such national cultures, a more organic form will better match the cultural and knowledge/learning predispositions of the organization's members, that are fundamental to the successful adoption of the highly disruptive nature of e-health (Doktor et al., 2005). Furthermore, Doktor et al. assert that cultural analysis have shown that experimentations driven in one culture may not be appropriate in another. Specifically, they discuss how the capacities of a successful health care delivery organization depend upon the values of the society it serves, and, accordingly, that one solution to e-health implementation problems does not fill all situations. These considerations brought them to state that it is only through a harmonious match of organizational structure and culture to membership national culture predilections that effective and efficient organizational learning can emerge; moreover, it is only through organizational learning that new technologies can be truly effectively utilized (Doktor et al., 2005).

6. Actors, network and alliances

In the studies of successful telemedicine applications, three categories of participants may be identified: 1) policy entrepreneurs, managers and bureaucrats; 2) the responsible subjects, who are the project leaders, researchers and designers; 3) the users, who are the healthcare professionals and patients. The different participants have different perceptions of what telemedicine is and whether an implementation is to be understood as a success or a failure (Obstfelder et al., 2007), factor encouraging a further analysis on which factors define the success/failure of an experimentation.

Moreover, the degree of collaboration turns out to be still inadequate, though the importance of the collaboration between clinicians and managers to improve local services and the need for effective clinical leaders has recently been highlighted (Pinnock et al., 2009) and is the base to solve the general lack of care experienced by patients. A study conducted by Garcia-Aymerich et al. (2005) reported that one out of five patients do not identify any medical figure responsible of his respiratory disease and that this lack of collaboration results in increasing hospital admissions of patients that are not regularly by any physicians, even if they present a moderate-to-severe COPD. This study shows that a real network of care delivery does not exist still. The generation of a shared plan of pathology treatment and management of eventual exacerbations would allow to coordinate interventions, to grant access to care and to provide the most adequate home care service; this would imply an advantage not only for patients, that receive a more appropriate service, but also for the health care system in general, since a more efficient service means less probabilities of

exacerbations requiring hospitalization and emergency care, whose cost is higher than costs for normal care.

7. Change management and responsibilities

Technology might be seen as an opportunity of change and at the same time it represents its driver. A re-thinking of the organizational structure is therefore mandatory in order to maximize the technological benefits, in term of productivity, cost effectiveness of healthcare and quality of care. Despite the large number of studies on a variety of technologies it is still difficult to ascertain the exact role and benefit that technology offers to the health care system. In fact, despite there may be an enormous potential for telemonitoring and the use of other forms of technology to assist in the provision of better care for those with long term respiratory diseases, at the present time there are many unanswered questions (Smith et al., 2009).

Technologies, in fact, are not static entities moving from invention through diffusion and into routine use. That is, new technologies alone do not create change (Obstfelder et al., 2007). A management able to face with the change and ready to assess its risk is required to better exploit the technology-related advantages.

In addition, there are many issues of concern regarding the legal and ethical aspects of telemedicine. These include the responsibilities and potential liabilities of the health professional, the duty to maintain the confidentiality and privacy of patient records and the jurisdictional problems associated with cross-border consultations. Telemedicine allows the transmission of health information across the borders of nation states. Cross-border telemedicine services have begun, but questions of jurisdiction and registration have yet to be answered definitively. While this may be true of many of the legal and ethical aspects of telemedicine generally, it is also the case that health-care professionals who undertake telemedicine in a prudent manner will minimize the possibility of medico-legal complications (Stanberry, 2006).

The potential legal and ethical problems associated with telemedicine are often waved as a "shroud" to support the view that possible complications of telemedicine mean that it could not be used to form the basis of a clinical service (Woottoon, 1996). At the heart of these opponents' reservation regarding telemedicine is their perception that the guidelines, standards and regulations that are needed to ensure telemedicine is practiced legally and ethically in a number of different scenarios – whether they be feasibility studies or, more worryingly, fully operational services that have been integrated into mainstream practice by a health care institution – are presently either inadequate or inexistent (Stanberry, 2000). Silverman (2003) conducted a systematic examination of US and European statutes, regulations and civil, criminal and administrative decisions pertaining to

telemedicine and e-medicine, as well as review of the ethical, legal and medical literature pertaining to the practice of telemedicine and e-medicine in the US and Europe. There appear to be four main areas of concern: 1) the doctor-patient relationship; 2) malpractice and cross-border licensure; 3) standards; 4) reimbursement. The lack of generally agreed interstate and international standards of law and ethics means that telemedicine will continue to struggle to gain widespread support from providers, patients and regulatory bodies as an acceptable means of health service delivery (Silverman, 2003).

2.2 Literature Gaps

As witnessed by the analysis of literature reported in the previous paragraphs, there are great expectations about telemedicine, but implementations of such applications has proven to be difficult and not widely used.

It is commonly suggested that the major reason for the low clinical use of telemedicine is the insufficient evidence of factors driving to the success of telemedicine services in terms of both clinical and organizational impact on the health care sector. Needless to say that, without evidence of any effect, professional and political support for telemedicine cannot be sustained; nevertheless, while it is speculated that the adoption of telemedicine reduces costs, enhances health care quality and assuages institutional stress on personnel requirements, there is little objective data to validate these statements (Chang et al., 2009). Hence, in order to avoid expensive pitfalls, an optimal implementation of e-health based on the best levels of evidence is desirable (Gagnon et al., 2008).

Moreover, the widespread telemedicine implementation is described only by anecdotal evidence, with a paucity of data on care coordination, patient-caregiver collaboration and patient outcomes, such as quality of life and self-care. Current studies assessing clinical outcomes have stated that results do not indicate whether a telemedicine system is effective or not. As a consequence, only a few telemedicine applications have been implemented and sustained on a wide scale (Chang et al., 2009). While today the biggest challenge is to move away from funding isolated telemedicine projects and to put successful projects into general clinical practice, evidence concerning the fact that telemedicine works, how, why and under what conditions are elusive. A research focused on the conditions and drivers that influence the organizational sustainability of a telemedicine service would therefore be desirable.

Most of the recent and less recent researches on the use of evidence in health care policies and practices were not based on theoretical foundations. This constitutes an important limit since theories and models are essential for a systematic analysis of the factors influencing the utilization of

evidence in clinical, organizational and policy decisions. Furthermore, factors influencing the utilization of evidence to support decision-making regarding e-health implementation are still unknown (Gagnon et al., 2008).

Theory aids in understanding the nature of what we evaluate, how to assign value to interventions and their performance, how to construct knowledge and how to use the knowledge generated by evaluation: most of previous research on the use of evidence in health care policies and practices were not based on theoretical foundations. This constitutes an important limit since theories and models are essential for a systematic analysis of the factors influencing the utilization of evidence in clinical, organizational and policy decisions. Furthermore, decision-makers need evidence on the effectiveness of e-health applications, but also on the conditions allowing their applicability in specific contexts (Gammon et al, 2008).

Actually the problems enhance when "evidence based" systems are incorporated into the complex world of people (e.g. doctors, patients) and organizations (e.g. health regions, GP offices). Therefore the specification of drivers enhancing the organizational sustainability of a telemedicine service should come not only from literature, but also from the analysis of concrete experiences.

However, lasting recent years, studies on "organizational issues" have emerged in the field of telemedicine that state that the outcome of clinical trials "does not tell the whole story about what it is needed to make telemedicine systems and services work" (Obstfelder et al., 2007).

This study will likely contribute to fill these gaps, trying to detect and analyze which critical success factors are responsible for the organizational success of telemedicine experimentations and therefore should be supported in each experience.

2.3 Research Questions

As it has been stated in the previous paragraph, this study is aimed at defining the factors and drivers that may affect positively and explain the organizational sustainability of telemedicine applications for the treatment of chronic illnesses, COPD in particular. In fact, though applications of these technologies are today widely adopted, since they appear as interesting opportunities for a better and more efficient employ of professionals and funds, increasing appropriateness of access and cares, clinicians and patients are still reluctant to include them in their routine. One of the factors explaining this reluctance consists in the missing attention on the organizational sustainability of the experimentations.

The organizational sustainability implied in the present work deals with the level of acceptance of patients, caregivers, lung specialists, GPs, nurses and all other professionals involved in the health

care delivery services through telemedicine device, which is vital to make the service effective and lasting in time.

Many examples prove that the correct and solid organization of the service delivery is an unquestionable enabling factor, missing whom the service is going to fail: without a correct organization the telemedicine services are difficultly going to become a routine, even if a rich financial aid is available (De Bont, A. and Bal, R., 2008). Despite this, the drivers allowing and increasing the organizational sustainability of the service are still not clear.

Therefore, the study is aimed at finding an answer to the following research questions (RQ):

RQ 1 What does organizational sustainability of telemedicine applications mean?

RQ 2.1 Which are the factors/drivers affecting organizational sustainability emerging from a literature analysis?

RQ 2.2 Which are the factors/drivers affecting organizational sustainability emerging from experience/case studies?

RQ 3 When a telemedicine application may be considered organizationally sustainable?

The research scope is, once defined what implies the sustainability of the organization of an health care delivery service, to build a theoretical explaining framework, through an accurate analysis of literature, to test it in the Italian reality of telemedicine applications and to derive from the comparison with them a complete and detailed empirical framework, that should increase evidence about factors enabling the organizational sustainability of a telemedicine service.

3. METHODOLOGY

3.1 Research Workflow

An advanced search of telemedicine literature was conducted in order to identify the relevant articles dealing with the issue of the organizational sustainability of a telemedicine service, through an explanatory approach aimed at knowing what works in it. In selecting the articles to be included in the study, a range of databases (i.e. Pubmed, Medline, Pneumonet, Google Scholar) has been initially sifted using specific key words as filters for the analysis (*Sustainability, Health Care, Telemedicine*). The search was subsequently refined and the number of articles reduced, by excluding the less relevant (e.g. articles focusing on sustainability in context significantly distant from health care). Thus, a smaller number of articles that described characteristics of successfully implemented telemedicine medical applications for chronic disease management were identified.

The analysis of literature showed an actual shortage of descriptions of the critical success factors enabling the organizational sustainability of a telemedicine experience: though the "organizational issue" has emerged (Obstfelder et al., 2007), evidence concerning the fact that telemedicine works, how, why and under what organizational conditions are elusive.

This consideration push to undertake a focused qualitative analysis on the small number of articles describing successfully implemented telemedical applications, with the aim to provide a specific conceptual framework of analysis, containing organizational features found to be important for a fortunate implementation of the services. The theoretical analysis helped to underline seven attributes in particular: patients/caregivers characteristics, professional characteristics, organizational characteristics, political factors, cultural factors, actors and network alliances, change management and responsibility; a more detailed description of these factors has been provided in the previous chapter.

Subsequently, an experimental analysis has been conducted in order to check if the conceptual framework had a possible verification in the health care delivery reality.

As a preliminary exploration of the topic, a selection of experiences focusing on the treatment of COPD or similar chronic/respiratory diseases has been executed. Moreover, the empirical research flow starts focusing the attention on Italian hospitals and networks of healthcare providers, in order to gain evidence from a homogeneous legislative context. In the healthcare background, in fact, rules have high impact. In particular, the Italian National Healthcare System (NHS) is characterized by a universal tax-based coverage with free access to all Italian citizens and legal immigrants. Patients' co-payment is limited, despite it is increasing year after year. The healthcare system is organized at

three levels: national, regional and local. The national level is responsible for ensuring the general objectives and fundamental principles of the NHS. The Regional governments, through the regional health departments, are responsible for ensuring the delivery of a benefit package through a network of population based health care management organizations (local health agencies), General Practitioners (GPs) and public or private accredited hospitals. Prices are based on Diagnostic Related Groups (DRG).

In addition to the choice to focus on the Italian context, the target of the analysis is telemedicine applications and services addressed to patients affected by COPD, because of the prevalence of this pathology on the population.

3.1.1 Case Selection

A study that deepened 9 Italian cases has been conducted; the selection among the experiences of Health Care delivery through telemedicine in the Italian context has been executed taking advantage of a data base of cases and remarkable trials of telemedicine experiments, collected in the context of the *Progetto Strategico BPCO* (see paragraph 3.2). the initial phase of the project predict the creation of a database containing all the experiences if telemedicine for COPD active in Italy; the identification of the experiences has been followed by a survey, that allowed to select the most remarkable typologies of services active in the Italian Health care System.

Besides,a preference has been granted to the cases that respected the Marshall and Rossman's (1989) requirements for an ideal research locus: (a) entry is possible; (b) there is a rich mix of people, process and interactions that are part of the research questions; (c) the researchers can maintain a continuity of presence for as long as necessary; and (d) data quality and credibility to the study are reasonably assured by avoiding poor sampling decisions. Moreover, for each selected case study it was assured the possibility to set an encounter with at least one of the professionals involved in the delivery of the services considered in order to clarify the characteristics of the service itself.

Each experience taken in consideration has been called with the name of the Italian Cities in which the hospitals/health care structures delivering the services are settled. In particular, the 9 cases are: Cremona, Torino, Rieti, Roma, Casatenovo, Arenzano, Varese, Mantova and Verona.

	Cremona	Torino	Rieti	Roma	Casatenovo	Arenzano	Varese	Mantova	Verona
Region	Lombardia	Piemonte	Lazio	Lazio	Lombardia	Liguria	Lombardia	Lombardia	Veneto
LHC	Cremona	Torino 2	Rieti	Roma	Lecco	Genova 3	Varese	Mantova	Verona
Name of the structure	Cremona Hospital	C.P.A. of Torino	San Camillo de Lellis Hospital	San Camillo-Forlanini	I.N.R.C.A. di Casatenovo	La Colletta Hospital	Fondazione Macchi	Carlo Poma Hospital	Bussolengo Hospital
Unit description	Complex operative Unit	Complex operative unit	Complex Operative Unit	Complex Operative	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit	Complex Operative Unit
Beds	30	-	1	60	5	10	35	20	16

Table 3.1 – Synthesis of the structure hosting the most remarkable services

These virtuous experiences of telemedicine supply have been analyzed in order to clarify the dynamics, the organizational and economic impact, the professionals and patients involved and general service delivery characteristics.

Following the explanatory nature of the research and according to the limited number of operators usually employed in the provision of the service, key informants have been carefully individuated for face-to-face interviews. In fact, through the database of the *Progetto Strategico BPCO* it has been possible to contact the person responsible of each project of interest, through a telephone call or by email; informed about the scope of the investigative encounter, the candidate interviewee was required to indicate other professionals or institutional actors eventually involved in the service, whose support in service delivery or in the organizational structure may be considered remarkable for a deeper understanding of the project. If the responsible did not oppose to it, the date and place of the meeting was defined; generally (Varese has been the unique exception), the encounter took place in the structure from which the service is delivered and this turns out to be useful, since some of the characteristics of the applications employed could have been shown on real time, if needed. As a result, 11 physicians and 5 nurses and 1 administrative director accepted to be available for the encounter.

	Cremona	Torino	Rieti	Roma	Casatenovo	Arenzano	Varese	Mantova	Verona
Specialist	2	1	1	1	2	1	1	1	1
Nurse	1	-	1	-	-	-	-	1	
Institutional	-	-	1	-	-	-	-	-	-

Table 3.2 – Prospect of the interviewees

Even though the number of interviews might seem scarce, an acceptable level of evidence has been reached for each experience. Whereas misunderstandings or uncertainties raised, more interviews were conducted, some additional documents were checked and the course of the service

was examined in person by the interviewer: the triangulation among these information allowed to reach a satisfactory level of comprehension.

Some services (i.e. Roma, Torino) were followed at the moment of the interview by a unique subject, which is the project referral: the involvement of any other person would have been useless for the scope of the encounter. Moreover, the interviews have been performed in the place in which the service is conducted: whereas some doubts about the functioning raised, the fact of being in the place gave the possibility to see how the service is run and therefore to have a demonstration of its functioning. Some services (i.e. Arenzano, Verona), on the other hand, have reached such a good level of importance in the medical entourage, that a discrete number of scientific publications reporting their functioning is available: the integration between the available literature, the contents of the interview and the experience of the service "in loco" allowed to gain a satisfactory level of comprehension of the characteristics of the service. Similarly, the interview performed in Varese did not involve nurses, even though they hold a significant role within the experimentation, because all the guidelines, protocols and reports concerning the project were available and consultable in the database of *Progetto Stratetico BPCO*. Lastly, the comprehension of the experiences of Cremona, Rieti, Casatenovo e Mantova was gained through an equal operation of triangulation among the contents of the interviews, the available documentation, the experiences in loco.

3.1.2 Data Collection

These main figures, responsible of the projects and therefore more widely exposed to the change, were asked to discuss about the main design principles that the telemedicine-based service entails and to explain which organizational levers has been introduced to render the work system sustainable. The meeting consisted in the conduction of a predefined interview to the actors involved in care delivery of each experience.

The baseline of the interview has been defined starting from the scientific evidence gained from the literature analysis about the impacts and criticalities of telemedicine applications.

In particular, the questionnaire was composed of five different sections: firstly, it includes two questions about the background of the interviewed (role covered in the structure, previous experiences in health care); then, the interview foresees to gather some information about the structure in which the experimentation takes place in terms of organizational characteristics, staff composition, type of activities performed together with the telemedicine experimentations and to define the critical success factors of the structure itself; the third section is aimed at exploring the interviewee's point of view about the meaning of the concept of sustainability when it is related to a health care delivery service and about the drivers that, in his/her opinion, make it possible to build a

sustainable health system. The fourth part is the core of the interview, as it contains questions aimed at investigating the details concerning the telemedicine experimentation conducted in the structure, in terms of duration, number of patients involved, state of advance of the project, but also in terms of organizational burden; a section is reserved to explore the degree of satisfaction of the interviewee about the experimentation, through the quest for the identification of success factors and faults of the experimentations. The last section is composed of a series of questions to help the interviewee in defining and explicating the factors driving to a sustainable telemedicine service delivery. The interview has been planned to last about an hour. The complete baseline of the interviews is available in Appendix A.

If the responsible indicated other professionals of interest for a deeper and more accurate understanding of the service delivery, the interview was conducted together with them (though posing question to each of the actors separately) or in separate interviews. As a result, the performed interviews were 15, of whom 11 to medics, 3 to nurses and 1 to an administrative director, as reported in Table 3.2.

3.1.2 Data Analysis

The interviews have been recorded and a report of each has been created, as a result of the integration among the records and the notes taken during the interview. To gain evidence from the gathered information, the results of the interviews have been collected and organized to make the experiences comparable and to help the raising of evidence about the enabling factors emerging from the empirical search. A predefined schema has been followed for each of the experiences and to synthesize them; it contains two sections, the first one exploring the characteristics of the structure (Region, Local Health Center of reference, name of the Health Structure hosting the service, unit description, characteristics of the service), while the second one focuses on the telemedicine experimentation (interviewee/s' role, service/s provided). A list of the main services provided in the context of tele-assistance is provided in table 4.2.

The interviews, once elaborated, re-written and completed with the schema, have been sent to the interviewees and validated by them. Some of the interviewees, together with their revisions, attached some additional information or more detailed results. The project referral of the service of Rieti, for example, was performing the quality assessment measures when the interview was performed and by the time that the activity of the validation had been performed the analysis was completed and therefore she communicated its results.

A parallel integration with secondary-sources data (scientific articles, information gathered from specific websites, business process documentation performance data report, technical information

system documentation, unpublished management reports, administrative guidelines, jurisdictional papers) has been performed, in order to complete the amount of available information about the service, its characteristics and its organizational burden. Triangulation of data from multiple informants and data sources, in fact, enhances objectivity (Mitroff, 1972), mitigates potential bias (Huber and Power, 1985; Miller et al., 1997) and helps developing "converging lines of enquiry" (Patton, 2002).

A critical collection of these factors has made it possible to build an empirical framework that confirmed some elements already identified within the conceptual schema, that discussed others and brought some unexpected ones. A further cycle of literature analysis to find out whether the unexpected factors had been erroneously missed out in the first analysis or not has been conducted. These information was used to clarify events and resolve eventual discrepancies. Then, the cross-cases analysis began, aimed at developing consistent patterns of the theoretical relationships across the cases (e.g., Eisenhardt, 1989, Gilbert, 2005).

Numerous tables and graphs were used to probe a variety of theoretical relationships. Once the cross-cases analysis was underway, cycles among theory, data and literature to adjust emerging construct definitions, abstraction levels, construct measures and theoretical relationships have been performed. This cycling process continued until a strong match between the case data and theory was achieved across most (sometimes all) of the cases.

Initially these steps of the analysis have been performed only on seven out of the nine detected experience; in fact, the two most virtuous and complete among them have been left aside and used subsequently to check the results of the analysis on the previous seven.

In particular, the test of the empirical framework has been performed on the two experimentations of *Mantova* and *Verona*, left out on purpose in the first analysis; the reasons that brought to chose these two experiences are linked with their degree of institutionalization, wideness of service (both involve more than 200 patients), duration and acknowledgment of the scientific world (number of scientific publications, participation to national/international conferences). The testing process showed the actual grounding of the empirical framework and added some more specific elements.

In conclusion, a further analysis of the implications that the empirical framework has on the definition of the organizational sustainability of a service has been performed, in order to answer to RQ3 (see Paragraph 2.3).

Table 3.2 provides a schema of the process of the analysis.

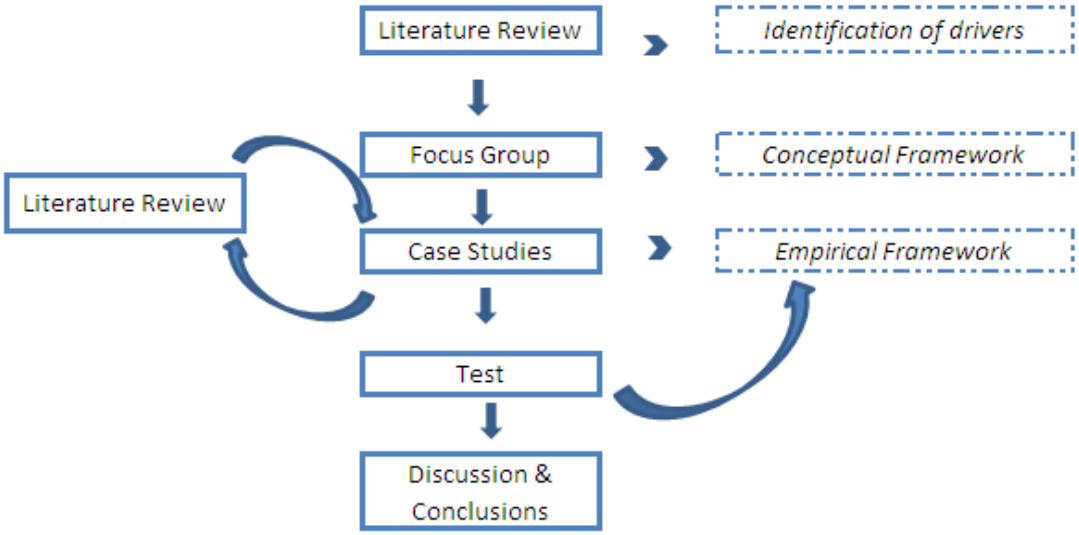

Table 3.3 – Research Workflow

3.1.3 Theoretical Foundation of the Methodology

The methodology described in the previous paragraph finds its theoretical base in the approach suggested by Yin (2003) for multiple case study research. As assessed by the author, this kind of analysis should be conducted applying the *replication logic*, that implies the reproduction of the same framework in all cases, in order to ascertain its robustness; if some of the empirical studies do not work as predicted, modifications must be made in theory (Yin, 2003). Accordingly, as it is visible in Table 3.2, the research workflow predicts that, once the conceptual framework is defined, the sample on the cases may bring to discuss its structure and contents; as a consequence, the schema is modified to create the empirical framework.

Even the choice to employ just two out of the nine experiences as samples for the empirical framework finds a motivation in the Yin's theory, since he assesses that the number of tests is not relevant, especially if different external conditions do not imply any remarkable effect on the results of the testing process; again, this is not the case of telemedicine experimentations, as the external conditions are typically similar for all of them, since they belong to the same cultural and political background.

Moreover, Yin suggests that evidence for the study of multiple cases may come from different sources: documents, archival records, interviews, direct observation, participant observation or physical artifacts. His suggestion is to employ more than one of these sources in the course of the study, in order to gain major accuracy and grounding in data collection. In effects, the present

analysis takes advantages of documents (administrative and clinical reports), archival documents (maps and organizational charts), interviews and direct observation.

3.2 Source of Data: Progetto Strategico BPCO

3.2.1 Introduction

The selection of the experiences of Health Care delivery through telemedicine in the Italian context, whose analysis is reported in the following chapters, has been conducted taking advantage of a data base of cases and remarkable trials of telemedicine devices collected in the context of an Italian National Project, leaded by Regione Puglia. The descriptions and aims of this strategic project are reported below.

3.2.2 Description and Scope of the Project

The aim of the Project, begun in January 2008 and whose deadline is in November 2010, is the comparison and evaluation of experiences of home care through telemedicine collected in the existing data bases, integrated with further projects in course identified among the most significant for number of patients enlisted and particularly innovative experimental model; it will enable the individuation and eventual experimentation of new integrated paths aimed at preventing and promptly diagnosing aggravating conditions, improving the appropriateness of interventions.

More specifically, the scope of the strategic project, called *Progetto Strategico BPCO* (COPD Strategic Project), is to individuate and put into practice a methodology of evaluation that can allow the gathering of information on different strategies of teleassistance in order to define which groups of patients could benefit the most of these assistance conditions, either from a clinical point of view and in relation to the cost-efficiency of different suggested models. The possibility to dispose of clinical and organizational information coming from experimental paths and to compare them with data collected at a Regional and National level, through the *Banca Dati dell'Assistito* (assisted patients data base), should allow to obtain new results and adequate procedures for the monitoring and treatment of patients affected by COPD. This results are expected to promote an integrated management of the pathology, through operative protocols and functional/organizational addresses that enhance the creation of a net of professionals working in accord with shared guidelines, maximizing the appropriateness of intervention. The work will be supported by a targeted study aimed at defining a multifactor gradated scale of classification of the COPD stadium, related to its

severity, through a panel of functional indexes assuring an appropriate foretell about the future trend of this chronic illness.

3.2.3 Expected Results

In Lombardia numerous projects – under regional or hospital coordination – are in course at the moment aimed at improving the continuity of care for patients affected by COPD through innovative technologies. The prove of the feasibility and the comparison among different telemedicine systems will permit to evaluate how patients affected by chronic respiratory pathologies - fragile by definition and frequently requiring a massive use of Health Care resources as hospitalizations, emergency accesses, medical checkups, prosthesis and oxygen therapy – should be treated in the most efficient way.

The continuative relationship among patient/caregiver, specialist, nurse and general practitioner, which is a constant factor in the examined experiences, may be the preamble for the creation of an integrated net of resources aimed at rationalizing the sanitary access and ameliorating the utilization of the guidelines of treatment described in literature. The project tends to harmonize and rationalize experiences in act and to compare their results and the different organizational model adopted. An evaluation of the active processes will be performed, together with the adopted technologies and clinical information managed. A general methodology will be pointed out and shared among the participants to evaluate the effectiveness-utility of paths, as well as the satisfaction of patients and professionals involved about the service delivery. Finally, the possible management conditions *a regime* of the most sustainable service models will be defined and proposed to be included in the regional listing of charges, clarifying the transferring modality and valorization of the service. A study aimed at indicating the most suitable criteria to classify the seriousness of COPD will be parallel conducted.

As a synthetic result of the activities of comparison and evaluation, some indicators will be presented, aimed at allowing a successive monitoring of the actual effectiveness of the experiences, whose model will be identified as successful during the progress of the project work. The indicators will summarize the efficiency of the analyzed models not only from the clinical point of view, but also organizational, technological and economical. This will allow to enlarge the focus, in order to analyze the telemedicine home care as a model enabling the sustainability of the entire Health Care System.

3.2.4 Actors Involved

The actors taking part in the study are listed below:

a) CEFRIEL is the Excellency Center in Information and Communication Technology (ICT) of Politecnico di Milano and it is active from 1998 in the field of research, innovation e training for enterprises and public administrations. The center integrates and emphasizes the value of experiences and competences in the academic world (Politecnico di Milano, Università degli Studi di Milano, Università di Milano Bicocca), of Regione Lombardia and of 20 among the most important enterprises working in the field of ICT in the Italian background. In the field of Health Care, CEFRIEL supports the introduction of technologies emerging from informatics and telecommunications: it collaborates with Public Administrations in projects of computerizing of hospital services and sustaining the strategic decisions concerning the adoption of ICT solutions aimed at sustaining the client in reaching the objectives of the National Health Care Plans; it designs and develops product for medical teleconsulting, addressed to service and second opinion suppliers and realizes these projects through the application of standard protocols or experimenting the use of innovative protocols allowing the exchange of bio-data and bio-images; it performs technology scouting and analysis of feasibility for enterprises, finalized to the development of operational prototypes, integrating in solutions for health care; it adopts innovative technologies to guarantee competitiveness for its customers on the market; it delivers training and high specialization courses addressed to operators of the Italian sector, together with the University Master of II Level in Telemedicine and Telecare for recent graduated people.

b) The Department of Management, Economics and Industrial Engineering (DIG) of Politecnico di Milano was born in 1990 as evolution of Department of Economics and Production (DEP). Research is the main objective of its activities and it is developed by way of the collaboration with the primary reference schools and institutions at national and international level. Beside research, teaching is another objective in its mission. DIG supports teaching at Politecnico di Milano, as it is the reference for main disciplines featuring the teaching offer of the Study Course in Management, Economics and Industrial Engineering. Moreover, it offers support to many Study Courses at Politecnico di Milano. DIG is also hosting the Doctoral Program in Management, Economics and Industrial Engineering (DRIG), which awards a professional competence for research activities in the field of management, economics and industrial engineering.

c) The Department of Public Health Care-Microbiology-Virology has been activated in January 2006 and its denomination comes from the origins of the department itself, in which the historical institutes of Hygiene, Preventive Medicine, Microbiology and Virology flew together. In the Department are actually involved 30 professors and researchers, 13 technicians of laboratory and 5 administrative employees. Teachers afferents to different scientific areas collaborate here on integrated topics. The most significant themes characterizing research activities are: epidemiology and primary prevention of non-infective illnesses, epidemiology and prevention of infective illnesses (with a focus on the study and experimentation of vaccines and illnesses transmitted through food), study of pathogenic agents (virus, bacteria, parasites), the resistance to drugs and toxicology, prevention and control of infective and non infective illnesses, organization and management of health care services, health care education, training in health care. About the themes of epidemiology and prevention of infective illnesses the Department collaborates on projects of international cooperation.

d) School of specialization in diseases of respiratory apparatus, Brescia.

3.2.5 Methodology Adopted

a) Population object of the study

The project focuses on the organizational set up and the results of experiences in act in Lombardia, primarily involving patients affected by COPD at a severe or seriously severe status (III and IV stadium of the GOLD classification). Object of the analysis are the models of service realized in the range of some predefined projects already known (AiRTEM – involving about 600 pneumopathic patients in Milan, Telemaco – involving 400 patients affected by COPD at a severe level, and IGEA SAT – project financed by the Spatial Agency that foresees to start a project on COPD) and other experiences selected among the most significant in course, with the support of the Scientific Society AIPO. The selection is conducted on the basis of the number of patients involved and on the innovativeness of the solution performed.

b) Interventions

The project is not intended to be a clinical study but an organizational multidimensional analysis, taking advantage of the Regional *Banca Dati dell'Assistito* (assisted patients data base). The comparative study requests documental analysis, interviews and elaboration of cases and it is aimed at gaining evidence for each experience on peculiarities of the context, points of force or weakness of the solution adopted in respect of the state-of-the-

art. Moreover, the project requests the analysis of results coming from the different experiences.

c) *Evaluating indicators*

Different fields of evaluation are highlighted: a. intensity and appropriateness in the use of technology; b. organizational aspects; c. clinical results; d. satisfaction of every actor involved; e. costs of supply of different services.

d) *Study design*

The initial phases consisted in the adjustment of the infrastructure dedicated to the communication among the Operational Units involved in the projects and to the diffusion of intermediate and final results, together with the analysis of the experiences of health care home delivery and the identification of the most significant.

The work will then required to verify the existence of a minimum set of common data among projects and to develop a model of evaluation through a panel of indicators compatible with the common dataset. The design of interfaces for the management of data and the statistical evaluation of results will then follow. Finally, the project will create a debate that will bring to the decisive definition of an extended and shared model of care. Results of this kind would be easily transferrable to all Italian units interested in starting a home care delivery experience.

3.2.6 Output of the Project

The output that the project is expected to provided according to its schedule are the production of a common work portal to share information among participants, a document of census of experiences and models of telemedicine for patients affected by COPD in Lombardia and, eventually, in other countries, a model of evaluation that allows to select the experiences worth deepening, the identification of a system of indicators necessary to compare the models, during the first 6 months.

4. CONCEPTUAL FRAMEWORK

4.1 Description of the Conceptual Framework

The literature analysis and the results of a panel discussion conducted during the Workshop of *Progetto Strategico BPCO* (November 26th 2009) brought to define a more specific conceptual framework of drivers explaining the organizational sustainability of a telemedicine service, some of which had already been mentioned in Table 2.2 and analyzed in the relative paragraph.

In particular, the main organizational drivers have been reduced from 7 to 5: the Political and Cultural Factors have been excluded from the framework, since the background of evaluation is the Italian context and therefore the cultural and political context is constant.

1. *Patient/care giver characteristics -> patients' education*

Many literature sources are unanimous in assessing that a key component of management guidelines in asthma and COPD is the recommendation for patients' education. Nevertheless, the opinions are heterogeneous: a Cochrane review found that self-management education had no effects on hospital admissions, ER visits and lung function, whereas a Canadian study reported that hospitalizations and ER visits could be reduced with self management strategies.

Further studies, aimed at identifying factors that might help to get a better understanding of which patients and why they continued to visit the ER, have demonstrated that, although information is not sufficient to reduce the burden of disease, patient education focused on self-management and behavioral change should be emphasized (Emtner et al., 2009).

Moreover, a correct education of patients may decrease the poor understanding of many of them about COPD and its implications and the misunderstanding coming from it; it may furthermore have positive effects not only on patients, but even on their families and caregivers. An incapacity in dealing with the disease with an acceptable level of autonomy may affect the family in deep, determining frictions, reducing their ability to engage in social activities and enjoy a normal life. Wagner et al. (2001) assess that chronic disease interventions that positively affect patient well-being necessarily include systematic efforts to increase patients' knowledge, skills and confidence to manage their condition (Wagner et al., 2001).

The most remarkable enabling factor dealing with patients' characteristics is therefore their level of education (*patients' education*).

2. *Professional characteristics -> role of nurses*

The literature analysis showed that the major contribution in the treatment of chronic disease is granted by nurses, as they possess the characteristics and competences to perform a large proportion of the care delivery, while the chronic disease management has been traditionally organized in horizontal systems, with patients being transferred between primary care and specialist hospital services, this model has been nowadays discussed since the weak integration of professionals involved determined its failure. Studies conducted on structures reforming the model by giving major independence to nurses, reported encouraging results. Firstly, in terms of service structures, the most common effect of nurses is on improving access to services, particularly for vulnerable or difficult to reach groups; for care processes, the strongest evidence of impact is on the care experience with evidence suggesting beneficial effect on patient satisfaction and care quality, though the strongest and most consistent impact relating to clinical outcome is on patient's behavior, particularly self care behaviors (Forbes, A. and While, A., 2008). Moreover, a regular nurse contact, together with the definition of a shared plan of care, is associated with a reduced need for unscheduled primary care consultations and a reduction in deaths due to COPD (COPD Update 4, 2008).

Although there is urgency to develop the core principles defining the nursing contribution at the individual, population and system levels within chronic disease management, the potential role that nurses may play in the service should be unquestionably analyzed in order to assess the organizational sustainability of a telemedicine service (*role of nurses*).

3. *Organization characteristics -> guidelines*

Since the management of chronic diseases, COPD in particular, requires different professionals (nurses, GP and other specialists or care assistants) to work in partnership to provide the best service to the patients, literature is unanimous in asserting that their activities can be properly executed only if evidence-based clinical practice guidelines exist (Zwar et al., 2008). The presence of shared ways of actions is also basilar to manage the risk connected to home care, since the number of professionals involved and the potential interference in their actions should result in a nebulous definition of which practices each of them should perform.

The presence of shared plans of action is therefore enumerated in the ensemble of the factors making a service sustainable (*guidelines*).

4. *Actors, Network and Alliances -> continuity of care; suppliers/backers involvement*

As it has been already assessed in the section dealing with the organizational characteristics, a strong commitment in making the care continuous instead of dangerously fragmented among the different professionals is a key component of a well functioning service. Notwithstanding, many studies highlighted the lack of collaboration among structures and professionals dealing with care; in particular, a study conducted by J. Garcia et al. (2005) reports that one out of five patients answering the question "who is in your opinion the most important doctor in treatment and control of your respiratory care?" did not identify any doctor responsible of their respiratory disease management; moreover, 21% of moderate-to-severe COPD patients admitted to an hospital by an exacerbation reported not being controlled regularly by any physician, not even a specialist. The prevalence of these episodes of low quality services, to the point that the disease is not even detected, push to take in consideration the *continuity of care* as an unquestionable factor of an appropriate and sustainable service.

Apart from professionals clinically involved in the activities of care, some articles mention the possible direct intervention of backers or technology supplier in care delivery. It is the case, for example, of some of the services involving a remote call center, or services promoted by the technology developers to test the efficacy of their devices. This involvement appears as an another remarkable factor in the network of care, since it may represent a source of ulterior complexity of coordination, a potential waste in resources or, on the other hand, it may be the unique possibility for some experimentations to survive in time (*suppliers/backers involvement*).

5. *Change Management and Responsibility -> technology employed*

Most of the articles analyzed perceive technology development as the main source of change in health care delivery models, while the enormous potential of telemonitoring and of the use other forms of technology to assist in the provision of better care for those with long term respiratory disease is commonly recognized (Smith et al., 2009). Nevertheless, the heterogeneity of technologies that may be employed, the difficulties embedded in their use (being COPD a degenerative disease, most of the patients requiring care at distance are

elderly and therefore have low familiarity with technology devices on average) and the organizational models imposed by the choice of a particular kind of device imposes are serious matters of concern and discussion. Moreover, devices are associated with software providing interpretative tools of the outlines; the correct functioning and definition of alarm thresholds or other parameters entails great responsibility, as if it does not work properly it can put the patient's life in serious danger.

This analysis has therefore brought to add the *technology employed* among the factors enabling the organizational sustainability of a telemedicine service.

Being *patients' education*, *role of nurses*, *guidelines*, *continuity of care*, *suppliers/backers' involvement* and *technology employed* the main variables explaining organizational sustainability emerging from the analysis of literature, the conceptual framework appears as the matrix reported in Table 4.1, that should be filled with the singular specification that each project provides of the different enabling factors.

	patients'education	role of nurses	guidelines	continuity of care	suppliers/backers' involvement	technology employed
ORGANIZATIONAL SUSTAINABILITY						

Table 4.1 – Conceptual framework of analysis

To assess if the conceptual framework is valid, complete and fulfilling, some case studies have been performed and an empirical framework has been defined from them.

4.2 Case Studies

The case studies reported in the present paragraph derive from a selection of the experiences of Health Care delivery through telemedicine in the Italian context that has been conducted taking advantage of a data base of cases and remarkable trials of telemedicine devices collected in the context of the *Progetto Strategico BPCO* (see paragraph 3.2). The information reported in the paragraph come from a consistent number of interviews conducted with the professionals involved in the service delivery (lung specialists, nurses, general directors), within the structures where the projects take place. The decision to focus the attention on Italian hospitals and networks of healthcare providers has been taken in order to gain evidence from a homogeneous cultural and legislative context.

The interviews (whose baseline is reported in Appendix A, while a synthesis of its contents is reported in paragraph 3.1) have been developed with the aim to better understand the delivered service and its organizational burden and to investigate what the interviewees meant with the expression “sustainability of a health care delivery service”.

To help the comprehension of the different kinds of services delivered, a list of the most common ones activated within the Italian context is provided in Table 4.2.

Service	*Description*
MONITORING	*Once the patients receive the devices at home, they are contacted by their personal tutor nurse/specialist/call center operator, that pose them some questions (qualitative, dealing with the general health condition and feeling of the patients; quantitative, as the patients are requested to activate the technology device and to read the values that come from it).*
TELEMONITORING	*Patients at domicile perform through the technological devices a record of the main vital parameters . The outline is automatically sent to the referring specialist/nurse. At predefined deadlines, the specialist/nurse examines the parameters and provide an evaluation of the patient's conditions.*
TELECONSULTING	*The home-assisted patients have the possibility to contact directly the referring specialist/nurse/call center in case of a perceived worsening of symptoms. The specialist/nurse tries to understand the situation and intervene in the most suitable way.*
DOMICILIARY ASSISTANCE	*In case of specific necessities that the LHC’s home assistence staff is not able to perform, the service foresees the intervention of the professionals belonging to the Hospital unit (specialist, nurse and technician).*

Table 4.2 – Synthesis of the most common services provided

The following paragraphs contain a detailed description of the case studies; each experience is described following a predefined structure, in order to facilitate the reading and make the activity of comparison easier. In order to respect the privacy of the interviewees, the text reports the roles they hold in the experience but not their names.

Initially, the description exposes some information about the structure hosting the service, about the historical evolution of telemedicine experiences conducted in it, a description of the patients which the service is addressed to and an explanation of the services active within the experimentations, whose comprehension is supported by some graphical representations of the workflow. Then it is reported a synthesis of the considerations mentioned by the interviewees about

the organizational sustainability of the service, in response to the questions of the last section of the predefined interview; this sub-paragraph is organized in three sections, each of whom is aimed at emphasize a different aspect of the gaps presented by literature about the topic of organizational sustainability (see paragraph 2.2): the section named SATISFACTION is aimed at investigating whether the staff and the patients accept to introduce the service in the routine activities or not; the section EFFICIENCY reports the aspects of the experimentation that give evidence on the potential links (if they exist) between the organizational and economical sustainability; the section COORDINATION focuses more on the factors influencing the organizational sustainability of the service.

Moreover, each paragraph ends with a reproduction of the conceptual framework, filled with details of the experimentation that explain the influence of each driver on the organizational sustainability of the service in the complex. Some of the information comprised in the spots are introduced by a symbol (+) or (-) in order to facilitate the identification of the positive and negative aspects of the experimentation in exam. Some are instead anticipated by the word ABSENCE, to underline a defective lack reported by the interviewees themselves. The last line of the Table reports the criticalities remarked by the interviewees that do not find any suitable location in the other spots of the Table; as a consequence, they would be deepened as *unexpected* drivers in the construction of the empirical framework.

In Table 4.3 a synthesis of the projects taken in consideration is reported. The deeper analysis of all cases is available in the following paragraphs.

	Telemedicine-based services provided	*Telemedicine-based Services Main Goals*	*Patients*		*Main Actors Involved*
			number	*typology*	
1 **CREMONA**	Telemonitoring Teleconsulting Domiciliary Assistance	Home Hospitalization	17	Seriously Severe	Hospital physicians; LHC staff
2 **TORINO**	Telemonitoring	Follow-up of ambulatory patients	15 -> 60	Quite Severe	Hospital physicians; Call center operator
3 **RIETI**	Telemonitoring Teleconsulting	Follow-up of ambulatory patients; overcoming of geographical barriers	29	Severe	Hospital Nurse
4 **ROMA**	Telemonitoring Teleconsulting	Follow-up of ambulatory patients	8	Quite Severe	Hospital physician
5 **CASATENOVO**	Telemonitoring	Follow-up of ambulatory patients; overcoming of geographical barriers	(A) 20	Severe	Hospital physician
			(B) 30	Severe	
			(C) 30	Severe	
			(D) 8	Quite Severe	
6 **ARENZANO**	Telemonitoring	Correct disease diagnosis	-	-	General Practitioners
7 **VARESE**	Telemonitoring Teleconsulting Temporary telemonitoring	Follow-up of ambulatory patients; overcoming of geographical barriers	≈ 300	Severe	Hospital physicians; Call center operator;
8 **MANTOVA**	Teleconsulting Domiciliary Assistance	Follow-up of ambulatory patients; Home Hospitalization	160	Seriously Severe/Severe	Hospital Nurse; LHC staff
9 **VERONA**	Telemonitoring Teleconsulting	Home Hospitalization	240	Seriously Severe/Severe	Hospital physicians; Hospital Nurse

Table 4.3– Synthesis of case studies

4.2.1 Cremona

The structure hosting the service is a complex operative Unit, whose director retains that its main critical success factor is the perfectly trained and highly qualified staff of which he disposes.

In Table 4.4 a summary of the main characteristics of the structure hosting the project is reported; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lombardia
	LOCAL HEALTH CENTER:	LHC of the Province of Cremona
	NAME OF THE STRUCTURE:	Hospital of Cremona
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Complex Operative Unit, with a semi-intensive Unit
	CHARACTERISTICS OF THE SERVICE:	9 Specialists 30 beds
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project referral (PR) LHC responsible for home care (LHCR)
	SERVICES PROVIDED:	Telemonitoring, teleconsulting, domiciliary assistance

Table 4.4- Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

A consolidated experience of Telemedicine service delivery has been running for 4 for years (from 2006) in the Ospedale Maggiore of Cremona. The PR does not intend to redefine or discuss any aspect of the service, as he is convinced that the actual organization is adequate from the point of view of both the patients and the staff.

Patients' descriptions

At the moment 17 patients are involved in the service, selected in accord with the Local Health Center (LHC); this last manages the technology supply and the delivery of the other home care assistance needs - apart from respiratory care – to the citizens in need. It is an intended choice of the responsible of the service to include patients in a severe stadium of COPD, ventilated or tracheostomized, interested by highly weakening comorbilities. In particular, the service is of great help in the management of patients affected by Amyotrophic Lateral Sclerosis (ALS), whose number

is considerably high in the district, as it gives them the opportunity to be de-hospitalized and live in their own houses, with the same level of safety that an hospitalization assures. The PR is convinced that following a limited number of patients preserves a correct relationship patient-clinician, that is a crucial element in the care of chronic illnesses: the awareness and knowledge of the clinical situation of each patient personally increases the effectiveness of the interventions.

Moreover, patients converging in the service belong to the district of the Hospital and live in an area whose maximum distance from the Hospital is of 30 kilometers: this wariness gives to the medical staff the opportunity to intervene in a short time when required.

Services Description

In 2006 began a collaboration among the LHC and the Unit of Pneumology directed by the PR, aimed at providing a high quality home care service for patients affected by COPD at a severe stadium. The partnership, called Integrated Domiciliary Assistance (IDA), foresees that the LHC provides the technology and manage the contracts with the suppliers, assuming the entire burden of the home care in all its needs, while the hospital unit staff is responsible for the management of COPD symptoms and exacerbations. In case of acute exacerbations or suspicious symptoms, the patients dispose of a preferential access to day hospital care.

The path of inclusion of a patient in the service starts when any clinician of the unit gets in touch during the normal routine with a person affected by COPD that suits the access criteria, fixed by the LHC. If the family agrees and the LHC retains that the patients could be an adequate candidate, the patient or his/her caregiver are contacted to fix a meeting in the domicile, in order to evaluate the typology of service needed and, as a consequence, which kind of financial reimbursement should be assigned. Regione Lombardia, in fact, provides two different solutions for the reimbursement of care at domicile, called *voucher* and *credit*, each of whom covers a different number, intensity and therefore cost of interventions.

Once defined the typology of aid needed, the LHC takes the duty to provide all the tools and devices that are necessary to manage the service. When the domicile is ready to receive the patient and the technology has been tested, the LHC agrees with the hospital Unit upon the day of the de-hospitalization, in order to organize in detail the moment of the arrival at home, helping the family to face the first difficulties dealing with the care at home.

A graphical description of the processes is available in the flowcharts in Table 4.5, 4.6 and 4.7.

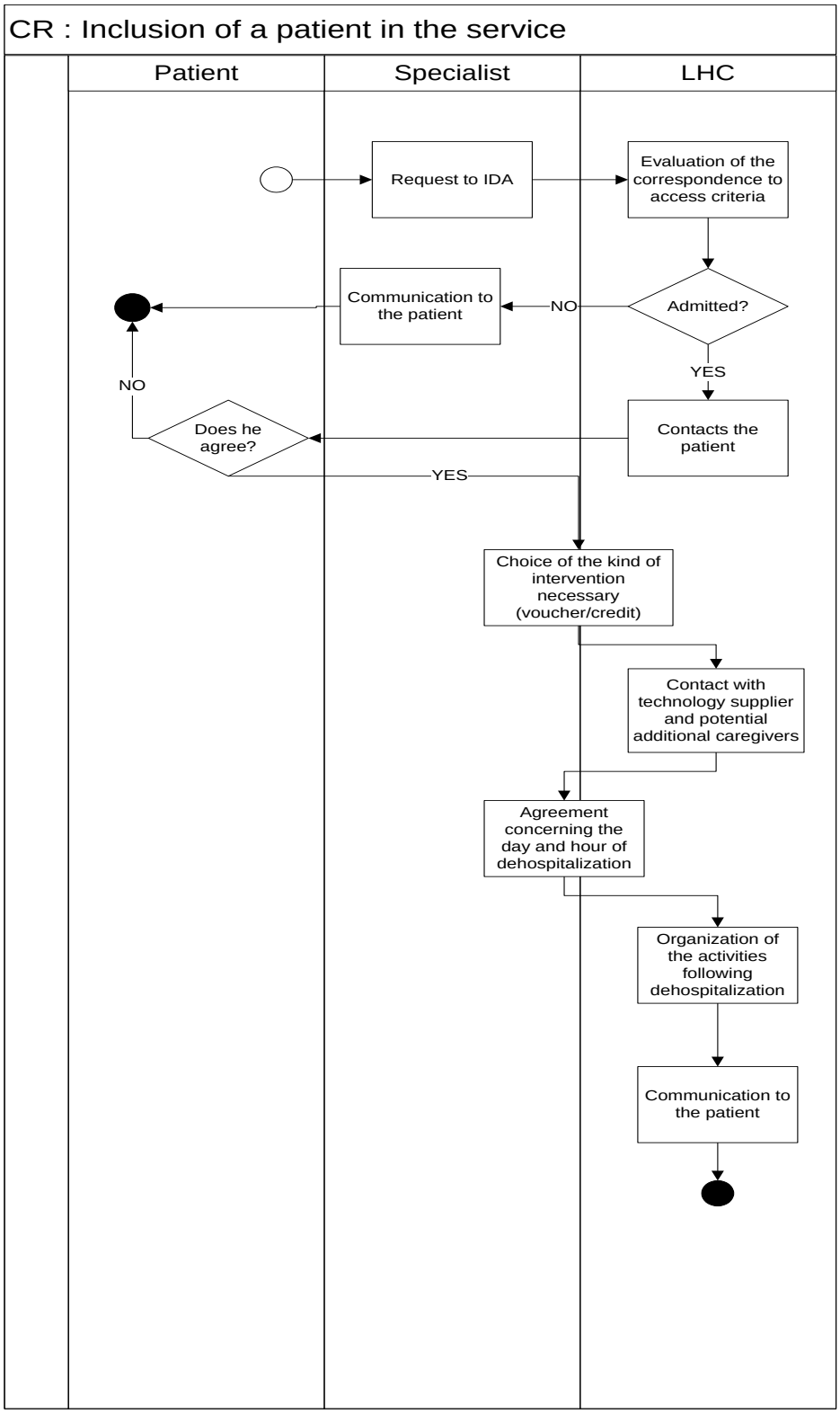

Table 4.5 – Inclusion of a patient in the service

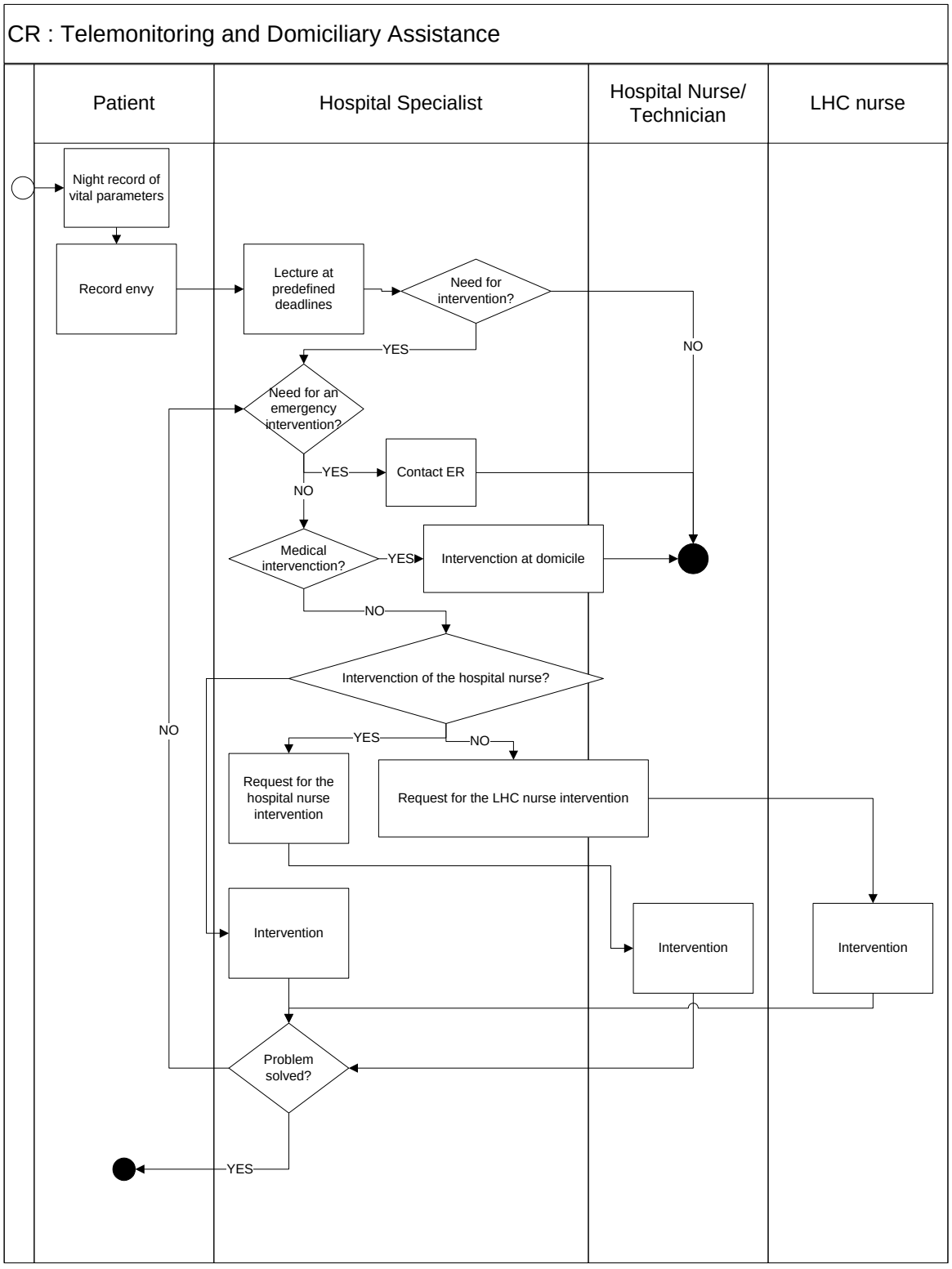

Table 4.6 - Telemonitoring and Domiciliary Assistance

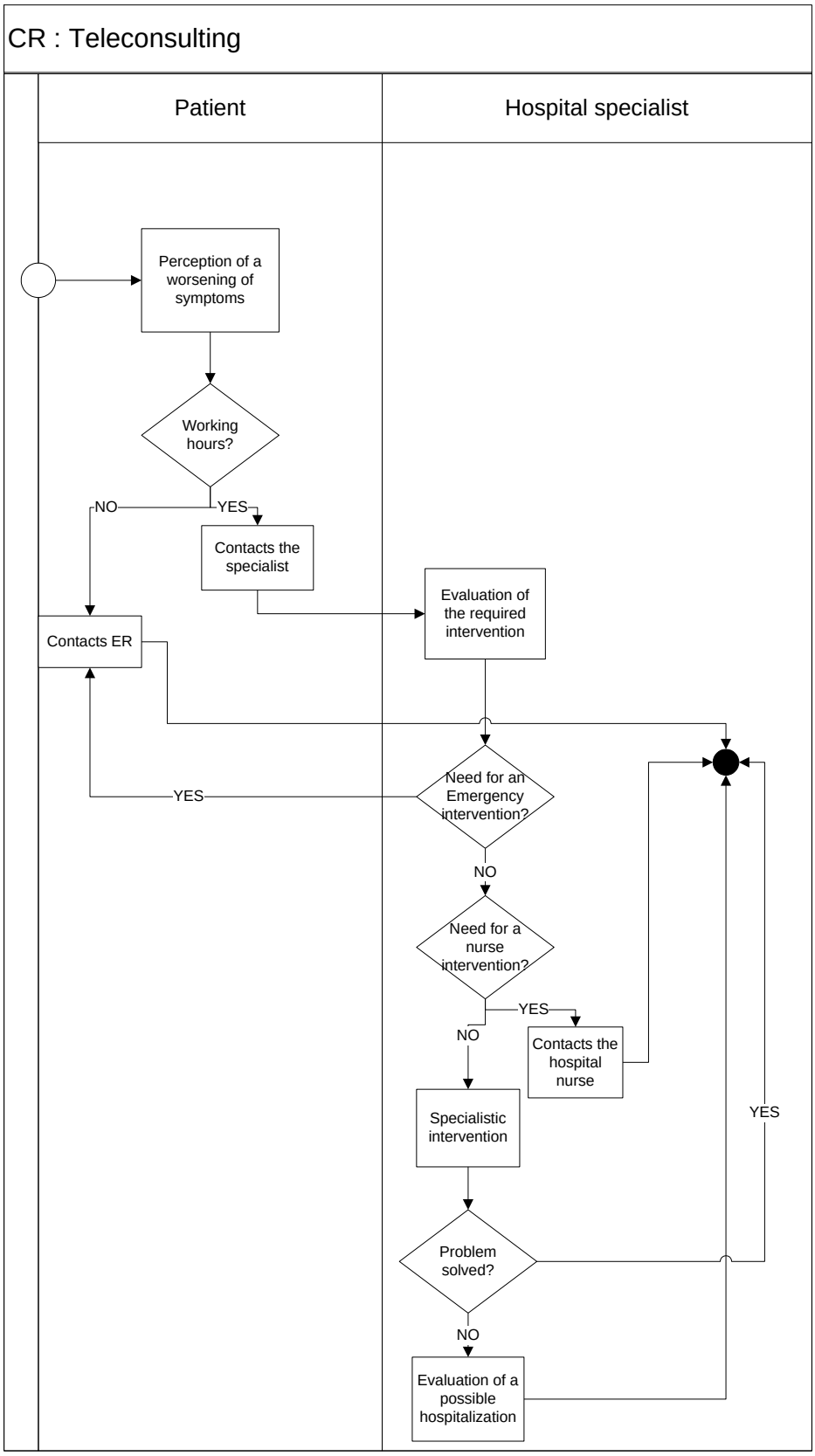

Table 4.7 – Teleconsulting

The services provided by the staff of the PR in the context of the Integrated Domiciliary Assistance are the following:

TELEMONITORING: Patients at domicile perform through the technological devices supplied by the LHC a record during the night of the main vital parameters (blood pressure, pulse and saturation). The outline is then automatically sent via-telephone to the referring specialist, assigned to patient when the service starts. At predefined deadlines, the specialist examines the parameters and send a medical report back to the patient via e-mail. The frequency and scheduling of the dispatch of the outlines is arranged and programmed personally, according to the clinical conditions of the patients.

TELECONSULTING: The home-assisted patients have the possibility to contact directly the referring specialist in case of a perceived worsening of symptoms. The specialist knows each patient and his clinical conditions personally: he can therefore understand more easily the situation and intervene in a more effective way. Nevertheless, since the service is not available out of the hours of activity of the Unit, potential emergency interventions remain under the responsibility of the Hospital ER Unit.

DOMICILIARY ASSISTANCE: Professionals of the LHC reach with predefined frequency the house of the patients to effectuate the interventions scheduled in the personal plan of the service of Integrated Domiciliary Assistance. In case of specific necessities that the LHC's staff is not able to perform, the service foresees the intervention of the professionals belonging to the Hospital unit (specialist, nurse and technician). If needed, the professionals reach the domicile of the patient autonomously.

Organizational Sustainability of the Service

The answers of the PR to the questions of the last part of the interview allows to discover that he is convinced that the sustainability of a health care delivery service in terms of economic effort and feasibility. He states that an health care delivery service is sustainable if the relationship between the demand and the offer of care is correctly analyzed and balanced. Nevertheless, an accurate evidence-based analysis is required to evaluate the care needs, the available resources and the characteristics of the territory. Once defined the most suitable offer in respect to the demand, investments in technology and training of staff is needed to align the two.

SATISFACTION: The actual organization of the service is perceived as positive from the point of views of both the patients and the staff, except nurses.

In fact, the hospital nurses do not hold an active role in the management of the service, since the operative care is performed by the nurses of the IDA. In particular, hospital nurses have contacts with the patients only when a lung specialist asks them to perform a specific intervention at domicile, that goes beyond the competences of the IDA nurses. Hospital nurses do not receive any additional remuneration for the service and they perform the interventions at domicile during their work hours. The lack of a motivating effort of the responsible and the understandable scarce availability of the hospital nurses to assume the risk of the interventions without any insurance result in a deficient enthusiasm about the service. The scarce involvement of nurses is endurable only because the service is dedicated, on purpose, to a limited number of patients: if the service was enlarged to a more numerous group of patients, the organizational burden would become too elevate.

Nevertheless, the organizational burden is already significant: nine clinicians and two nurses belonging to the unit are involved in the service. Each of the specialists follows a maximum of 3 patients of the home care service autonomously. The responsible of the project decided to involve the nurses of the endoscopy since they are more frequently in contact with tracheostomized patients in their routine activities. Nevertheless, the whole Unit is involved in the service and the staff is available in case of need.

EFFICIENCY: The absence of a shared list of charges and of shared guidelines defining the risks and the legal responsibilities of the different professionals (GPs, nurses, lung specialists etc) involved in the patients' management at domicile, represent two important challenges to the organizational sustainability of the service.

COORDINATION : The integration between hospitals and LHCs is an enabling factor to build a sustainable service, as it allows the structures to both evaluate the needs of patients better and avoid taking up *ex-novo* solutions, applicable only in theory. This integration should translate, operatively, in the strengthening of the collaboration and cooperation among specialists and GPs; institutionally, in increasing the dialogue among the hospital and the LHC. More in deep, the integration should be realized in the control of costs, orientations and strategies, management of human resources.

In order to increase the sustainability of the currently active service in the structure, it is necessary to: 1) clarify the charges or, alternatively, identify a coherent system of incentives; 2) the patients' domiciles should belong to the hospital district, in order to increase the possibility for a clinicians to intervene on time; 3) considerate that the technology cannot substitute the direct relation among clinicians and patients; in fact, although telemedicine represents a valid tool to avoid the hospitalization of patients that, on the contrary, should stay in the hospital permanently,

preserving a personal relationship is crucial since it allows to create a climate of trustfulness that enhance the effectiveness of the service delivery.

Nevertheless, though the collaboration among the LHC and the hospital Unit is positive, the contribution of the GP is still not clear. Some GPs, in fact, do not want to be involved in the service and the lung specialists proceeds in keeping them occasionally updated about the conditions of the patient; others, on the contrary, are seriously collaborative in the delivery of care, performing some of the interventions otherwise demanded to the hospital staff. Nevertheless, the lack of shared guidelines defining the requested involvement of GPs is cause of ineffectiveness in the service. A common action on the home care delivery would allow, in fact, to provide a more flexible service and a more correct use of professionals.

The following Table reports the structure of conceptual framework filled with the information derived from the interview conducted in Cremona.

CREMONA	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	(+) ability to notice imminent worsening of condition (direct call to the Spec) = better diagnosis & resources saturation decrease	(-) able to be autonomous in providing part of the care BUT play a marginal role in patients' management	ABSENCE : requested involvement of GP; risk management	(+) Hosp & LHC : alignment and integration of actions	(+) Hosp&LHU: effective partnership	(+) dehospitalization (+) easier day hospital examinations planning when needed
				(+) collaborative staff mood		(+) opportunity to fill the gap bw GP&Spec
CRITICALITIES	Positive opinion based on impressions (lack in demonstrability of results); lack in shared guidelines for risk management; high organizational burden.					

Table 4.8 – CREMONA: conceptual framework

4.2.2 Torino

The structure hosting the service is a complex operative Unit, whose director retains that its main critical success factors are: 1) the possibility for the patient to take advantage of a direct access to care; 2) the presence of an ambulatory of high level of respiratory physio-pathology, well-known in Torino; 3) the possibility for the patients to be treated through a detailed and customized follow-up program.

In Table 4.9 it is reported a summary of the main characteristics of the structure hosting the project; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Piemonte
	LOCAL HEALTH CENTER:	LHC of the Province of Torino 2
	NAME OF THE STRUCTURE:	C.P.A. of Torino
	TYPOLOGY OF STRUCTURE:	Qualified Institute presidium of the LHC
	UNIT DESCRIPTION:	Complex Operative Unit
	CHARACTERISTICS OF THE SERVICE:	5 Specialists, 3 nurses
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEE:*	Project referral (PR)
	SERVICES PROVIDED:	Telemonitoring

Table 4.9 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

The first experimentation involving the employ of telemedicine devices has been conducted in the structure from July 2008 till July 2009; given the relative satisfaction of patients and professionals, the projects has been extended to the following year. Later on, the LHC accepted to finance a further extension of the service for 2010. The technology is provided by Vivisol, who is responsible for the management of the service.

Patients' descriptions

At the moment 15 patients are involved in the service, but the LHC has accepted to extend the service to 60 participants in the next future. The access criteria consists in severe pneumological conditions, with a measured FEV1 (see Table 1.1) lower than 50%. All the patients followed at domicile, live in the district of competence of the LHC.

Services Description

Two years ago (2008) started the collaboration of the CPA of Torino with Vivisol, that awarded the call for tenders for the oxygen supply for the respective LHC. The Company suggested the Unit to test a telemedicine service, that would have required a low organizational burden for the staff. In effect, Vivisol is not only responsible for the technology and its maintenance, but also for the management

of the relationships with patients involved in the service through the institution of a committed call center.

Any clinician of the Unit that treats a patient affected by COPD may propose him to join the service, if he suits the access criteria. If the patient and/or the caregiver accepts, the clinician is expected to give him a complete informative prospect, that explains the service in deep and to ask the patient to sign for the acceptance and to inform his GP about it. If even the GP agrees, the clinician contacts the technology provider, that proceeds in defining the details of the service required. Once the technology is available at home and the patient/caregiver is able to manage it, the service starts.

With a predefined cadence, an operator of the call center calls the patient's domicile on the telephone; with the aid of a predefined questionnaire, called *Respicard*, the operator poses some questions about the general conditions of the assisted person and the values resulting from the records of vital parameters. Each answer corresponds to a score; the sum of the scores defines a total value that, correctly interpreted, provides a synthesis if the general conditions of the patient.

Once conducted the interview, the operator proceeds in uploading the answers and the total score on a website, where the clinician may access and control at predefined deadlines the general trend of the pathology for each patient. If he detects an alarming situation or finds some suspicious values, the clinician contacts the patient directly and tries to understand if an exacerbation is in course (if so, he calls the ER service); if the situation seems stable, he may ask the call center to augment the frequency of the gathering of parameters or to predispose an hospitalization aimed at checking the general situation.

A graphical description of the processes is available in the flowcharts in Table 4.10 and 4.11.

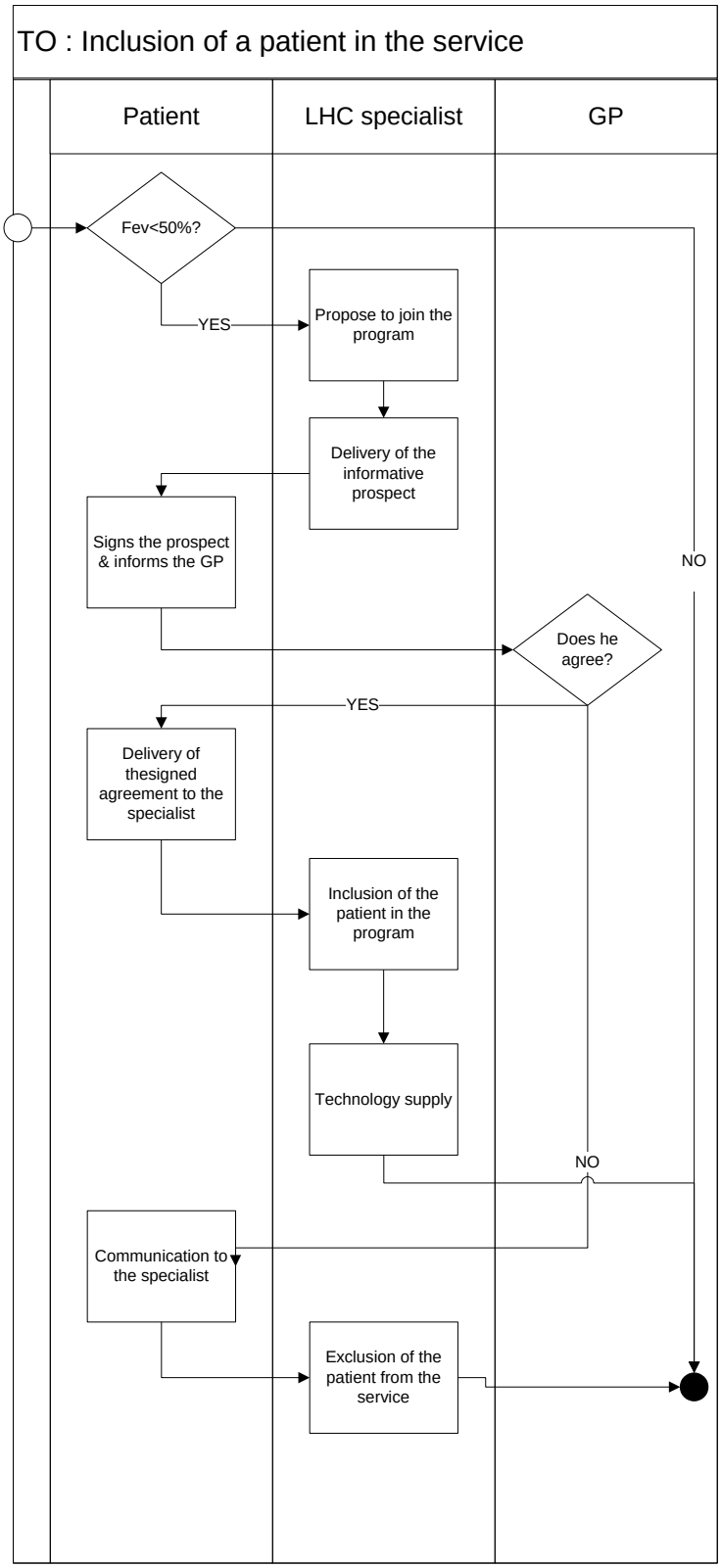

Table 4.10 – Inclusion of a patient in the service

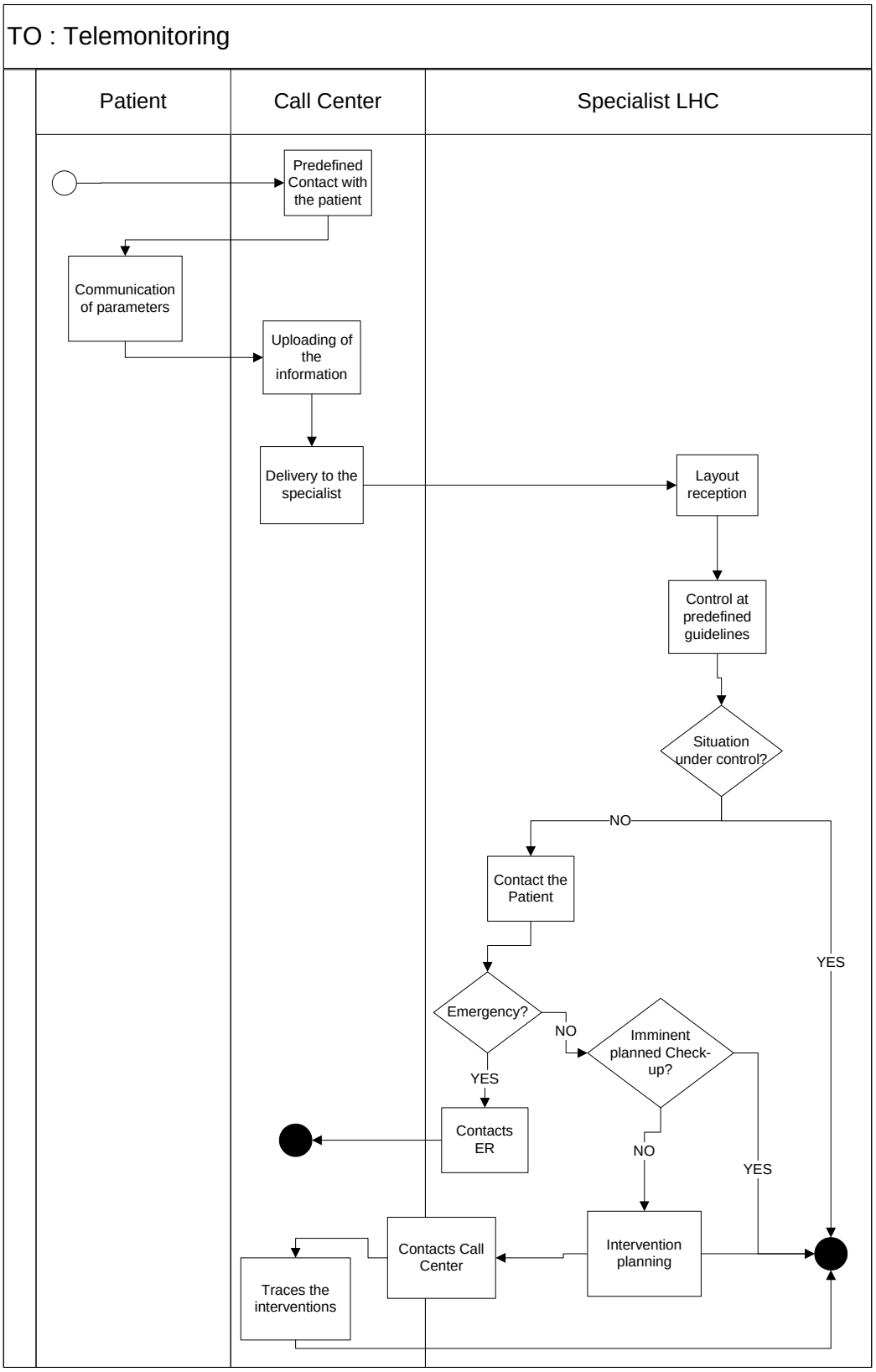

Table 4.11 - Telemonitoring

The services that the PR and his staff provide in the context of the Integrated Domiciliary Assistance is the following:

TELEMONITORING: The patients/caregivers perform through the technological devices supplied by Vivisol a record of the main vital parameters (blood pressure, pulse and saturation) during the night. At predefined cadence, an operator of the call center contacts him and poses some questions regarding his general conditions and records the parameters in a predefined gridline. The operator proceeds in uploading in a server the file resulting from the interview. The clinician examines the outline and he is aided by the software in detecting potential suspicious values. If the health conditions justify it, the clinician contacts the patient directly and defines the intervention required.

Organizational Sustainability of the Service

The PR, once interrogated about his conception of sustainability, told that he intends the sustainability of health care service delivery as the balance between the available resources and the best service deliverable.

Nevertheless, the commitment of the competent political authorities is the unique driver cited in order to enhance it, even though, in order to help the authorities, it would be desirable to create a shared model of action among all the professionals involved.

SATISFACTION: The organizational burden of the service has been sustainable until now, since the workload for the clinicians has remained unchanged: they have to take the habit to check the email more frequently than before, but the activities necessary to check the patients' conditions take no more than 15 minutes a day. Moreover, the specialists are positive about the service, since it allows them to have higher visibility on the pathology and to follow it better.

Nevertheless, the call center, which is the factor enabling the lung specialists to experiment a lower burden of care, is not always welcomed positively by patients; some of them, in fact, expressed discomfort about the intrusiveness of the operator, while others decided to abandon the service since they felt that the personal relationship with the specialists was diminishing.

EFFICIENCY: The service is not obstructed by the LHC, since it does not imply much costs and it represents a first step for the domiciliation of the service, useful to better accompany the patients in the treatment and to reduce the hospitalizations.

Doubtless the program will require higher commitment, since Vivisol foresees to enlarge the service from 15 to 60 patients. This enlargement may push the responsible to take in consideration the possibility to involve the nurses in the service, totally excluded by now.

COORDINATION: An obstacle to the definition of a common model of care is the existing difference among the services provided by the different LHCs of the city of Torino; to overcome this

problem, the clinicians of the CPA are trying to find an agreement with the lung specialists of the other LHCs of the Province of Torino, in order to involve them in the service.

The GPs do not pay any active role in the service; the lung specialist proceeds in keeping them occasionally updated about the conditions of their patient.

The following Table reports the structure of the conceptual framework filled with the information derived from the interview conducted in Torino.

TORINO	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	(-) Scarce: contacted by the call center the patients answer the questions of the Respicard	ABSENCE : nurses not involved in the service	ABSENCE: differences in the service delivered by the different LHUs	ABSENCE : GP only kept updated + nurses not involved	(-) external call center: patients' perceived intrusiveness	(+) dehospitalization
CRITICALITIES	lack in demonstrbility of results but will to further enlarge the service; scarce personal contact with patients (lack in psychological support; perceived intrusiveness of the call center in patients' lives.					

Table 4.12 – TORINO : Conceptual framework

4.2.3 Rieti

The structure hosting the service is a complex operative Unit, whose director retains that its critical success factor are: 1) an excellent and publicly acknowledged treatments of sleep-related diseases; 2) an excellent management of therapies dealing with chronic and acute in chronic respiratory insufficiency.

In Table 4.13 is reported a summary of the main characteristics of the structure hosting the project; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lazio
	LOCAL HEALTH CENTER:	LHC of the Province of Rieti
	NAME OF THE STRUCTURE:	San Camillo de Lellis Hospital
	TYPOLOGY OF STRUCTURE:	Qualified Institute presidium of the LHC
	UNIT DESCRIPTION:	Complex Operative Unit
	CHARACTERISTICS OF THE SERVICE:	5 specialists, 6 nurses, 2 health auxiliary 1 bed for day hospital service
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project referral (PR) Professional nurse (NU) Strategic Director of the hospital (ADM)
	SERVICES PROVIDED:	Telemonitoring, Teleconsulting

Table 4.13 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

Until 1980 the structure has functioned as tuberculosis dispensary; later, the progressive decrease in the incidence of this pathology push the Regional Authorities to reconvert the service in a qualified institute presidium of LHC, active on the territory. Afterwards, a dedicated pneumologic Unit has been created, in order to focus on the treatment of sleep-related respiratory pathologies and chronic respiratory failures, illnesses highly spread in the area.

Given the mission of the Unit, the path bringing to the activation of a telemedicine service has been brief. In fact, the territory of Rieti is particularly suited for home care delivery through telemedicine, since it is mountainous, spread with little towns scarcely populated, travelling is difficult and transports insufficient. Moreover, since the age of the population is very high in comparison with the national average, the impact of chronic illnesses is very remarkable.

Accordingly, experimentations of home care delivery started in advance if compared to other parts of the Country. In fact, the first experimentation of home care has taken place on the territory in the 1990s, when some lung specialists of the Hospital voluntarily beard the domiciles of a group of patients affected by chronic respiratory insufficiency and occasionally checked their vital parameters, in order to keep the pathology under control. The service delivery turned out to be strongly ineffective, as the coordination was low and there were no plans of the interventions or possibilities to store historical data and, therefore, to reach a more complete vision of the treatment through their analysis. Hence, at the end of the 1990s, some telemedicine devices have been introduced for the first time in the district. The renewal of the service had been managed in partnership with the

actual project referral of the project analyzed in Verona, an Italian lung specialist strongly committed in the diffusion of telemedicine services.

Nowadays the service is well structured and the experimentation is growing in importance, since it is well accepted by the patients, by the clinical staff and by the strategic direction of the Hospital.

Patients' description

Though the historical data show that already 60 patients have been assisted through the service, at the moment 29 patients are involved in the home care delivery service. Citizens that may be assisted through the service are affected by chronic respiratory insufficiency (COPD at stage III and IV), subject to oxygen therapy of long term or even ventilated, for which it is impossible to move away from home and reach the hospital if not with great difficulties.

All the patients, moreover, belong to the district of the San Camillo the Lellis Hospital (about 155.000 people).

Services Description

About ten years ago, the PR decided to organize the home care service better, as it had been previously provided with great enthusiasm but scarce effectiveness. Afterwards, the contract with the provider of the technology expired and the service was suspended, till a new Company, SapioLife, won the call for rentals for the oxygen supply and provided some new telemedicine devices. Together with the devices, the Company is providing a software to manage data records that is currently adopted by the nurses. In this case study, in fact, two nurses (one of them is the tutor of the experimentation) are responsible for the management of the service.

The introduction of a patient in the service is possible from a triple source: either the GP, a specialist of the Unit or even specialists belonging to other units of the hospital may inform the tutorial nurse of the presence of a possible candidate for the service. If the patient suits the criteria, the nurse contacts him and proposes to join the service. In fact, although the service is well-accepted by the majority of the patients, some of them felt it too invasive and intrusive in their normal lives and decided to decline the proposal of the nurse.

In case of agreement, once verified that the conditions for the service delivery exist (some areas of the territory, for example, are not reached by the telephone line and this lack forces the staff to exclude the potential patients), the GP is informed and, if he agrees, he signs the contract of acceptance.

Once defined the adequateness of the patient to the service and informed the technology supplier, an hospital nurse reaches the domicile of the patient to start the training of the patient himself or of the caregiver. The training is customized according to the necessities of the family:

many people affected by severe COPD are old and the available caregiver, which is commonly represented by the wife/husband of the patients, do not feel very comfortable in the use of technology or is not physically able to perform some necessary care activities.

In any case, the service becomes active only when the nurses understand that the caregiver has reached an acceptable level of confidence with the technology. The activities of training, prerogative of the nurses, is particularly important in respect to the population to which the service is destined, since the nurse that took part in the interview reported some example of the deep lack of medical education showed by the patients, even in aspects of the care that would seem very simple and intuitive. In particular, she talked about a man that asked her to change the mask of the ventilator as it was not functioning properly; when the nurse met the patient to effectuate the change, she found the top of the oxygen mask burned, because the patient used to smoke while assuming the oxygen.

A graphical description of the processes is available in the flowcharts in Table 4.14, 4.15 and 4.16.

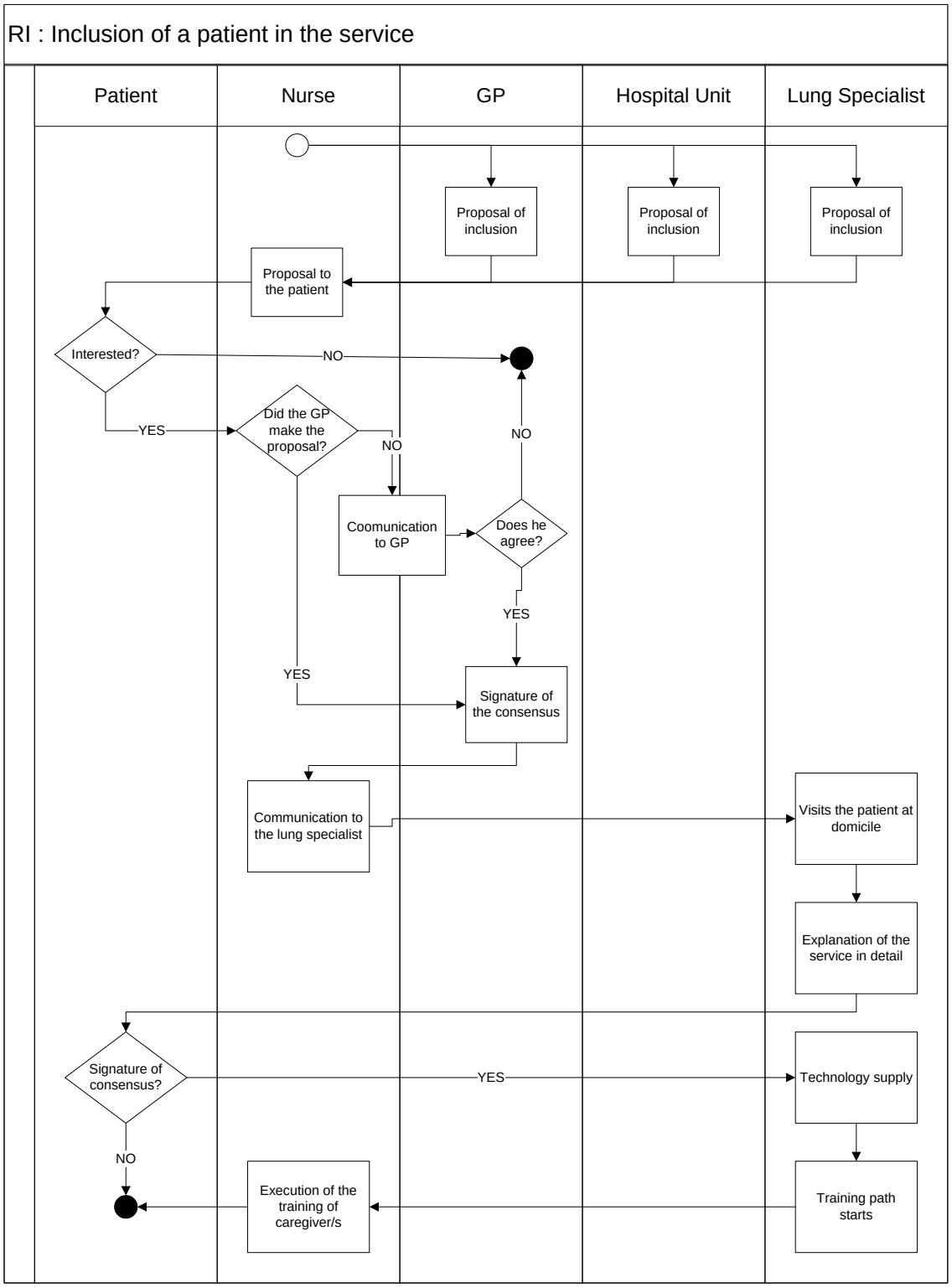

Table 4.14 – Inclusion of a patient in the service

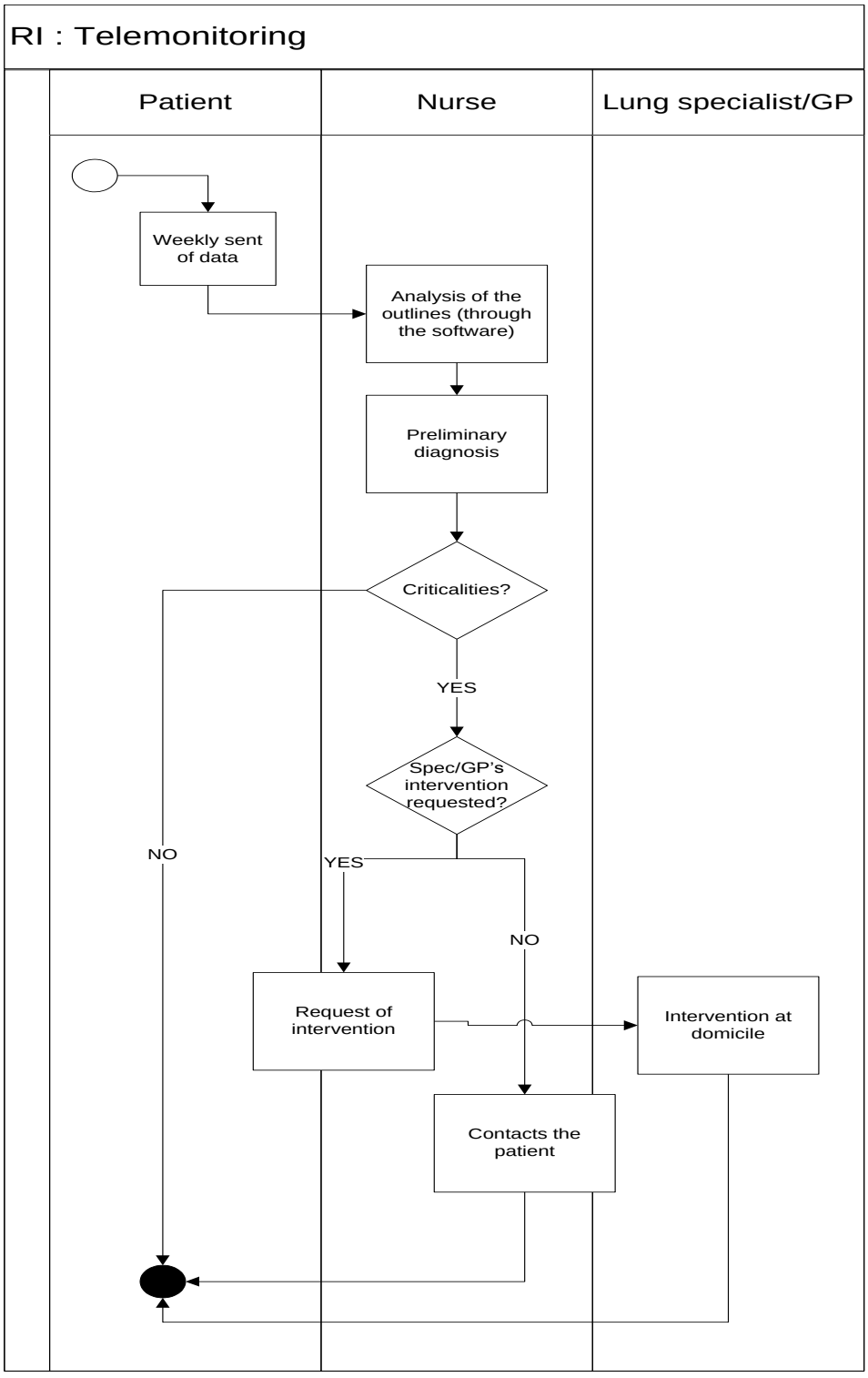

Table 4.15 – Telemonitoring

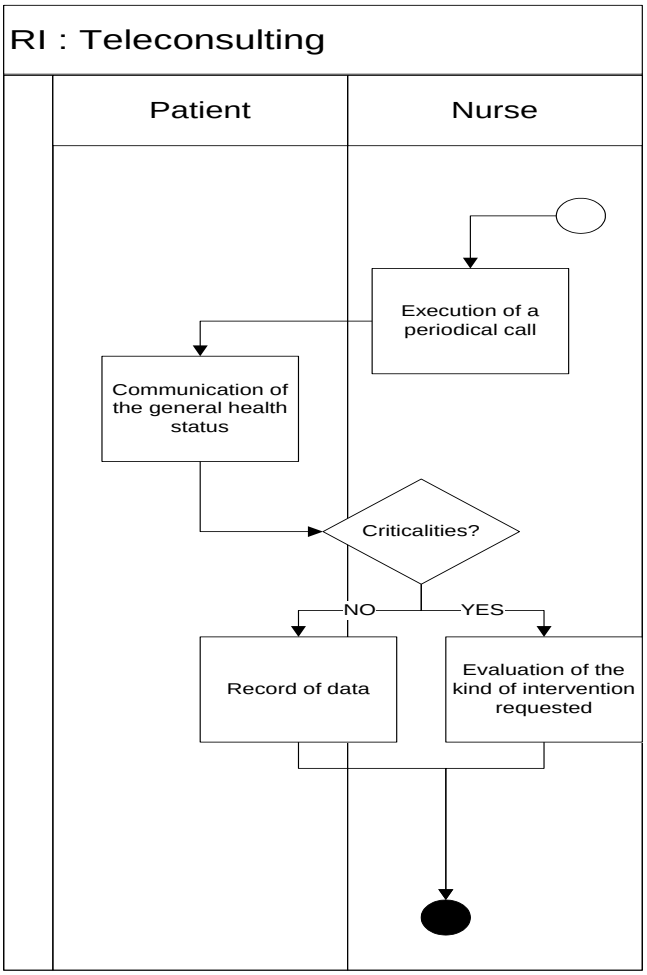

Table 4.16- Teleconsulting

The services that the staff of the PR provides in the context of the home care assistance are:

TELEMONITORING: Once the training is terminated, the service becomes active in all its aspect. Each patient plans with the nurse the frequency of data recording; the nurses, aided by the software that organizes data in a more legible and effective way, controls the outlines and, if she notes any parameter out of normal, contacts the domicile of the patient to understand if a specific intervention is needed. After this preliminary analysis, the nurse decides whether to call the specialist, the GP or even the emergency service.

TELECONSULTING: Even if the vital parameters are good, the nurses proceed in calling the patients at domicile with a predefined frequency, in order to make sure that the situation is under control by every point of view (family troubles, need for psychological help, etc). The patient/caregiver himself may call a special number to talk directly with the nurses and to ask some specific questions, when needed.

Organizational Sustainability of the Service

The PR believes that, in order to create a sustainable health care delivery structure, it would be necessary to put the actual one in discussion. In particular, the potential future guidelines for the pneumologies are identified in spreading the delivery of care on the territory and to consequently restructure the hospital units, in order to make them suitable to face only with the activities of precocious diagnosis and the management of the exacerbations of the two main pathologies lately interesting lung treatment: lung cancer and chronic diseases. Her idea is therefore to move the routine activities of treatment out of the hospital and this would require a partnership among the hospitals, LHCs and GPs. Moreover, a crucial aspect for an efficient intervention is the broaden epidemiologic study and the return to an evidence based medicine, since, if the necessities of the territory are not clarified, every attempt to create an health care service is a potential waste of resources.

The strategic director states that a service may be considered sustainable if it purchases an acceptable output and without requiring an excessive resource consumption; this is possible only if the implemented projects are able to auto-sustain themselves, that is to limit the asking to the competent authorities for their support and sustenance.

SATISFACTION: Nurses hold a basilar role in patients' assistance, as they autonomously define the personal care plans and they express great satisfaction, as their professional is emphasized and taken in higher consideration. A budget for permanent training is dedicated to them by the strategic administration and they are therefore expected to take specific courses annually and to be updated about the treatment of the chronic illnesses.

The hospital structure hosts the Pneumological Nursing Ambulatory (PNA), whose members are responsible for the activities of education and training of patients and/or caregivers. Moreover, the tutor of PNA proceeds in assigning each patient followed by the home care service to a specific nurse, so that each preliminary diagnosis can be more complete, since deriving from a more complete and aware lecture of the clinician conditions.

Moreover, this solution tranquillizes the patients, as it allows them to have a unique and dedicated interface with the hospital and this increases their already high trustfulness in the service.

Satisfaction is measured not only by the general positive mood of the professionals and patients involved, but the director is defining a formalized assessment model. Some measures of efficiency (patients' agreement index, number of hospitalizations of a patient-at-home with respect to a control group treated in ordinary way, differences in the quantity of oxygen employed in the two different situations) are included, together with some measures of efficacy (number of patients adequately assisted for each typology).

EFFICIENCY: The project of telemedicine active in the structure presents drivers reasonably enabling its sustainability, since it is: 1) suitable for the territory; 2) allowing a rational employ of the professionals and therefore the release of critical resources, now employable in different way; 3) a warranty for a suitable home care delivery.

Moreover, the structure of the service is continuously under discussion in order to increase its efficiency as much as possible; at the moment, for example, nurses and specialists are meeting regularly in order to define a standard questionnaire to guide the nurses in the activities of telenursing: predefined and focused questions may help in driving and simplifying their work and may therefore enhance the effectiveness of the service.

To increase the completeness of the service, the hypothesis to increase the number and typology of measured parameters is under discussion: including, for example, weight and blood pressure would make it possible to involve the cardiology Unit too and to provide a more complete service to the patients.

Though the service is well structured on the whole, some uncertainties exist concerning the lack of shared guidelines in the management of ethical and legal risk.

COORDINATION:

The coordination with the territory is assured by the fact that the hospital is a presidium of the LHC, while the collaboration with GPs is particularly scarce. In fact, while some of them understand the importance of the service and turn out to be highly collaborative in its delivery, others mistrust the initiative and spread an unjustified skepticism among potential patients.

The following Table reports the structure of conceptual framework filled with the information derived from the interview conducted in Rieti.

RIETI	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	(+) patients attend the training for the use of technology	(+) become responsible (TUTOR and CASE MANAGER) for chronic pathologies treatment (Anglo-Saxon model)	ABSENCE : requested involvement of GP; risk management	(+) some GP actively proposes his patients = easier way to include who needs to	(?) founds requested to sustain organizational burden 24h	(+)more rational employ of resources and professionalisms
				(-) some GP frightens patients and discourage them from taking part in the program		(+) dehospitalization
		(+) responsible for patients' training to technology use		(+) specialists only marginally involved (2nd opinion) = correct burden & better employ of professional		(+) it suits the needs of the territory
				(+) collaborative staff mood		
CRITICALITIES	Incomplete demonstrability of results					

Table 4.17 – RIETI : conceptual framework

4.2.4 Roma

The structure hosting the service is a complex operative Unit, whose director retains that its main critical success factors are: 1) the ability to assist patient properly and therefore to avoid improper hospitalization; 2) the assumption of patients otherwise abandoned, since GPs do not generally know how to manage COPD-related pathologies; 3) the application of a flexible and easily replicable service.

In Table 4.18 a summary of the main characteristics of the project is reported; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lazio
	LOCAL HEALTH CENTER:	LHC of the Province of Roma
	NAME OF THE STRUCTURE:	San Camillo - Forlanini Hospital
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Complex operative Unit - Central Day Hospital of Continuative Care
	CHARACTERISTICS OF THE SERVICE:	2 specialists, 6 nurses 60 beds + 10 beds for intensive therapy
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project Referral (PR)
	SERVICES PROVIDED:	Telemonitoring, Teleconsulting.

Table 4.18 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

In the last decade, the Unit has been interested by a series of serious attempts of rationalization, as the Regional Authorities reduced the number of beds available for hospitalization from 300 to 60. This solution brought to put in action some structured measures aimed at managing the so called *outpatients,* which are patients that may be followed by an home care program. Their de-hospitalization would in fact allow to reserve hospital beds to patients particularly fragile or subject to exceptional therapies requiring hospitalization. the Central Day Hospital of Continuative Care leaded by the PR has been created in order to better structure this process of de-hospitalization.

This structure found great help for the management of the outpatients in all the technologies supporting care at distance. In fact, the first experiment of the use of telemedicine devices took place

in 1998, when a project called *ARIA* has been activated in order to solve the concern about the reduction of beds in the Unit; the experimentation won the award for excellence raffled off by the Regional Authorities in 2004.

Nevertheless, a complete telemedicine service has been activated only in 2007, through a profitable partnership with Hospital San Giovanni in Rome. In fact, at the beginning of 2000s, some voluntary associations linked with this Hospital gathered funds for the research activities on COPD; the strategic direction decided to invest them in the development of technologies and software aimed at facilitating home care delivery. To test their efficacy, the hospital decided to collaborate with Hospital San Camillo – Forlanini: while the latter found candidates for the service, the former took care of the technology assessment and maintenance. Many releases of technology followed the first one, but the software is now flexible and fits its scope perfectly. At the moment, the PR is trying to help the direction of the Hopsital of San Camillo to become aware of the importance of having its own research center, but the actual shortage in economical resources is making the administration less disposed to take it in consideration.

Patients' description

Although the intention of the PR is to enlarge it, the service is actually active just for 8 patients. The access is reserved to people affected by chronic respiratory disease at a severe but relatively stable stadium, interested by a high number of annual hospitalizations having reference to exacerbations.

Services Description

The introduction of a patient in the service starts when a lung specialist belonging to the Unit visits a patient that may suit the access criteria of the service. The specialist proceeds in explaining the opportunity that the service would give to the patient; if the patient or his/her caregiver agrees to participate, he/she signs a consensus protocol and delivers it to the GP. In case of agreement of the GP, the staff of the Central Day Hospital contacts the technology service of Hospital San Giovanni, responsible for the delivery of technology. Once defined the level of care needed by the patient, a team composed by an hospital specialist, a nurse and a technician reaches the domicile of the patient and starts the activities of customization of the software and training of the user.

Once the patient/caregiver is ready, the service becomes active.

A graphical description of the processes is available in the flowcharts in Table 4.19, 4.20 and 4.21.

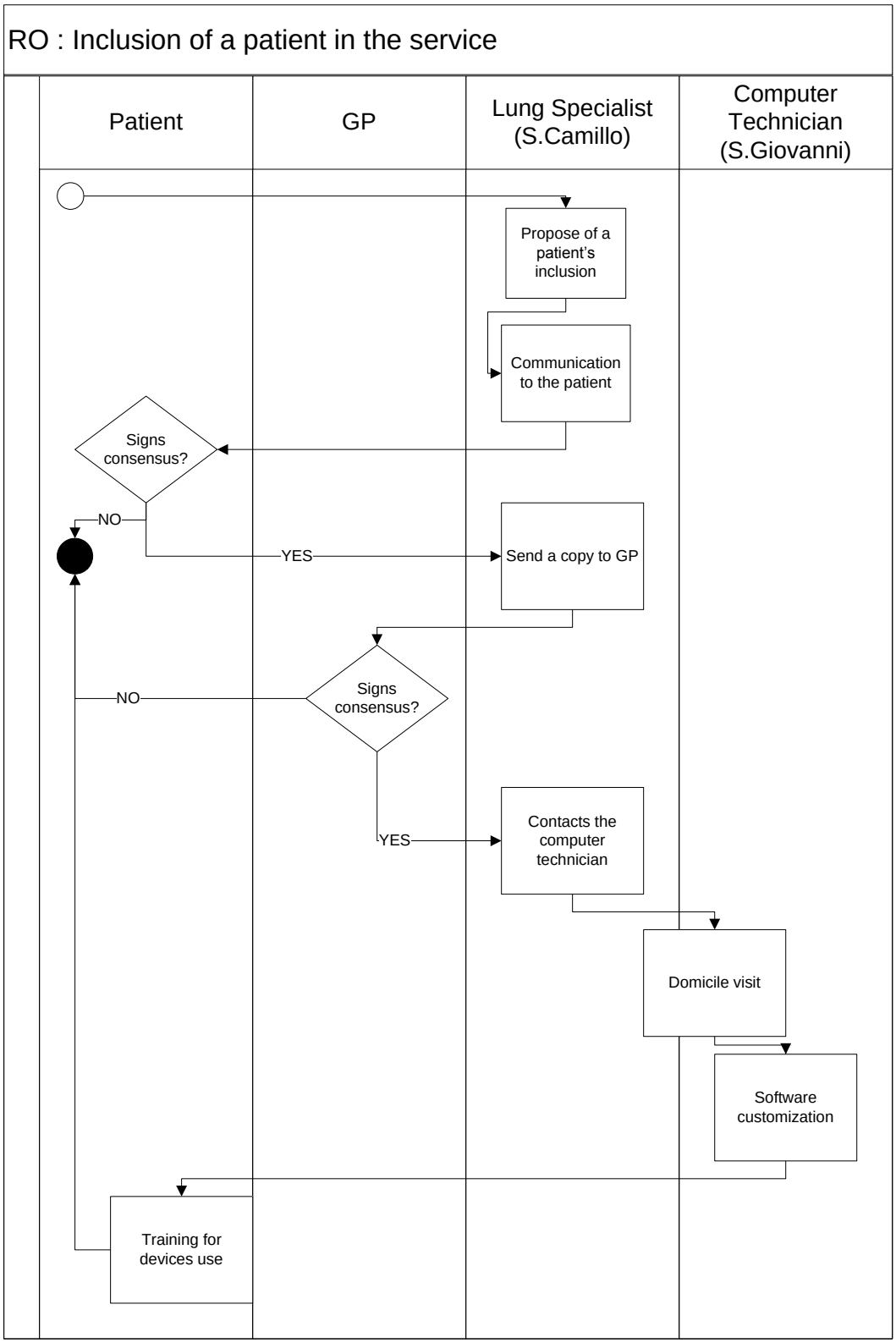

Table 4.19 – Inclusion of a patient in the service

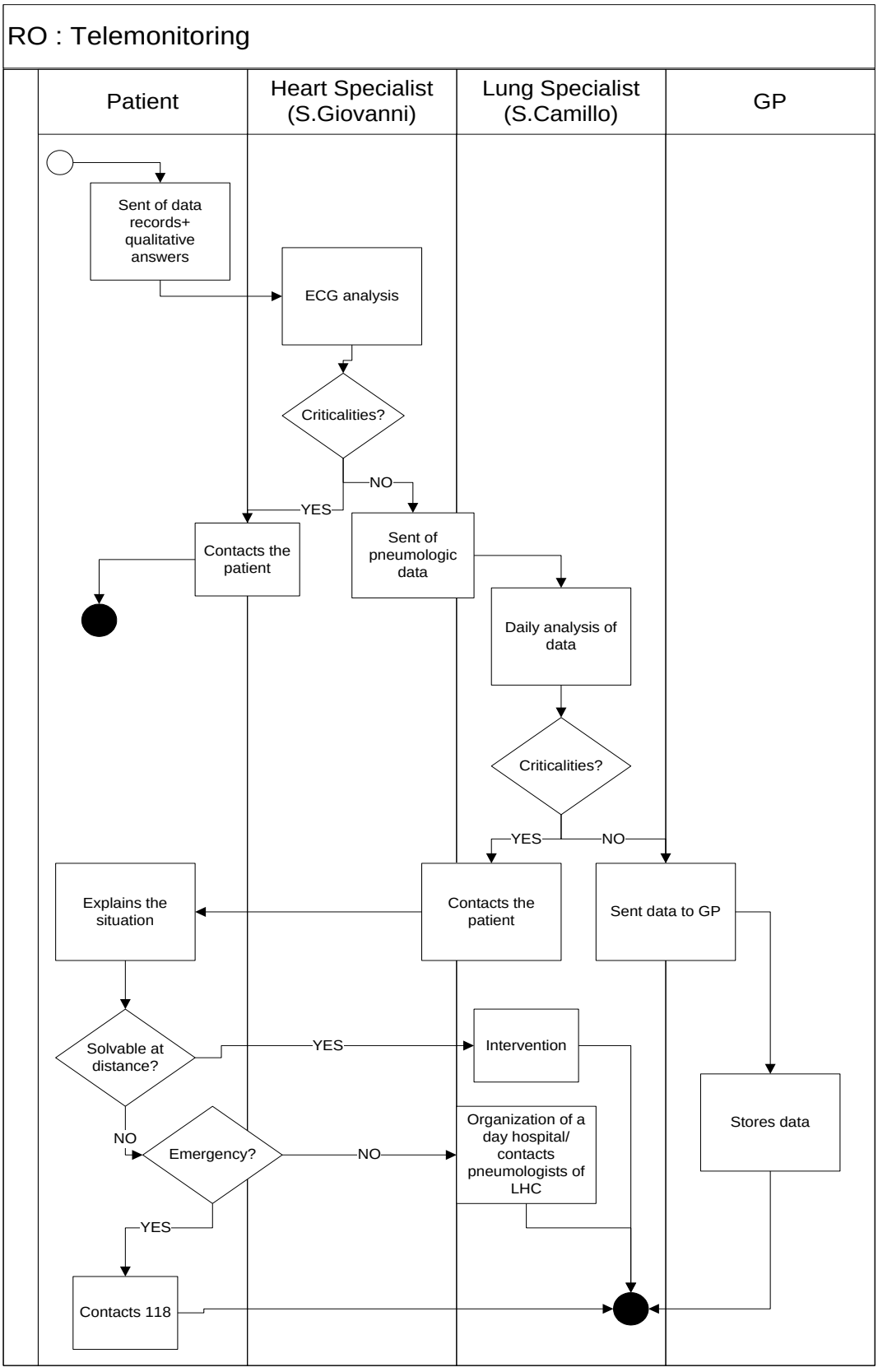

Table 4.20 - Telemonitoring

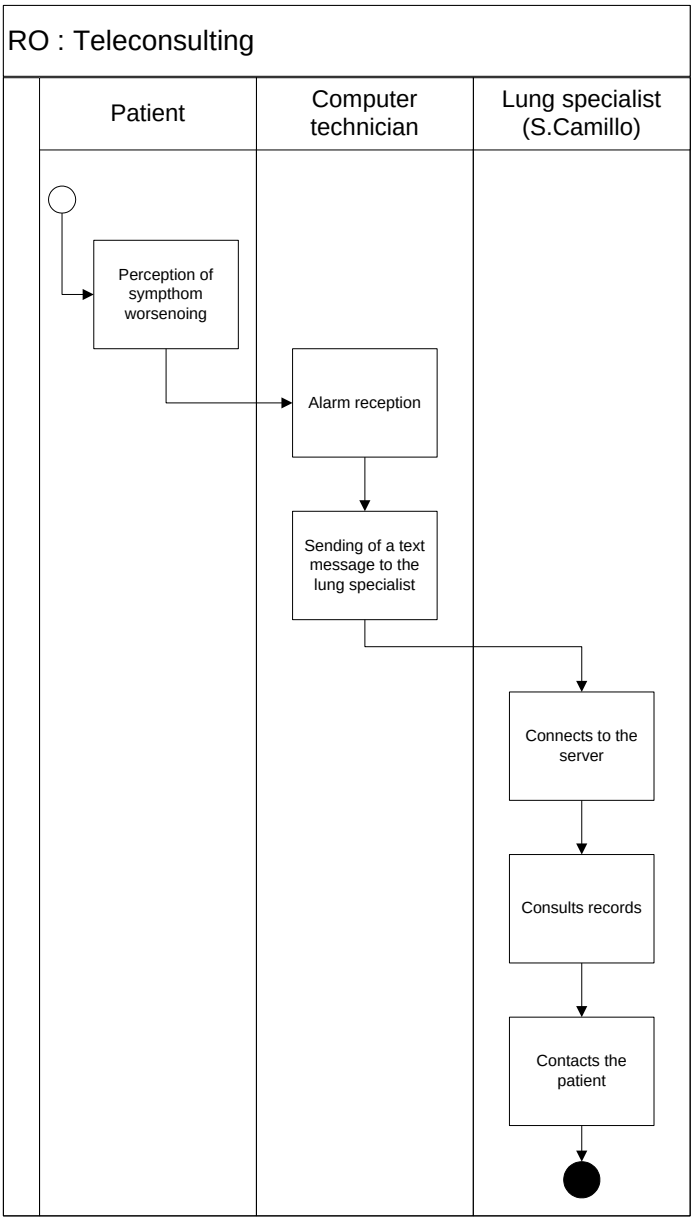

Table 4.21 - Teleconsulting

The services that the staff of the PR provides in the context of the home care assistance are:

TELEMONITORING: Once the training is completed, the service becomes active in all its aspects. The patient sends his records of saturation, blood pressure, ECG and glycemia daily to the predisposed server; in the meanwhile, an operator of the call center run by the San Giovanni Hospital calls the patient with a predefined cadency, to pose him some qualitative questions dealing with his general health conditions and family mood. Quantitative data are firstly submitted to the attention of a heart specialist that controls the vital parameters of the patients and intervenes immediately in case of real or presumed criticalities. If the general health situation is stable, the computer technician proceeds in uploading data (both quantitative and qualitative) on a server where the lung specialists

of the San Camillo-Forlanini Hospital connects daily and check them. If the specialists notice any critical value, they contact the patient to check the situation personally, or ask a nurse to do that; in case of need for intervention, two specialists belonging to the LHC involved in the project are available to perform intervention at domicile.

On the other hand, in case of situation under control, the lung specialists send data to the GP - if he had accepted to take part in the service – and he stores them in order to create a sort of historical archive of the patient.

TELECONSULTING: In event of perceived deterioration of health conditions, the patients have the possibility to contact the call center, that proceeds at sending a text message of alarm to the lung specialists. If possible, the specialists connect with server, check the situation and, when necessary, contact the patient and predispose an intervention; otherwise they proceed directly in contacting the domicile. The service is not fully active at the moment, since patients currently involved are very limited in number and each of them possesses a direct access to the specialist (generally his mobile phone number). This direct management will not be possible anymore when the service will be enlarged.

Organizational Sustainability of the Service

In the PR's opinion, in a situation of finite resources, a health care service may be sustainable only if structures effectuate an adequate prevision of pathologies, driven by a correct epidemiologic analysis. In any case, the ordinal hospitalization should be avoided, since it is expensive and seldom inadequate or inappropriate.

SATISFACTION: The organizational burden of the service delivery is particularly high, and the burden will even increase with the extension of care to a higher number of patients. Fortunately, the general direction is demonstrating interest in the service and considers the hypothesis to hire additional resources to sustain the service. The need for new resources should push the responsible of the service to consider the hypothesis to increase the involvement of nurses.

Nevertheless, both the patients and the specialists involved declare satisfaction about the service. The PR believes that this good result is mainly due to the correct and efficient employ of access criteria to select patients for the service, which is the driver allowing to keep the abandon rate low.

EFFICIENCY: The main source of inefficiencies is the technology, whose availability is not always granted, as the signal is sometimes disturbed or low. Future releases are expected to be more effective and performing.

To increase the efficiency of the experimentation it would be necessary to structure it precisely and to dedicate resources in order to give dignity and importance to it; moreover, all professionals belonging to the staff (nurses, specialists, technicians) should be aware of the importance of the service and involved in making it work.

As soon as people understand the importance of these experiments, it will be possible not only to extend the service, but even to improve it, in order to include, for example, patients affected by highly weakening comorbilities (e.g. ALS). This further step will require, moreover, to dispose of adequately trained personnel even in the psychological aspects of the care.

COORDINATION: The level of coordination with the structure on the territory is pretty high. Two lung specialists belonging to the LHC are involved in the service and perform interventions at domicile when the hospital lung specialists ask them to do that. Moreover, the GPs are involved to the point that every time a specialist performs an analysis of data, the medical report is delivered to them via web, even if they do not perform any activity of the service.

Moreover, the service is an attempt to increase the collaboration among different medical specialization, aimed at creating a more complete care delivery; an example of this collaboration is the contribution of heart specialists as consultants in the service.

The following Table reports the structure of conceptual framework filled with the information derived from the interview conducted in Roma.

ROMA	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	ABSENCE : adequate training	(-) possess skills to replace the Spec in the analysis and mgmt of patients BUT do not play any active role	ABSENCE : requested involvement of GP; risk management	(+) the service involves hosp spec + 2 LHU pneumologists + GP (+) cardiologic preliminary diagnosis	(+) acceptance of the quest for new human resourcesto sustain organizational burden	(+) efficient alert system = decrease in hospitalization rate
CRITICALITIES	lack in demonstrability of results; scarce technology reliability and efficacy.					

Table 4.22 – ROMA : conceptual framework

4.2.5 Casatenovo

The structure hosting the service is a complex operative Unit, whose director retains that its main critical success factor is the ability to take care of the patient with great attention, professional and humanity; in particular, he mentioned nurses as the most committed professionals in making the patient feel like being at home.

In Table 4.23 a summary of the main characteristics of the project is reported; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lombardia
	LOCAL HEALTH CENTER:	LHC of the Province of Lecco
	NAME OF THE STRUCTURE:	National Institute of Shelter and Care for Ancient People (INRCA) of Casatenovo
	TYPOLOGY OF STRUCTURE:	Scientific Institute of Shelter and Care (IRCCS)
	UNIT DESCRIPTION:	Complex operative Unit of intensive therapy
	CHARACTERISTICS OF THE SERVICE:	5 specialists, 6 nurses 5 beds
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project Referral (PR1) Project Referral (PR2)
	SERVICES PROVIDED:	Telemonitoring.

Table 4.23 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

The Institute is basically aimed at rehabilitating patients de-hospitalized from the intensive care units of Milan and Lecco and it hosts a General Medicine Unit, a Cardiologic service and a Radiologic Unit, together with the Respiratory Intensive care Unit.

Since the Regional reimbursement structure foresees significant gaps among the budget granted for intensive care and the budget for rehabilitation, though the demanded energies and resources in the care of patients are not significantly different, technologies allowing care at distances are taken in high consideration, as they enable a higher control of costs. This is the reason why the structure hosts 4 different experimentations involving the employ of telemedicine devices. One of them (A) has been launched in 2005 and concluded in 2008, while other two (B and C) has started in 2003. A fourth experimentation (D) had started at the beginning of 2010 and it is headed by D.sa Bonardi.

Patients' description

Each experimentation is addressed to different kinds of patients; in particular: (A) involved 20 patients in continuous ventilation belonging to the district of Lecco; (B) and (C) involve 30 patients in continuous ventilation settled in any Region of the Italian territory; (D) includes 8 patients affected by COPD at severe-acute stadium, belonging to the district of Lecco.

(B) and (C) are addressed to a wider group of patients, since the Institute is considered as an excellence of respiratory rehabilitation and technologies allow to take care even of people located far from the specialists.

Services Description

(A): The experience started in 2005 and was abandoned in 2008, since the new available technologies were not compatible with the software initially developed. In fact, in the context of a partnership with MedicAir, the responsible of the project decided to develop a customized software, in order to create the most suitable service to look after these patients. The program, created by an expert computer technician together with the clinicians involved in the service, allowed to monitor the health status (saturation, ECG) and modify the treatment in remote.

The service put at patients' disposal a predefined telephone number; when the patient perceived an exacerbation of his symptoms called the predefined number and a nurse tried to detect the problem acceding in the software through his/her personal password. If the nurse understood the problem, he/she intervened autonomously, modulating, for example, the flux or quantity of oxygen in remote and, if needed, checking the situation via webcam. In case of need for an intervention of the specialist, this last proceeded in accessing in the program with a second level password, that allowed him to put in action more invasive measures, though anyway in remote. If the seriousness of the situation required the intervention of the emergency service, the specialist effectuated the call; in order to increase this emergency service, the ER received a notice of alert every time a new patient was involved in the service. This measure, together with a predisposed warning to the electrical energy supplier, was particularly useful in case of black out, when a special emergency service was put in action in order to provide substitutive batteries for the electrical ventilators.

The person responsible considers the experimentation as a successful attempt of care at distance: the software was perfectly customized and user friendly, patients and caregivers did not need any training since the treatment was completely managed at distance. The GPs demonstrated interest and had been collaborative to the point that a following phase of the project would have contemplated the possibility of an additional dedicated access to the software for them.

The organizational burden was negligible since the number of patients was limited and the staff was enthusiast as the service was perceived as a possibility to reinforce their professionals.

The service did not became part of the routine because technologies change too fast and devices connected with the software become rapidly obsolete and therefore useless. A further weakness of the service was the total lack of investments operated by the administrative direction to increase the safety of the service; the legal risk was in fact very high since, if a miscreant discovered the

passwords, he may take control of the electronic devices, with serious potential consequences for the patients.

(B): The second experience has been active in the structure since 2003 and foresees the settle of devices able to measure and send to a clinician via internet the nocturnal outline of blood saturation in the domicile of the patient on demand. The specialist examines data and sends a computerized version of the medical report to the patient. The service involves people belonging to areas located even very far from Casatenovo; one of the participants, for example, lives at Lipari Islands. This diffusion of patients is due to the fact that the Institute represents an excellent center for respiratory rehabilitation and patient belonging to different Italian districts use to address there.

The organizational burden implied by the service is very restricted, since it takes 10 minutes to the specialist to examine an outline and the activity is performed only twice a month. The burden increases whether the health status of a patient worsens, since further spot checks may be required.

The main criticality concerning the service is the model of reimbursement, still unclear.

(C): The third experience, called *Sole*, is substantially very similar to (B); the main difference concerns the fact that medical reports are sent to the GP and not directly to the patient. Technological devices are provided by MedicAir; the oxymeters are able to transmit data via modem to the GPs that are consenting it.

(D): The last experience is a project of study that started 6 months ago. The PR2 has become responsible of this study, born in the context of a collaboration between the LHC and MedicAir, and proposed to 8 patients affected by COPD at a severe stadium to take part in the experimentation. Every patient is provided with a user-friendly electronic keyboard that guides him daily in the insertion of his vital parameters and in answering to some simple qualitative questions. The keyboard is connected through the telephone line to a server, where data are collected, analyzed and summarized in a synthetic score. The specialist possesses a password that allows her to consult the outlines and examine the score. The interpretation of data is facilitated by a chromatic legend, that underlines criticalities with vivacious colors. Moreover, each patient is associated with a different alarm threshold, according to his health status.

This activities are performed daily; moreover, the patient disposes of a telephone number that allows him to contact the specialist during her working hours, if necessary.

The organizational burden is negligible, mainly because the number of patients involved is restricted and therefore compatible with the routine employ of the specialist. The major criticality of the project regards the scarce confidence of the patients, generally elderly people, with the technology, even if it is very easy to use. Nevertheless, one of the patient asked for a paper based version of the service and MedicAir predisposed a call center, whose operator calls the patient daily

and poses the same questions predefined by the keyboard. The difference is that the upload of data is not automatic, but effectuated by the operator.

The project seems to generate positive results right now, though the number and the shortness of the period of examination do not provide any qualitative or quantitative result. For sure, the service helps the patients to understand more in deep their pathology: the ability to interpret the signs of their pathology make them able to be autonomous in its management.

A graphical description of some of the processes described is reported in the flowcharts in Table 4.24 and 4.25.

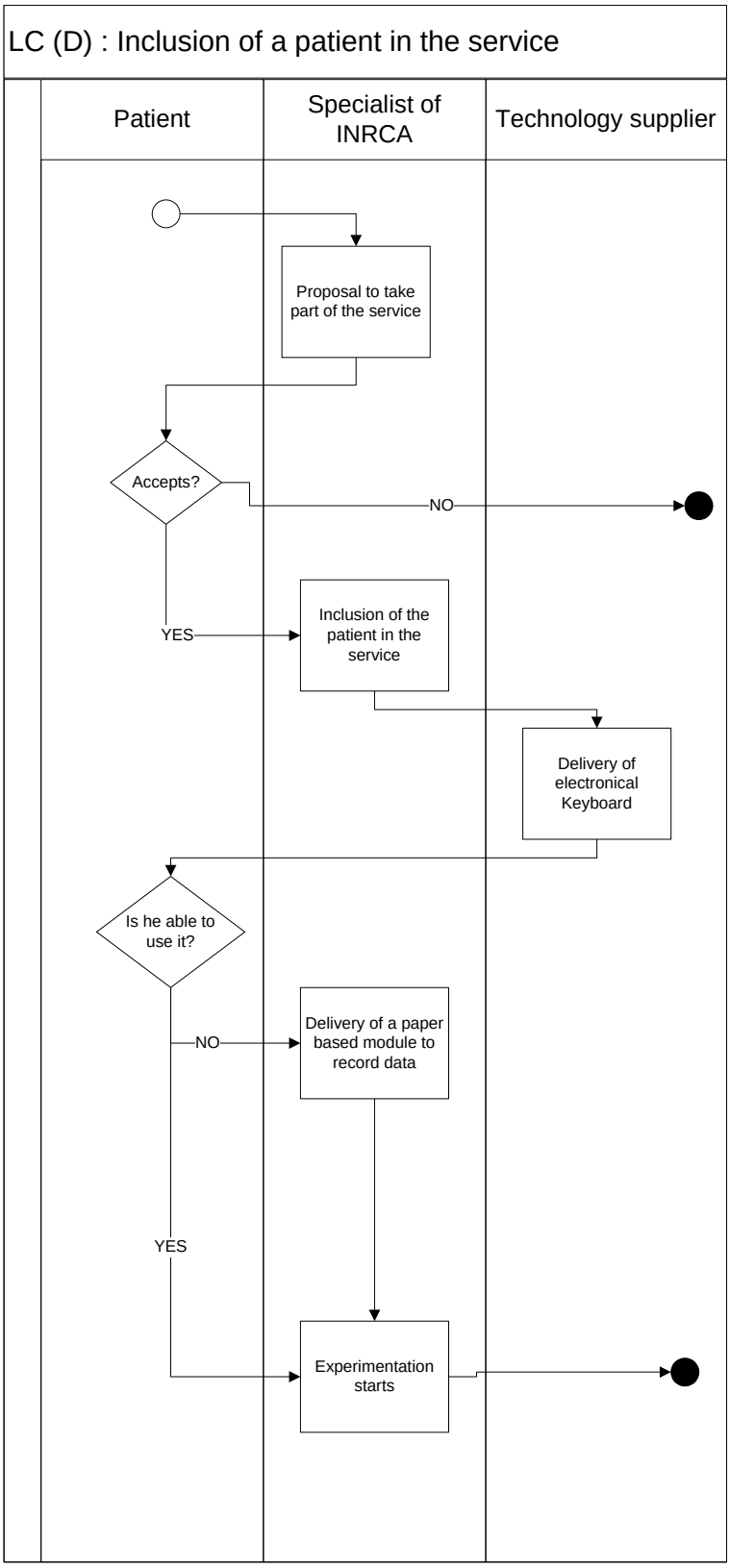

Table 4.24 – Inclusion of a patient in the service

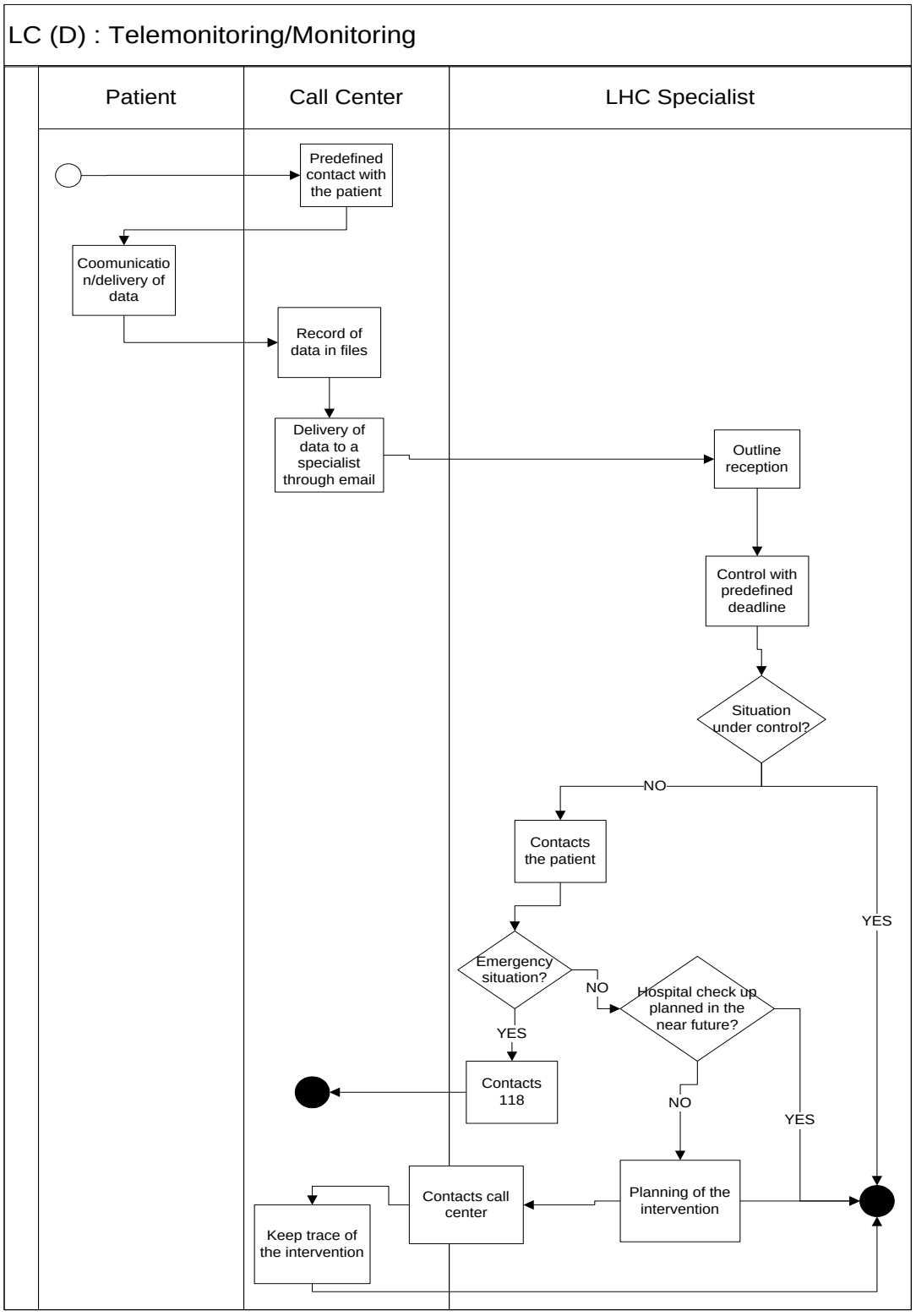

Table 4.25 – Telemonitoring/Monitoring

Organizational Sustainability of the Service

In the PR's opinion an health care system is sustainable if it creates the best deliverable service with a predefined budget and with great attention to the psychological aspects of the care: the definition of an environment suiting the needs (medical or not) of the patients, allowing them to live their pathology with dignity, is the key for sustainability. Doubtless, all this would be impossible without any economic/financial aid and without the availability of an adequately trained personnel.

SATISFACTION: The professionals involved in all the projects are satisfied about it, though any professional is particularly enhanced. Patients are generally satisfied, although only in project (D) there is serious commitment in making them able to face their pathology through a self-evaluation of symptoms, while in project (A) the patients had been totally excluded from care that was performed at distance.

EFFICIENCY: The main inefficiency deals with the fact that some resources have been wasted; in project (A), for example, all the efforts made to create a software have been vain since, though perfectly customized, it was too rigid and therefore not applicable to the subsequent technology releases.

Moreover, the decision to take care even of patients living very far from the structure makes the management of potential emergencies highly inefficient. Lastly, the budget predefined by the Regional listing of charges to rehabilitate people after a period in intensive care is too low and it does not allow to invest in new and more adequate techniques of care.

COORDINATION: Differently from the others projects of telemedicine in the Italian context, the involvement of GP is pretty high in these experiences and, through it, the connection with the territory and LHC.

The following Table reports the structure of conceptual framework filled with the information derived from the interview conducted in Casatenovo.

CASATENOVO		patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	(A)	(-) complete remote control	(+) responsible for preliminary data analysis and manage part of treatment autonomously	ABSENCE : risk management	(+) nurses + pneum constantly in touch (+) ER + local electricity supplier informed		(+) remote control of medical equipment (scarce need for home visits)
	(B) & (C)				(+) GP receives email medical report		
	(D)	ABSENCE : fear of technology though actually very easy to use			(+) LHU involved	(+) supplier's operator translates paper based reports in telematic reports	
CRITICALITIES	Many different approach without serious committment in demostrating results and therefore undertake the best service; scarce attention on patients' awareness; technology developed authonomously = unability to sustain it as progress proceeds						

Table 4.26 – CASATENOVO: Conceptual framework

4.2.6 Arenzano

The structure hosting the service is a complex operative unit, whose director retains that its main critical success factors are: 1) the activities of ambulatory, that comprehend the definition of a specific follow-up program for each patient; 2) the service of confinement for sleep-related pathologies; 3) the definition of high quality rehabilitation circuits.

In Table 4.27 is reported a summary of the main characteristics of the project; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Liguria
	LOCAL HEALTH CENTER:	LHC of the Province of Genova 3
	NAME OF THE STRUCTURE:	La Colletta Hospital
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Operative Unit of rehabilitative pneumology
	CHARACTERISTICS OF THE SERVICE:	5 specialists, 19 nurses 10 beds + 1 bed for sleep-related disease treatment
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project Referral (PR)
	SERVICES PROVIDED:	Telemonitoring.

Table 4.27 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

In 2002, a project called *ALLEANZA* has been launched by the PR and his staff, with the financial support of Astra Zeneca Pharmaceuticals. In particular, the pharmaceuticals industry offered 1000 spirometers, that have been distributed to the same number of GPs, during the course of dedicated conferences organized in most of the Italian Regions. The project ended in October 2004, since Astra Zeneca stopped financing it.

At the moment it is under discussion the starting of a new project that, though analogous to *ALLEANZA,* intends to focus more strictly on COPD. The GPs contacted are only 10 at the moment and the plan is to limit the organizational burden demanded to the specialists: they would employ just one hour a-week to write the medical reports back to the GPs.

Patients' description

Any including criterion has been initially defined, since the staff wanted to concede the maximum freedom of action to the GPs, at least at the beginning. When the number of measures and patients involved had become conspicuous, the staff asked the GPs to classify patients in 4 groups: 1) smokers or ex-smokers without any respiratory syndrome; 2) subjects with respiratory syndrome, like gasps, chronic cough, dyspnoea, without any previous diagnosis of COPD; 3) subjects with a previous clinical diagnosis of bronchial asthma; 4) subjects with a preexistent clinical diagnosis of COPD.

In total, 638 GPs from every part of Italy have been involved and, through them, the project reached 9312 patients and monitored their conditions.

Services Description

The aims of the staff in the initial phase of the project were essentially two: 1) verify if GPs are really able to effectuate spirometries; 2) verify if the involvement of the GPs allows to effectuate the diagnosis of the disease more correctly and adequately. To reach these scopes, the staff profited of the 1000 spirometers offered by Astra Zeneca and organized a series of meeting with the GPs, during which they presented the project and trained the GPs in performing the spirometry and transmitting the signal via telephone.

The service delivered through these technologies is detailed below.

TELEMONITORING: Once the training was performed, the service was active: anytime a GP effectuates a spirometry, he called a specific telephone number, connected with a central call center located in the Hospital of Genova. A lung specialist and a technician were there available to answer.

Once the connection was established, the technician asked the GP to lean the spirometer on the telephone; the device was in fact able to sent electronic signals that were codified through the software installed in the call center. If the signal resulted upset or troubled, the technician asked the GP to perform the measuring again and disposed advice to help him in reaching better results. Once the signal resulted clear and the technician codified it, the lung specialist took vision of the outline and made a real time medical report, that were immediately communicated to the GP. The results of the medical check were then available in few minutes and both the medical and the patient knew the response without any waste of time. In fact, the offer of a real time service of high quality has been the main success factor of the service, together with the possibility for GPs to cooperate with a careful and competent interlocutor.

The service was available from 9 to 19, from Monday to Friday. Once reached the threshold of 100 calls a day, the staff has been doubled. Moreover, just before the moment in which Astra Zeneca stopped its financing, a preliminary cardiologic consult was performed too.

Organizational Sustainability of the Service

In the PR's opinion, sustainability deals with a triad of factors that should coexist. First of all, a serious commitment in the epidemiologic study of medical needs is necessary, since focusing on the care of a pathology interesting a negligible portion of the population is neither sensible nor sustainable. Secondly, the system should not behave auto-referentially, but it should rather employ resources and operate according to protocols and guidelines validated and shared at a higher level. Lastly, results should be demonstrable. If these three factors are respected, the service possess all the elements that could allow it to be sustainable.

The PR believes that the telemedicine services active at the moment in Italy are not sustainable at all, since every attempt to make them work is totally committed to the good will of the single specialist that operated without any guideline: this way of acting causes a serious waste of resources.

SATISFACTION: The major aim of the project was to involve GP in the diagnosis and treatment of respiratory-related pathologies and it has resulted in the actual raise of consciousness of some GPs, that started the procedure of a correct diagnosis of the pathology, decreasing need for specialist consult and useless drugs prescription. On the other hand, some lung specialists interpret the involvement of GPs as a potential interference in their work, though the PR is convinced that they should better concentrate only in the treatment of exacerbations and not in the preliminary diagnosis.

The service involved technicians but did not involve nurses.

EFFICIENCY: The provided service was good, though it was not really complete. The available spirometer, in fact, allowed only analysis in exhalation for hygienic reasons; to reach a more precise and efficient level of diagnosis, it would be useful to insert in it some disposable hygienic filters that would allow the analysis in inhaling.

Moreover, the presence of a unique call center was troublesome in terms of organizational burden and provided scarce support in the definition of objectives and guidelines near to the single LHC needs.

COORDINATION: The main characteristic of the project was the central role played by GPs, to whom the service was actually addressed. Some of them showed to have reached an effective ability to diagnose the pathology properly, though others remained indifferent. A defect of the service was that the GPs did not have the possibility to see the outline of the exams they performed, but only the medical report resulting from them: if the service will be repeated, the PR would like to correct this aspect.

The following Table reports the structure of the conceptual framework filled with the information derived from the interview conducted in Arenzano.

ARENZANO	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	ABSENCE : not predicted	ABSENCE : not predicted	initially undefined including criteria on purpose	(+) focus on GP's ability in COPD diagnosis	(-) providing call center and devices: once dismissed the service collapsed	(+) diagnosis available real time
			ABSENCE : requested involvement of GP; risk management	(-) Scarce visibility of GP on the performed spirometries		
CRITICALITIES	difficult functioning of devices; lack of shared guidelines of high level (national).					

Table 4.28 – ARENZANO: Conceptual framework

4.2.7 Varese

The structure hosting the service is a complex operative Unit leaded, whose director retains that its success factors are: 1) the high quality services of telemedicine active in the structure; 2) the excellent respiratory rehabilitation activities.

In Table 4.29 a summary of the main characteristics of the structure hosting the project is reported; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lombardia
	LOCAL HEALTH CENTER:	LHC of the Province of Varese
	NAME OF THE STRUCTURE:	Ospedale di Circolo – Fondazione Macchi Hospital
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Complex Operative Unit of pneumology
	CHARACTERISTICS OF THE SERVICE:	14 specialists, 50 nurses 35 beds + 25 beds for rehabilitative activities + 2 bed for day-hospital
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project referral (PR)
	SERVICES PROVIDED:	Telemonitoring/Monitoring, Teleconsulting, Temporary Telemonitoring

Table 4.29 – Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

The first experience of domiciliary assistance of patients affected by chronic respiratory illness dates back to the beginning of the 2000s, when a partnership among the LHC and the Unit had been created in order to facilitate their treatment.

In 2006, a more structured service has been created in collaboration with the Regional Government, that was seriously committed in defining a model of care able to solve problems related with the treatment of the chronic diseases; therefore, a program, called Telemaco has been launched in order to experiment telemedicine solutions. The experience conducted in Varese is part of this program.

At the moment, the service appears perfectly in line with the last Social Health Plan of Regione Lombardia, defined and published on June 30th 2010[2]. The Plan, in fact, suggests the employ of technologic devices to enable the creation of a *net of health*, resulting from a perfect coordination among the different Health structures; this approach should be driven by a perfect visibility of the conditions of the patient, possible through the employ of ICT devices. If each patient for example, disposed of a medical report available on internet, this would make it possible not to concentrate the care on the pathology, but to enlarge the focus on the patient as a fragile individual, interested by different comorbilities. An effort to create this cooperation and to shift the focus on the patients instead than on the pathology has been made in Varese, since, within the service, a unique nurse is responsible for each patient both for his COPD-related disturbs and for the cardiac insufficiency. The general aim of the creation of the net of health supported by the Regional Plan and, therefore, by the service available in Varese, is to provide a better prevention of exacerbations and to assure better quality of life for people affected by chronic diseases, through advanced technologies and interdisciplinary team work. These measures appear as particularly suited to the geographical, demographic and epidemiologic characteristics of the mountain territory in which it is settled (difficult transport, sparse population...).

Patients' description

The patients involved in the experimentation belong to the district of Varese and Province; access criteria are related to their dependency on oxygen and ventilator and to the severity stadium of the illness.

Being a Regional-driven experimentation, the staff does not have high autonomy in defining the details of the service; in particular, though a monitoring service is generally useful if continued in time, the experimentation predicts a fixed period of monitoring of six months, than can be

[2] Piano Socio Sanitario Regionale 2010-2015 – Legislative Decree nr. 000165, June 30th, 2010.

prorogated only for some particular cases. This determines an high variability in the number of patients involved and therefore a punctual datum is not available, though the PR assesses that since the beginning of the service delivery about 400 patients took part in it.

Services Description

The aims of the experimentation settled by Regione Lombardia were the reduction of the urgency access to the hospitals, of the hospitalizations and of their average duration. To achieve these goals, telemedicine devices seemed to offer great opportunities.

The ongoing service in Varese, foresees that if a GP or a specialist belonging to the Unit comes in contact during his routine activities with an individual that represents a suitable potential candidate for the service, he can propose him the possibility to take part in a program of monitoring 24h and to dispose of a direct telephone number that puts him in contact with the nurse or specialist in case of need. If the patient is interested in taking part in the service, his GP has to be informed of these intentions. This step is very important, since each patient located out of the hospital is under the GP's legal responsibility: therefore, if a GP opposes to the patient's participation, the service cannot be provided.

On the other hand, if the GP accepts, a personal electronic medical record is prepared for the patient, containing the two agreements (patient's and GP's), the personal information (name, address, characteristics of patients), the typology of service provided. In fact, on the basis of what the patient needs, different levels of care are disposed.

Once the medical record is ready, the tutorial nurse proceeds in contacting the technology supplier (HTN) and in training the patients or caregivers in the use of technologies.

A graphical description of the processes is available in the flowcharts in Table 4.30, 4.31, 4.32 and 4.33.

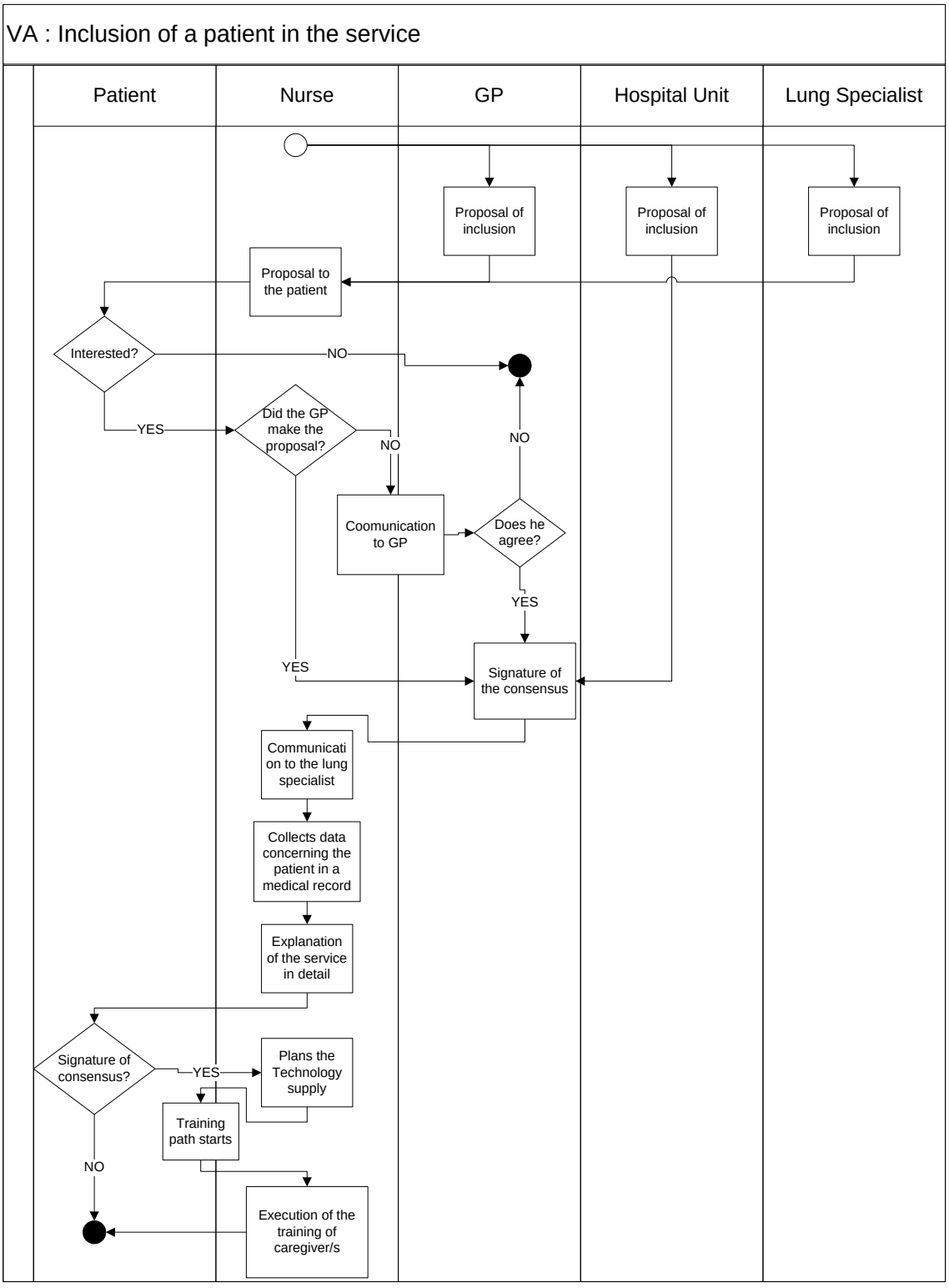

Table 4.30 – Inclusion of a patient in the service

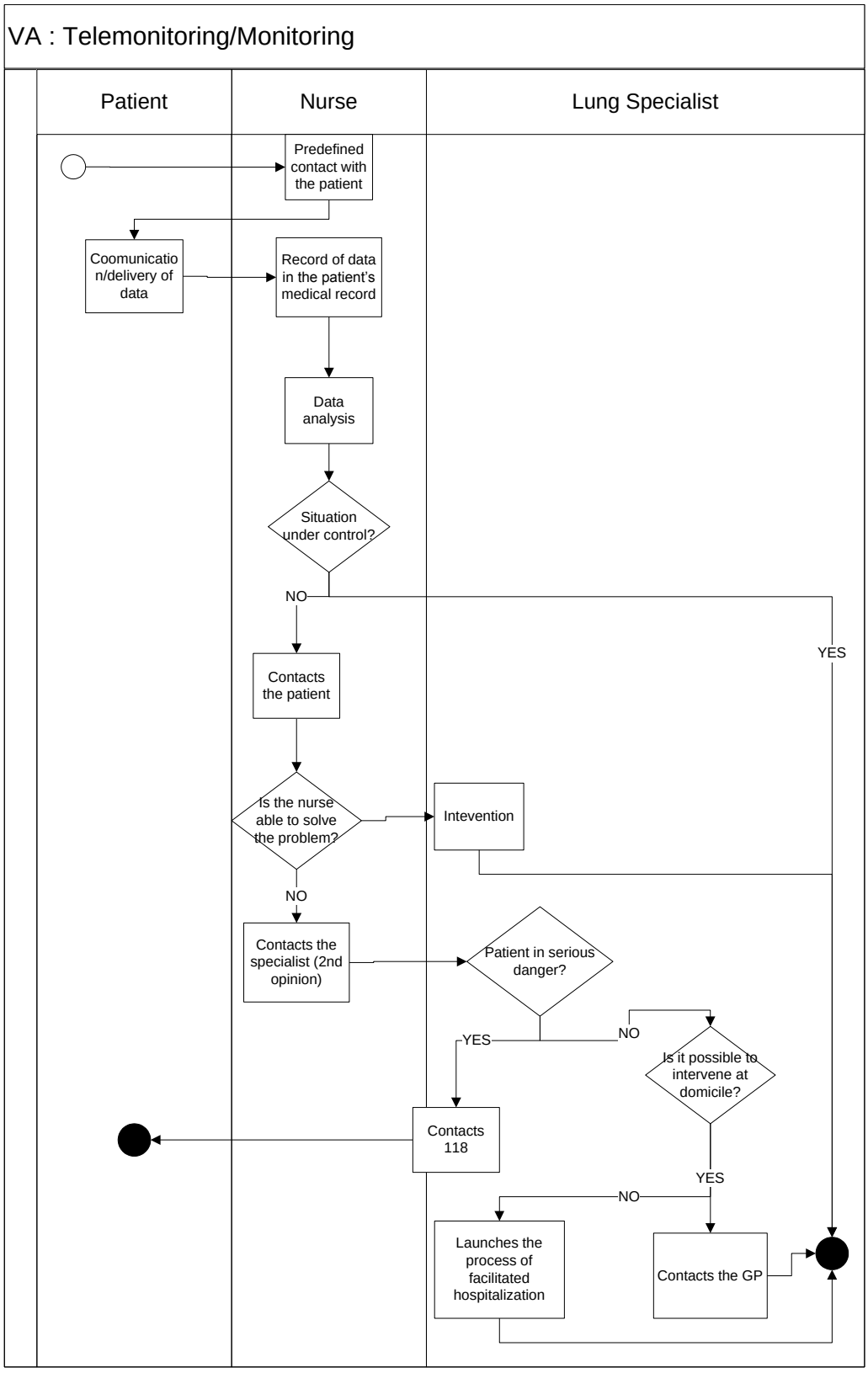

Table 4.31 – Telemonitoring/Monitoring

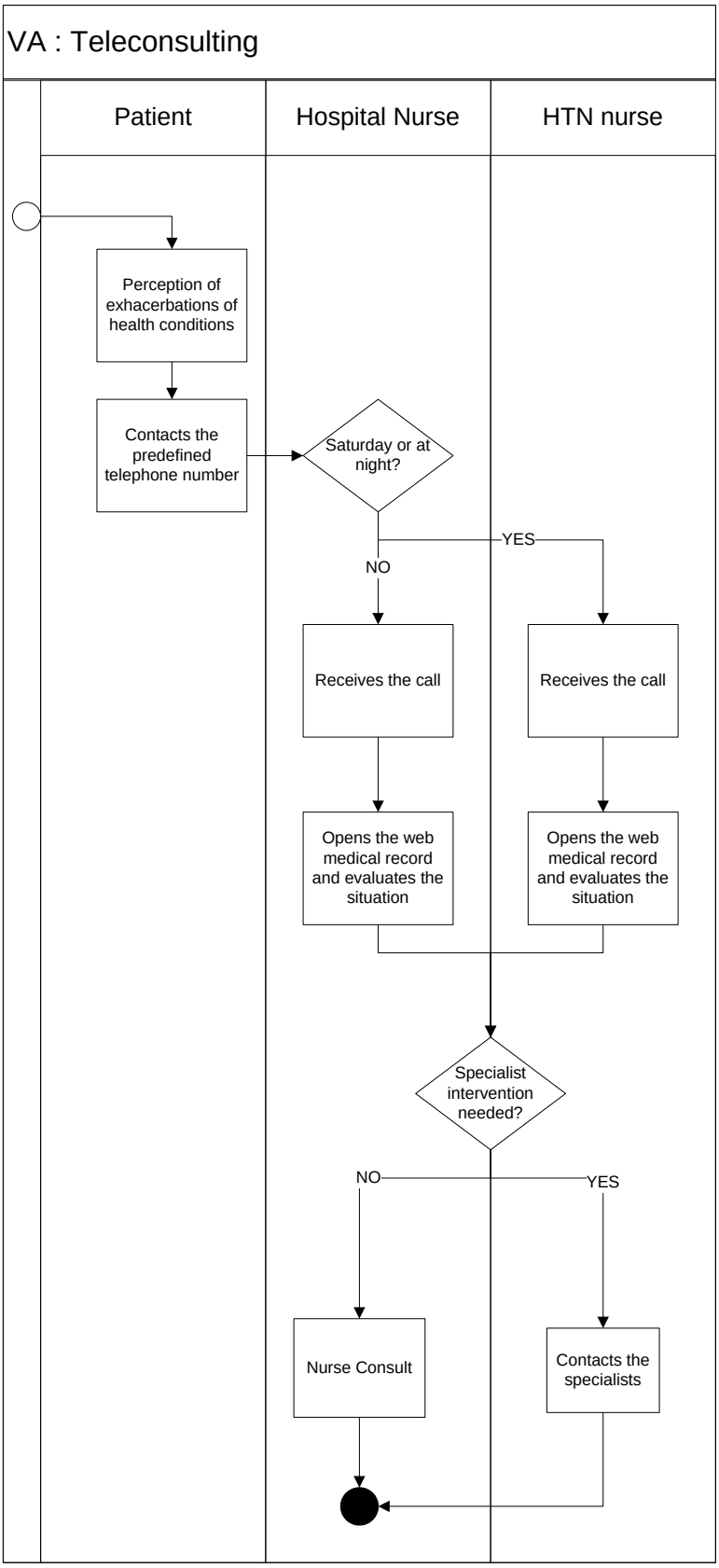

Table 4.32 – Teleconsulting

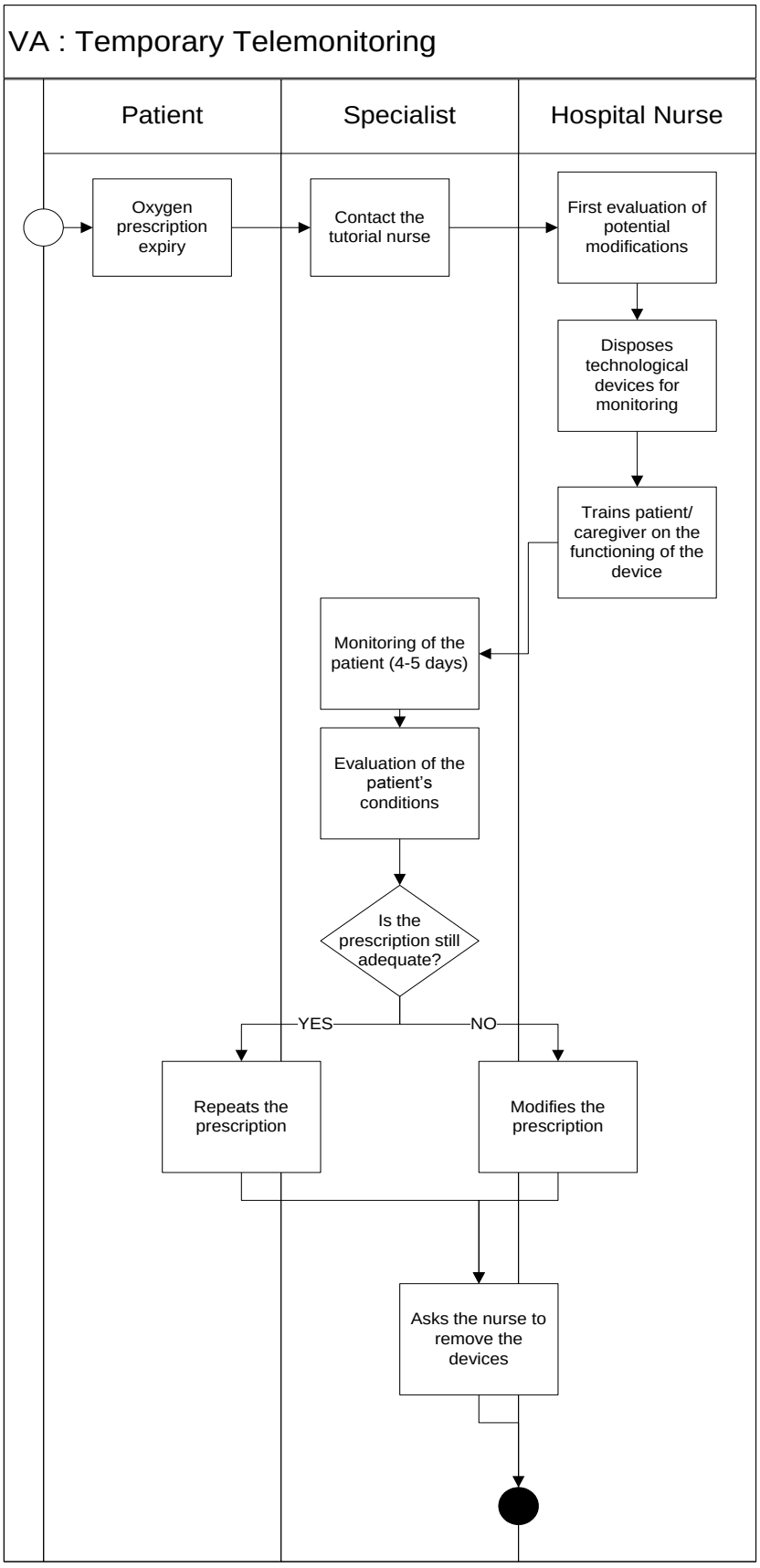

Table 4.33 – Temporary Telemonitoring

The services that the staff of the PR provides in the context of the home care assistance are:

TELEMONITORING/MONITORING: Once the patients receive the devices at home, they are contacted weekly by their personal tutor nurse, that pose them some questions, some of which are qualitative and deal with the general health condition and feeling of the patients while others are quantitative; the nurse in fact asks the patient to activate the technological device and to measure through it the values of blood pressure, oxygen content and cardiac frequency. At this point, the nurse performs a first analysis of data that allows her to underline eventual criticalities or parameters out of normal. This activity is facilitated by the fact that every answer to the predefined questionnaire is associated with a number; the total sum of these provides a score that represents a more immediate and easy check. If the conditions are stable, the nurse restricts herself to the update of the medical record; if the nurse perceives some criticalities that she is not able to solve by herself, she has the possibility to contact a specialist as a second opinion. At this point, the specialist evaluates the conditions and he may decide to contact the GP and ask him to perform a visit at domicile, to contact the emergency service for an immediate intervention or to activate the facilitated path of hospitalization available for these patients.

In cases in which, for example, a weekly check would not be enough to monitor the patients since their conditions are particularly precarious, some technological devices apt to perform a continuous monitoring and to send the outlines via web are established at the domicile of the patient; in this way, nurses have major visibility on the patient whenever they want to.

TELECONSULTING: Each patient involved in the service is provided with a telephone number that allows him to contact his tutor nurse directly and for free in case of need. Nurses are available from Monday to Friday during the day. If the patient feels a sudden worsening of his conditions during the night or in weekends, a nurse operating in a call center located in Brescia and managed by HTN is available to answer and to take decisions about the patient, since she has visibility on the on line medical record of each patient.

TEMPORARY TELEMONITORING: Before this service became active, whenever an oxygen prescription expired, the activity of renewal for patient affected by pathologies that made it seriously difficult to move from their houses were hurried and therefore unsatisfactory for both the patient and specialist. The availability of telemedicine devices have represented a suggestion some time ago to improve the service. At the moment, a tutor performs a first evaluation at the domicile of the patient; then, he equips the house of the patient with some electronic devices that will allow the hospital specialist to monitor the situation in remote for 4-5 days. After this period of monitoring, the

specialist expresses a final judgment about the conditions under which the prescription should be renewed. Once defined it, the nurse comes back to the house of the patients, removes the technology and trains the patient about the new details of his treatment (if they exist).

Organizational Sustainability of the Service

In the PR's opinion, sustainability of health care delivery should be intended by three different points of view: 1) organizational, since a structure should be able to organize and activate the service autonomously; 2) functional, since the health care system should weight on the reality in which it is embedded; 3) economic, since resources are finite and every attempt that excludes an attention on the available resources is destined to decline soon.

The major drivers enabling to take sustainable decisions are the ability to provoke a positive upgrade in service (even though resources remain unchanged) and the ability to discuss continuously the performed activities in critical terms.

SATISFACTION: Satisfaction about the service is very high from both the patients' and the nurses' point of view. Patients, in fact, feel more secure, increase their quality of life and, which is more important, have the possibility to comprehend their pathology better, assuming major autonomy in treating it. Nurses, on the other hand, feel the service as a possibility to enhance their professionalism; their appreciation toward the service is witnessed by the increased number of applications that the PR received from other nurses that would like to join the service. Nevertheless, the choice is performed personally by the responsible since he wants to evaluate, beside their academic/professional background, their ability to relate properly with patients.

Though the service is particularly appreciated, its organizational burden is high, since it requires 3 nurses dedicated full time; furthermore, all the specialists belonging to the Unit are available to perform a second opinion when needed.

EFFICIENCY: The cost of the service is under control, since the PR decided to dedicate an entire cost center to the activities of telemedicine. Moreover, while in the majority of the other experiences analyzed the financing of technology came from the call for rentals for oxygen supply, in this case the Region foresaw a specific call for rentals bounded to the supply of technology. The actual holder of the contract is HTN.

The most delicate aspect of the service deals with the activities of the call center provided to support the service of teleconsulting when nurses are out of service; the possibility of harmful interferences (though limited by the presence of the online clinical record) and the uncertainties about the legal responsibilities of actions are, in fact, matters of concern. To limit this inconvenience, every call performed is recorded and therefore available in case of dispute.

COORDINATION: The level of coordination with the actors of the health care system is pretty high, since from the moment when the service became active, just one GP denied to his patient the access in the service.

Moreover, the service is driven in collaboration with Regione Lombardia and is therefore well accepted by the institutions.

The following Table reports the structure of the conceptual framework filled with the information derived from the interview conducted in Varese.

VARESE	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	(+) patients considered as the center of the treatment, instead of their disease (+) patients learn to face the pathology and recognize the sysmpthoms	(+) dedicated nurses manage patients authonomously	(-) imposition of the maximum duration of the treatment (6 months)	(+) partnership among LHC, Hospital, Regional Governement (+) Creation of a *net of care*	(+) providing devices (call center only on limit cases)	(+)more rational employ of resources and professionalisms
CRITICALITIES	The project is predefined to last only 6 months.					

Table 4.34 – VARESE: conceptual framework

4.3 Introduction to the Empirical Framework

4.3.1 Preliminary Analysis of Results

The analysis of the seven case studies performed in the previous sections and the consequent attempt to detect the concrete exemplifications of the drivers indicated by the conceptual framework have brought to confirm some of them and to identify some others, unexpected, and therefore not previously included in the framework. The result of this further analysis is the definition of an empirical framework that is then tested on the two last experiences.

In particular, the unexpected factors have been identified taking in consideration the negative dynamics reported by the interviewees, damaging for the performances of the service. Among the most serious factors identified as detrimental, interviewees are unanimous in quoting the incorrect employ of nurses' professionalism; the experiences taking them in serious consideration (i.e. Rieti, Varese) present significantly better results if compared with those leaving them aside (i.e. Roma, Torino).

Beside this, the lack of shared guidelines aimed at managing the risk of care for patients pouring in severe health conditions is considered potentially fatal, since the absence of precise rules of intervention in case of emergency would turn out to be lethal. Nevertheless, the absence of predefined protocols does not affect only the legal/ethical risk, but also the level of uncertainty

about the degree of involvement required to the different professionals concerned. The most cited example are many GPs that, although responsible for the care of patients once they leave the hospital structure, show scarce interest in the service and, since no protocol sanctioning their degree of involvement exists, show indifference or even dissuade patients in taking part in it.

A cause of this attitude of diffidence of GPs with regard to the telemedicine applications is identified by some of the interviewees in the lack of a sincere and effective commitment in demonstrating the validity of the achieved results through the experimentations already conducted or active at the moment. This absence of evidence is responsible also for the distorted perception of the usefulness of telemedicine application of many pneumologists. The experimentation run by the project referral of Arenzano and his staff, for example, has been obstructed by some specialists since they perceived that, if the GP learned to perform the diagnosis of COPD autonomously, they would unfairly steal part of their work; on the contrary, the project referral of Arenzano is convinced that demonstrating the results of the experimentations with unequivocal measures would have lead them to understand that, if GPs were able to perform a correct diagnosis of COPD, specialists would have the great opportunity to focus only on the treatment of the most challenging and advanced diseases, omitting big amounts of time lost in secondary activities.

Among the factors having negative effects on the deployment of the experimentations, the scarce commitment in training patients and their caregivers has a considerable importance, being training not only about the use of technology devices, but also and mainly about the ability to detect by themselves the symptoms leading to an exacerbation and therefore to live together with their disease in a more conscious way. This aspect is mainly referable to the tendency of many professionals to pay more attention on the disease than on the patient himself and his necessities.

Lastly, considering the driver concerning the involvement of suppliers and backers, almost all the experiences organized through the employ of a call center run by the technology supplier (i.e. Torino) report some episodes of patients refusing to take part in the service anymore because of the excessive intrusiveness of the operator of the call center in their lives and the perception of the impossibility to have a direct contact with the referring specialist.

Table 4.35 collects together the criticalities more cited with regard to the experimentations reported by the interviewees.

SHARED CRITICALITIES	patients'education&training	role of nurses	guidelines	continuity of care	suppliers/backers involvement	technology employed
organizational sustainability	ABSENCE : adequate training	(-) able to be autonomous in providing part of the care BUT play a marginal role in patients' management	ABSENCE : requested involvement of GP; risk management	ABSENCE : GP only kept updated (-) some GP frightens patients and discourage them about taking part in the program	(-) call center: patients' perceived intrusiveness	
CRITICALITIES	Scarce demonstrability of results					

Table 4.35 – Shared Criticalities of the experimentations

4.3.2 Confirmed/Partially Confirmed/Not Confirmed Drivers

As assessed in the paragraph exposing the workflow of the analysis, proceeding from the conducted interview it is now necessary to advance in confirming some of the factors reported in the conceptual framework, to eventually deny some of them and underline some unexpected.

The paragraph 4.3.1 has reported a preliminary analysis of the case studies with regard to the aspects perceived as negative or damaging by the subjects responsible for the different experimentations. This analysis allows to underline which factors detected through the literature review turn out to be effectively present and notable in the experiences.

Patients' education & training

This first element of analysis has been fully confirmed by the interviewees, since almost all of them quoted that telemedicine experimentations may be defined effective if they help the patient in ameliorating his relationship with the pathology, making him more aware and able to detect symptoms connected with it. With this aim, devices allowing the remote control and action of the clinicians are less useful, since they do not require any effort of understanding and training by the side of the patient and/or the caregiver.

Besides the educational aspects, training is also necessary for a correct management of the technologies, since an incorrect or partial knowledge of the modes of employ would turn out to be fatal in case of breakdown or emergency.

Nevertheless, the training activities are not uniquely addressed to patients, since the responsible for training are generally nurses, the clinicians or, in some cases, technology suppliers; therefore, they should be trained themselves about the mode of employ. Moreover, the introduction of this kind of devices modifies the routine activities and implies the acquisition of some skills and competences generally learned through refresher courses which nurses and clinicians should be required to attend.

This driver is therefore partially confirmed, since, in order to underline the necessity for both the patients and the staff to train and acquire new competences, it has been changed into *realignment of skills*.

Role of nurses

The interviewees showed almost unanimous agreement about the fact that nurses are the professionals that should hold the role of case manager and/or tutor of the patient in the experimentations of telemedicine. Moreover, as it has been assessed in the previous paragraph, experiences leaving them aside (i.e. Roma, Torino) present worse results than the others or, at least, find in their marginalization a serious source of criticalities. The project referral of Cremona, for example, showed concern in the fact that nurses involved in his experience are not correctly motivated: this factor is source of scarce enthusiasm and may cause a growth of skepticism, fatal for the good performances of the service.

Furthermore some people responsible of those experiences that leave nurses aside are taking in serious consideration the idea to involve them in the future; for example, the project referral of Torino is planning to enlarge the service from 15 to 60 patients and, aware of the organizational burden that this change would entail, he is planning to ask nurses to take part in the service.

The driver is therefore confirmed and no changes in its denomination are necessary.

Guidelines

As assessed in paragraph 4.3.1, the absence of shared guidelines has impact, in particular, on the level of involvement required to each professional performing part of the care delivery and on the absence of a correct and suitable agreement about risk management.

More in deep, many interviewees noticed that the collaboration with GPs is not only scarce (i.e. Rieti), but even irregular and unpredictable. In fact, while some of them understand the importance of the service and turn out to be highly collaborative in its delivery, others mistrust the initiative and spread unjustified skepticism among potential patients. The existence of a dedicated protocol for each kind of service provided (i.e. Teleconsulting, Telemonitoring), ratifying explicitly the roles and duties of each professional, would therefore turn out to be a useful tool, since each professional would take the decision to take part in the experimentation with greater awareness, knowing the amount of commitment required before starting.

Moreover, since the services are mainly dedicated to patients whose conditions are severe or even seriously severe, as shown in Table 4.3, a shared protocol of action for the management of risk is seriously wished. Some experiences (i.e. Casatenovo (A)) foresees the direct involvement of the emergency service in case of need, while others do not. In any case, given the high number of actors taking part in the service and having direct relation with patients (hospital nurses, LHC nurses, clinicians, GP, paramedical staff, caregivers…), the need for shared procedures and actions is required even to define legal and ethical responsibilities in case of disgrace.

The driver is therefore partially confirmed since, in order to take care of both the aspects (required involvement of professionals and risk management) it has been named *institutionalization*.

Continuity of care

The continuity of care, which is among the drivers detected through the literature review, has been reaffirmed as a crucial factor not only by the interviewees, but also by the institutions. The project referral of Varese, for example, mentioned the fact that the plan of Regione Lombardia for 2010-2015 foresees explicitly the creation of a net of care, with the patient in the center and all the actors involved in his care gravitating around him.

A preliminary analysis of the interviews shows that the continuity of care is assured by the coordination within the staff and with the territory: if a matter of disagreement exists in one of these two, the positive performances of the services are seriously compromised. Therefore, although the driver is confirmed as essential, in order to better specify it, it has been split in two: *coordination among specialists and nurses* and *coordination between hospital* (or the structure hosting the service) *and LHC*.

Suppliers/Backers Involvement

Some experiences have underlined the effective possibility of a direct intervention of backers and technology suppliers in care delivery.

In most of the cases the backer is represented by the LHC, that possesses the funds to bound to the services (i.e. Cremona, Torino, Rieti, Roma, Varese). Its direct intervention in the service is very rare, as the LHC generally limits itself to manage the call for rental, taking in consideration for it the consultancy of the medical staff committed in the service.

On the contrary, in many cases the technology supplier plays an active role in the service, performing, for example, the activities of data storing and mining or managing the call center. Nevertheless, though the activities of data management are generally well accepted by the staff involved in the service since they simplify their duties, the choice to delegate the direct contact with the patient to the operator of the call center is not always welcomed with enthusiasm neither by the staff, nor by the patients. This is the case of Torino and Casatenovo: in both the experiences same patients left the service because of the heavy inference of the call center in their daily life and because they felt the intrusion of the call center operator as a forced separation from their referring specialist, whose presence is generally perceived as a source of safety. More positive are the experiences (i.e. Rieti, Varese) where the call center is run by the hospital staff: the possibility to talk with a well-known person reassures the patients and their caregivers considerably. In any case, the

direct involvement of technology suppliers in care delivery may represent a source of complexity in the activities of coordination and therefore is generally avoided in all the experiences analyzed.

There are examples in which, instead, the backer coincides with the technology supplier; this is the case of Arenzano, where Astra Zeneca Pharmaceuticals decided to test its devices financing the project. Nevertheless, though the service turned out to be efficient and appreciated by GPs and patients, once the Company decided to abandon it, any possibility to continue the experience was given, since both the funds and the devices were denied.

This behavior represents a real challenge to the sustainability of the service; this is the reason why the driver is only partially confirmed, since the real focus is reserved to the *stability of financing*.

Technology employed

Most of the interviewees assessed that technological devices are quite interchangeable and submitted to a call for rental, typically conducted once a year and under the control of the LHC, whose personnel generally takes in consideration the consultancy of the medical staff.

The type of technology employed is therefore not a variable characterizing an organizational model in comparison with the others, but rather a constant feature. This driver has been therefore excluded, though a hint to the contribution of technology in the service is considered among the unexpected drivers (paragraph 4.3.3).

A part from this last, none of the other drivers proposed in the conceptual framework has been discussed and judged not adequate for the description of the case studies: although some of them have been denominated in a different way, they have been confirmed as remarkable. Table 4.36 reports a synthesis of the modifications. Moreover, in the next paragraph some unexpected drivers are reported.

	STATE	MODIFICATIONS
patients'education&training	PARTIALLY CONFIRMED	*rialignement of skills*
role of nurses	CONFIRMED	
guidelines	PARTIALLY CONFIRMED	*institutionalization*
continuity of care	PARTIALLY CONFIRMED	*coordination spec-nurses* *coordination LHC-hospital*
suppliers/backers involvement	PARTIALLY CONFIRMED	*stability of financing*
technology employed	NOT CONFIRMED	

Table 4.36 – Synthesis of Confirmed/Partially Confirmed and Not Confirmed drivers

4.3.3 Unexpected Drivers

The analyzed experiences push to reconsider the drivers proposed in the conceptual framework and put them under discussion. The work performed in the attempt to detect the negative and positive aspects of each experimentation allowed to identify three other drivers, omitted in the conceptual framework, but almost unanimously cited by the interviewees, which consist in: psychological support, technology reliability and demonstrability of results.

Psychological support

Among the factors having negative effects on the deployment of the experimentations, the scarce commitment in training patients and their caregivers has a considerable importance. This represents an important matter, since training does not deal only with the use of technological devices, but also and mainly with the ability of patients to detect by themselves the symptoms leading to an exacerbation and therefore to live together with their disease in a more aware way. This aspect is mainly referable to the tendency of many professionals to pay more attention on the disease than on the patient himself and his necessities. This scarce attention on the personal sphere of the patient may turn out to have strong negative consequences; for example, if the patient does not feel neither secure nor adequately considered, he would make an excessive (and therefore wrong) use of the available channel of contact with the specialist, determining a heavy organizational burden and a worse functioning of the service. Moreover, he may decide to abandon the service or to remain in it without gaining the awareness about the disease and the capabilities in its management that the service should provide to the patients joining it.

Therefore, almost all the interviewees are unanimous in assessing that the psychological support to the patients and their families, as a patient suffering of a chronic degenerative disease comports a serious burden on it, is strongly required to create an organizationally sustainable service. Accordingly, the empirical framework comprehends among the drivers the *psychological support* to the patient and his family.

Technology Reliability

Although the technology employed is not a variable characterizing an organizational model in comparison with the others, since the applications are similar and so are the devices, there are some problems related with some of them, especially if part of the equipment or software is developed autonomously by the users. This is the case of Roma, where the project referral drew up an agreement with the specialists of the Hospital San Giovanni, that were committed in developing a software and were looking for patients to test their technology; the project referral affirmed that,

though the technology was good in general, some problems of reception of the signal and transmission have been detected. If a Company was responsible for the technology, the defect would have probably been detected and solved more rapidly, as it could have more available resources and skills to repair it.

Moreover, the autonomous development of the devices requires a great effort on the side of the developers that do not give a satisfactory pay off in general. This is the case of Casatenovo (A), where significant energies have been employed to develop a software that allowed the nurses and the clinicians to control the devices in remote and, if needed, to modify its functioning parameters. Nevertheless, months of hard work have been totally useless since, in a short time, the devices have become obsolete and therefore the builder put them out of the market and the software was not suitable for the new release. Even in this case, if a Company was responsible for both the technology and the software, the development of a new release would have been accompanied by a new version of the software too.

Nevertheless, in some cases the attempt to create autonomously the system turn out to be adequate; moreover, it happens very often that Company building devices and the medical staff work together in order to create a tool that suits the needs in the best way. Therefore, the autonomous attempt to create has not to be totally refused or considered harmful, as soon as the tools possess an adequate level of safety and reliability.

Given that, the type of technology is not a characterizing factor, while its reliability is a variable influencing the trend of the experimentation. This is the reason why the *technology reliability* has been included among the unexpected drivers.

Demonstrability of Results

As assessed by the project referral of the experience conducted in Arenzano during his interview, sustainability deals with a triad of factors that should coexist. First of all, a serious commitment in the epidemiologic study of medical needs is necessary, since focusing on the care of a pathology interesting a negligible portion of the population is neither sensible nor sustainable. Secondly, the system should not behave auto-referentially, but should rather employ resources and operate according to protocols and guidelines validated and shared at a higher level. Lastly, results should be demonstrable. If these three factors are respected, the service possess all the elements that could allow it to be sustainable.

This last criterion turn out to be particularly mentioned (explicitly or not) by many other interviewees, since much of the criticalities concerning the missing involvement of GPs, patients or institutions are generally linked with the absence of a serious and shared visibility on the potential results of the experimentations. In fact, if the suggested positive effects are not evident and

demonstrated, it is more difficult to understand the reasons why taking part in the experiments is worth doing and, moreover, backers would be more easily inclined in abandoning one experience for another, since they look similar and none of them is able to assure better results.

Some of the interviewees showed awareness on this topic and they told about the development of a panel of indicators and scorecards aimed at measuring the results of their experiences; needless to say that if a shared panel of indicators do not exist, it will be hard to understand which experience is performing better, but this operation represents by the way a serious attempt in giving evidence on the usefulness of these experimentations.

Since the telemedicine services active at the moment in Italy have some problems in demonstrating their level of sustainability, as every attempt is totally entrusted to the good will of the single specialist that operates without any shared guideline, causing the serious risk of a waste of resources, the attempt to create a panel of indicators is considered as an important driver to encourage the organizational sustainability of the service.

For this reason, the empirical framework comprehends among its driver the *demonstrability of results*.

About these three unexpected factors, an further and more specific analysis of literature has been conducted, in order to correct the possible omissions of a not exhaustive preliminary search and to eventually find confirmations about them.

In particular, the analysis showed that the need for the *psychological support* is cited in few articles, which assess that coexistent anxiety and depression are particularly common in COPD (Borson et al., 1998; Brenes, 2003), though in many cases the symptoms of COPD overlap with them (e.g. sleep disturbance, decreased energy, shortness of breath and catastrophic thoughts about physical symptoms). Moreover, other articles attest that patients affected by the disease are not the sole subjects psychologically involved; families, for example, are typical targets of psychological stress, since they often initially respond to the illness by becoming over-protective and fostering dependence and a sense of impaired competence in the ill person, but, as the illness worsens, they often experience exhaustion because of the demands of new roles, depleted finances and other aspects of a changed lifestyle (Tilden et al., 1987) . At this proposal, it is generally underlined that comprehensive programs that incorporate psychosocial intervention may significantly improve health status and quality of life (American Thoracic Society, 1999), although the impact of psychosocial components is not always clear: some studies show positive effects of stress management for reducing anxiety and depressive symptoms and increasing functional status among patients with COPD (Blake et al., 1990), while others demonstrate no unique benefits of stress management over and above traditional rehabilitation strategies (Emery et al., 1998). Nevertheless,

though the awareness of the need for psychological support is attested in the articles, none of the analyzed documents suggest the insertion of figures related within the staff of the telemedicine services.

Concerning *technology reliability*, a further analysis of literature showed that, though technology is commonly perceived as the main enabling factor of these experimentations, few researches underline the importance of its reliability. Among those, G. Williams et al. (2000) assessed that the increasing adoption of technology to support independent living at home through and, ultimately, telecare systems poses some safety problems; therefore, the implications of any failure of the technology must be addressed in order to provide a safe and reliable care service (Williams et al., 2000). Moreover, C. Ruggiero et al. (1999) affirm that important aspects of technical solutions are: simplicity of operation and management, availability, reliability and affordability (C.Ruggiero et al., 1999).

On the contrary, *demonstrability of results* is never cited explicitly among the factors to take in consideration as enablers of the organizational sustainability of a telemedicine service. Among the exceptions, H. Wagner et al. (2001) introduced the matter in their article, reporting a Cochrane research concluding that "there is a number of multifaceted models [now] being tested. The choice of components within the models has often not been based on a theoretical or empirical rationale. Future research should evaluate reproducible complex interventions and encourage replications of using the same model". As a consequence, they conclude that the major barrier to quality improvement efforts in chronic disease consists in the lack of a common performance improvement framework, whose main component is a quality improvement –evaluation program (Wagner et al., 2001). Although the need for a shared evaluation program may be considered as a consequence of the demonstrability of results, since no evaluation can be performed if the object and its performances cannot be measured, *demonstrability of results* is not explicitly cited.

5. EMPIRICAL FRAMEWORK

5.1 Description of the Empirical Framework

The analysis performed in the previous chapter was aimed at preserving the drivers confirmed through the interviews, at modifying the partially confirmed and excluding the not confirmed; as a consequence it has brought to the creation of an empirical framework. Moreover, the unexpected drivers have been included in the model, whose structure is comparable to the conceptual one, though its contents are more complete; the structure of the empirical framework is reported in Table 5.1.

	realignement of skills	role of nurses	institutionalization	coordination spec-nurses	coordination LHC-hospital	stability of financing	psychological support	technology reliability	demonstrability of results
organizational sustainability									

Table 5.1 – Structure of the Empirical Framework

The empirical framework resulted from the match with the experts, completed with evidence coming from literature, is lastly tested on the two most virtuous Italian experiences, left aside from the preliminary analysis on purpose, to verify the consistency of the model.

5.2 Test of the Empirical Framework

The test of the Empirical Framework of Table 5.1 has been conducted on two out of the nine experiences, initially selected because of their degree of institutionalization, completeness of care delivered and scientific related acknowledgements (publications, awards…).

Doubtless some of the already analyzed experiences may had suited these requirements; nevertheless even the apparently most completed among the seven possessed by the way some faults that had brought to the decision to effectuate the test on the services delivered in Mantova and Verona.

In particular, the service in Cremona is active only for patients affected by ALS and the number of patients is kept limited on purpose; the experiences of Torino, Roma and Casatenovo are similar, but they are still at an experimental stage and conducted on a limited number of people, while the service delivered by the project referral of Arenzano presented some unusual characteristics and moreover demonstrated to be not sustainable over time. On the other hand, the project referral of Varese provided a complete and innovative service, but it is still at the stage of project and the

service is currently delivered only for a limited time interval of 6 months; Rieti, on the other hand, has an equally structured program, but a limited number of patients.

The analysis of the last two experiences is provided in the following paragraph.

5.2.1 Mantova

The structure hosting the service is a complex operative Unit, whose director retains that its main critical success factors are: 1) a good level of partnership of the Unit with the LHC, since they actually behave and perform as if they were part of a unique Company; 2) a good level of partnership among the professionals involved within the service; 3) the presence of highly qualified professionals; 4) the definition of medium and long term strategies that starts out from an accurate epidemiologic analysis; 5) the achievement of an equal relation among the involved professionals (higher autonomy and, as a consequence, greater exploitation of clinicians, nurses and technicians).

a summary of the main characteristics of the project is reported In table 5.2; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Lombardia
	LOCAL HEALTH CENTER:	LHC of the Province of Mantova
	NAME OF THE STRUCTURE:	Carlo Poma Hospital
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Complex Operative Unit and Intensive Care, Simple Unit of Domiciliary Respiratory Assistance (DRA).
	CHARACTERISTICS OF THE SERVICE:	11 (9 specialists + 2 allergists), 3 therapists of mobility, 26 nurses 20 beds
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project Referral (PR) Nurse Case Manager (NU)
	SERVICES PROVIDED:	Monitoring, Teleconsulting, Domiciliary Assistance

Table 5.2 – Summary of the Project

Historical Evolution of the Experimentations and Actual State of the Service

The first phase of the experimentation in the structure started in 1994; from 1995, the service required to dedicate a lung specialist and a nurse part-time. In 2001, 2 nurses have been dedicated to the service full time, since it had reached an extent of 175 patients per year. From 2008 on, 4 nurses

have been completely staffed on the service and they manage the whole service delivery autonomously.

Patients' description

The patients involved in the service are 160, 30 of which are in continuous or intensive ventilation; they all belong to the district of the LHC of Mantova. Actually, the service has lately been enlarged and at the moment it reaches 70 additional patients living in the neighbor Provinces. Nevertheless, the Unit of Domiciliary Respiratory Assistance (DRA) is committed in delivering them a service of external consulting and does not operate any activity of domiciliary assistance.

Access criteria are related to the dependency of patients on the ventilator, partial (8 hours minimum) or continuous.

Services Description

The request of inclusion of a patient in the service may come from the Operative Unit, from other Units of the Hospitals, from GPs or from the LHC. If the patient suits the access criteria and the patient/caregiver is collaborative, the nurse case-manager plans with them a meeting to define a Personal Care Plan (PCP) suitable for the patient's needs.

The definition of the PCP starts with an accurate evaluation of the patients and his/her family in social, welfare and financial terms. If the family reflects an acceptable situation, the second step of the Plan definition consists in the identification of one person (2 if the patient is subjected to continuous ventilation) that would be available and able to take care of the patient; if no figures of caregiver are available, it is necessary for the case-manager to find a structure of continuative care different from the domicile of the patient himself.

Once the caregiver has been detected, the nurse proceeds in signaling the possible inclusion of a patient into the Integrated Domiciliary Assistance (IDA) of the LHC and to the GP; besides, she sends to the LHC the request of the technological devices to equip the domicile of the patient. The LHC, in fact, conducts annually a call for rentals; every technology supplier may participate, if its devices possess the characteristics requested by the medical staff of the DRA. The ten-yearly experience of the nurses and specialists of the service, in fact, allowed them to reach a high level of technological competence.

Once the devices are delivered, they are tested in presence of the nurse and the future caregiver: in this moment the training path starts. The training represents a central factor of the IDA and it is completely leaded by the case-manager nurse, that disposes of a predefined check list to enumerate the activities (items) that the patient/care giver should learn to perform; every item is reached before in theory before and after in practice, until the candidate caregiver assumes a

satisfactory comprehension ability in performing the activity. The predefined check list helps the nurse in the activities of training, since it makes it possible to insert an evaluation for every item concerning: 1) the degree of comprehension; 2) the practical ability; 3) the ability to learn the sequence of activities to perform. These evaluating check lists are inserted in the medical record of the patient as certifications of the training received. A correct training is considered vital to increase the autonomy in the management of the pathology.

Once the caregiver results suitable to sustain the assistance adequately, all the required technological devices (pulmonary ventilators, extractor fan of secretions, devices for the assistance to cough crisis, devices for oxygen therapy, disposable for the management of the line of ventilation), all the tools for aided mobility (pram, lifter, articulated bed, walker) are delivered at domicile. Moreover, the environment is prepared in the most suitable way for the management of care (elimination of infrastructural barriers, improvement in the safety of the electrical system).

When the domicile is ready to host the patient, the case-manager plans a meeting with the territorial équipe and the GP in order to share the PCP with them and the service becomes active.

A graphical description of the processes is available in the flowcharts in Table 5.3, 5.4 and 5.5.

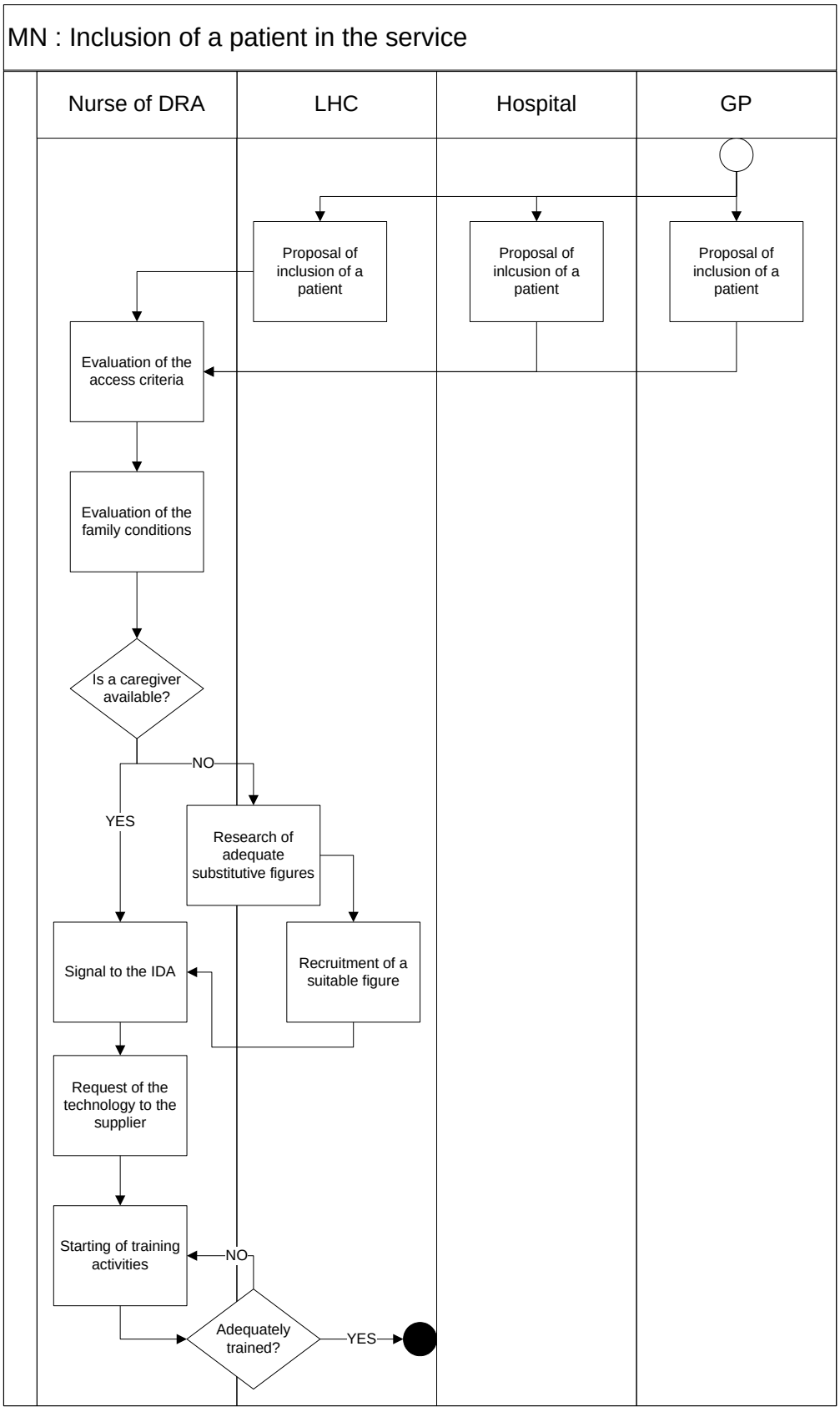

Table 5.3 – Inclusion of a patient in the service

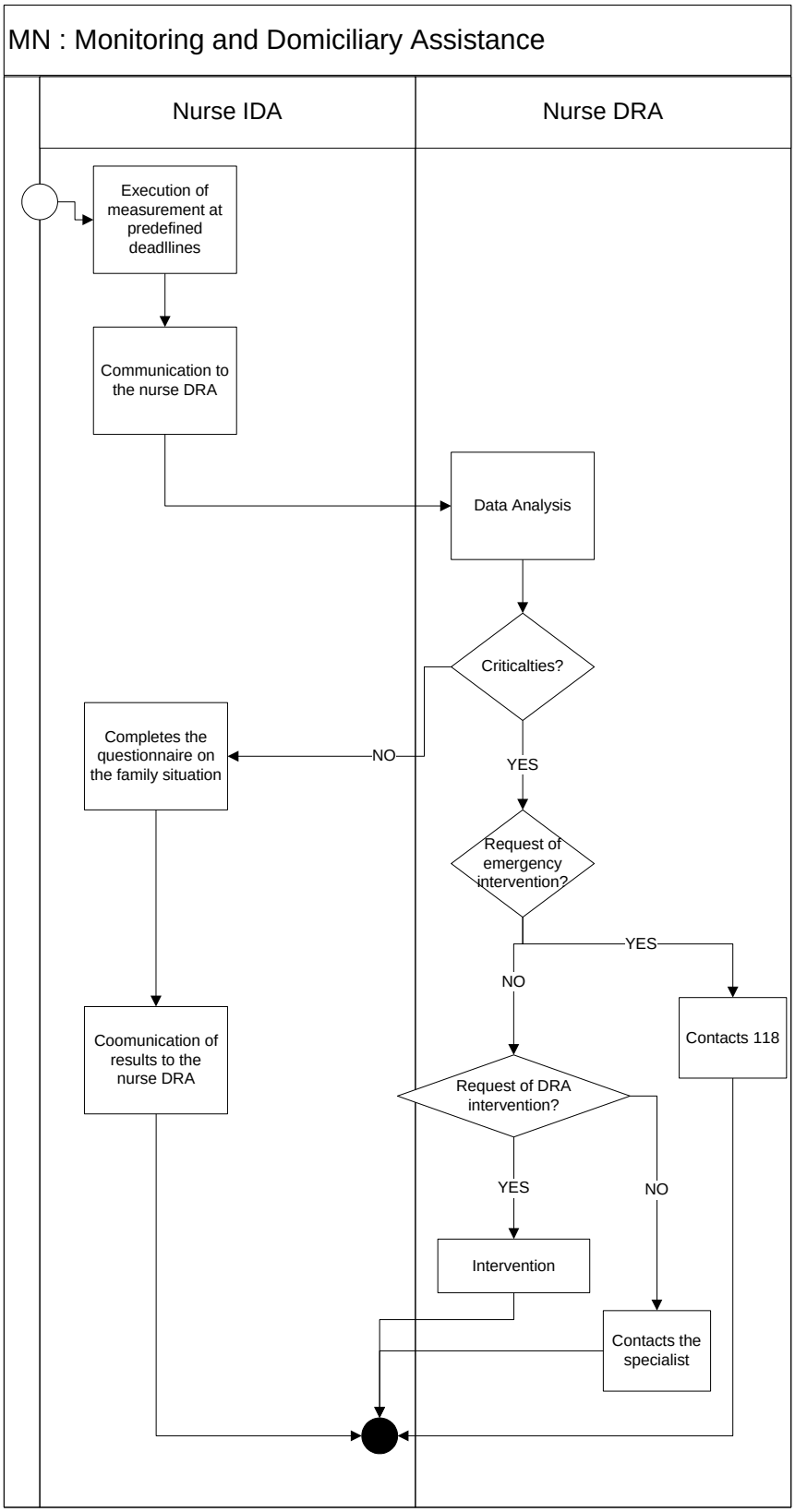

Table 5.4 – Monitoring and domiciliary Assistance

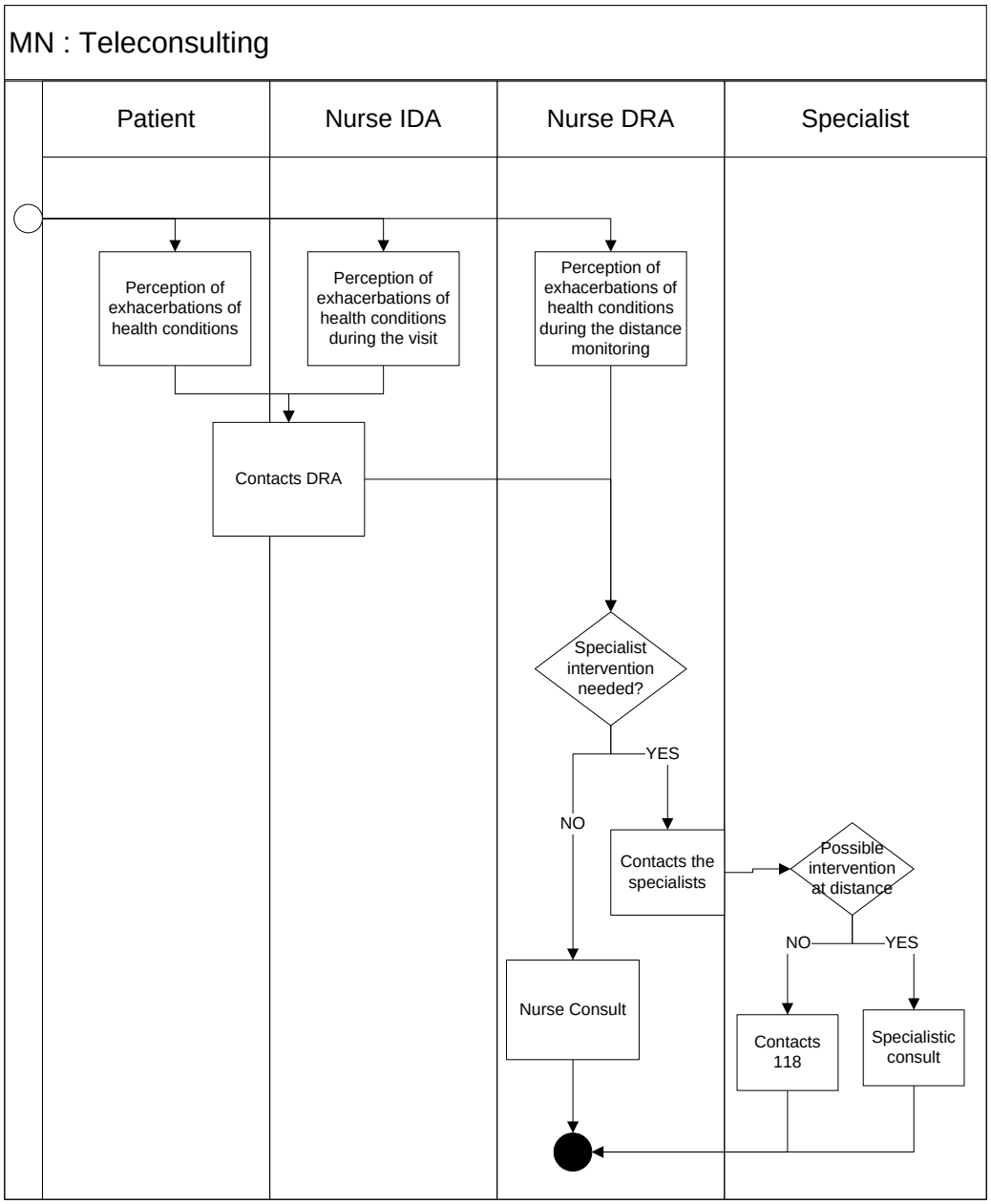

Table 5.5 – Teleconsulting

The services that the Unit leaded by the PR provides in the context of the home care assistance are:

MONITORING and DOMICILIARY ASSISTANCE: This service is conducted in collaboration with the LHC. The nurse of the IDA service, in fact, reaches the domicile of the patients and proceeds in recording on a predefined card the vital parameters that he/she is expected to monitor. The frequency of the visits is predefined on the basis of the health conditions of the patient at the moment of the resignation. In general, patients with invasive ventilation for 8-12 hours per day receive one visit per week and, if their condition is judged pretty stable, the visits are performed

more rarely; if the patients are ventilated more than 16 hours per day, visits are initially performed every day.

Once recorded them, the nurse sends the filled card via fax to the nurse of the DRA and this last examines it. The staff of the DRA service has prepared two different releases of the card, one for patients on invasive ventilation and the other for patients on non-invasive ventilation. If the nurse of the IDA notices some criticalities (clinical, psychological or technical) that she is not able to solve by herself, she proceeds in alerting the referring professionals (GP, technician) and the DRA service too.

Beyond its clinical effectiveness, the visit at domicile allows to monitor the effective suitability of the caregiver and to identify eventual conflicting situations within the family; the predefined questionnaire, in fact, requires the nurse to answer to some qualitative questions dealing with the observation of the situation at domicile.

Data sent to the DRA center via fax are collected in a database, that allows the case-managers not only to monitor the situation of every patient but also to effectuate statistical analysis on data. This analysis is particularly useful to evaluate the situation of each patient and to eventually modify procedures and protocols of the PCP on the basis of considerations established on facts more than on impressions. Periodically a nurse of the DRA visits the patient at domicile together with the specialist to perform activities that go beyond the competences of the nurse of the IDA; the schedule of the visits is planned according to a geographical scheme that allows to optimize the operations (e.g. minimize time to perform the visits).

TELECONSULTING: Each patient has the possibility to contact the case manager nurse directly and to receive an immediate consulting ad hoc. The service is available from Monday to Friday, from 7.30 to 19.30 and on Saturday from 7.30 to 13.30. To assure the service on Saturday afternoon, an emergency alternative number is available for patients that need it. Moreover, the staff of the Respiratory Intensive Care is available on Sundays and during the night.

Organizational Sustainability of the Service

In the PR's opinion, the sustainability of health care delivery as the ability to look at reality that the nurse and specialists face in their routine work; a service cannot be considered sustainable if it leaves aside a strong commitment in personalizing the care and establishing a relationship with the patient and his family. To make this happen an organizational, motivational and training effort is necessary, together with a correct integration with all the organs committed in managing the social aspects of the disease, that may actually optimize this endeavour. The definition of figures of interface trained to be expert in managing complex situations that require the collaboration among different specific

professionals is necessary too. The recent activation of multidisciplinary and integrated teams is an interesting experience with regard to it is.

Moreover, telemedicine is perceived as a possibility to implement this degree of coordination, if some forethoughts are respected; in particular, the PR is convinced that a call center managed remotely by the technology supplier would be totally useless to conduct the service, since it would only determine a waste in energy and resources and, furthermore, it cannot provide any specialistic consult, being therefore useless for care. Moreover, the record of a too high number of parameters is useless too, since it generates a ground noise that may become harmful to the scope of the service.

SATISFACTION: The experience is considered positive by patients, since they benefit of the possibility to make use of a complete service provided by an équipe of collaborators that know their health conditions personally. It is considered beneficial by the nurses too, although the interviewed nurse underlines the necessity to involve ulterior personnel to face the eventual enlargement of the service; the organizational burden is, in fact, not negligible since 4 nurses are committed to the service full time and they receive an average of 50 calls per day, while engaged in the training activities for caregivers and other nurses too.

Nevertheless, the decision to delegate nurses for the management of the service had turn out to be particularly efficient, as it has been calculated that more than 80% of the requests of patients can be solvable by the nurse herself. In any case, when a specialist consulting is needed, the nurse disposes of a list of 3 lung specialists at least to whom she may address any patient's request.

A further element of satisfaction for patients is the presence of dedicated psychological care.

EFFICIENCY: The good trend of the experimentation is precisely assessed by a panel of indicators defined in collaboration with the LHC, which includes: 1) the readmission rate; 2) the number of prolonged hospitalizations; 3) number of patients charged (which should physiologically increase if the service is really efficient and efficacy). Measuring these indicators, the provided service appears as being of very high quality.

COORDINATION: The continuity of care assured by the service is one of its main critical success factors, since it involves in a very efficient way specialists, hospital and LHC nurses, psychologists, social operators and technicians.

Moreover, great coordination is contemplated among the DRA and emergency services. Each patient, in fact, is provided with an informative card to show in case of complications not directly manageable by the referring structure: in this way the emergency intervention is facilitated as the card helps the operators to choose the most suitable solutions, with respect to the plan of care in progress. To further increase the degree of collaboration with the emergency service, the nurses prepare and update periodically an informative prospect of the most precarious patients subjected

to mechanical ventilation: next to the name and address of every patient, it is indicated the pathology from which it suffers, the model of ventilator employed, the maximum autonomy of batteries, while a colored light (green, yellow, red) indicates the priority of intervention in case of prolonged electric black out. In this way, in case of request of emergency intervention or electric black out that causes the deactivation of any electrical device, the emergency operators are able to plan the order of intervention effectively, according to the specific health conditions of the patients. The presence of a defined and shared protocol allows a more adequate risk management, since each actor knows what he is supposed to do in case of need.

This high level of coordination is very helpful to face the main sources of risk of care at distance, which are prolonged electrical blackouts, caregiver's stress, risk of infections, scarce ethical and welfare continuity. The possibility to create shared and well managed plans and the presence of common guidelines is very helpful in keeping all these under control.

Table 5.6 reports the empirical framework fulfilled with the information gathered through the interview.

MANTOVA	rialignement of skills	role of nurses	institutionalization	coordination spec-nurses	coordination LHC-hospital	stability of financing	psychological support	technology reliability	demonstrability of results
organizational sustainability	(+) predefined training path for patients and caregivers (checklist) (+) mandatory annual refreshment courses for nurses	(+) responsible for the service and its management	(+) IDA (+) PCP shared with LHC and GPS	(+) DRA = actors know their duty in care	(+) IDA in collaboration with LHC and hospital (+) LHC responsible for technology delivery	(+) annual call for rental managed by the LHC	(+) predefined questions to monitor the psychological situation at domicile (+) activation of multidisciplinary teams involving specialists	(+) technology suppliers responsible for quality and maintenance	(+) possibility of sharing with the LHC

Table 5.6 – MANTOVA: Empirical Framework

5.2.2 Verona

The structure hosting the service is a complex operative unit, whose director retains that the main critical success factors of the Unit are: 1) the perfect organization of duties within the Unit, disposed by a chart that suits the ambitions and professionalities of the staff involved; 2) the high quality of the service, acknowledged by Public Boards (the Unit has been the first in Italy considered meritorious of the ISO 9000 certification) and by the scientific society (the editor Springer has started a cooperation with the director of the Unit that had already edited with them an entire chain of articles concerning quality management in health care); 3) the intensive use of information technology devices and applications in the management of care.

In Table 5.7 a summary of the main characteristics of the structure hosting the project is reported; a more detailed description is available below.

CHARACTERISTICS OF THE STRUCTURE	*REGION:*	Veneto
	LOCAL HEALTH CENTER:	LHC of the Province of Verona
	NAME OF THE STRUCTURE:	Bussolengo Hospital
	TYPOLOGY OF STRUCTURE:	Hospital
	UNIT DESCRIPTION:	Complex Operative Unit
	CHARACTERISTICS OF THE SERVICE:	6 lung specialists, 6 technicians of physiopathology, 1 molecular biologists, 1 technician biologist 25 nurses, 2 psychologists 16 beds of ordinary hospitalization, 2 beds for monitoring in breath therapy
TELEMEDICINE EXPERIMENTATION	*INTERVIEWEES:*	Project Referral (PR)
	SERVICES PROVIDED:	Telemonitoring, Teleconsulting.

Table 5.7 - Summary of the project

Historical Evolution of the Experimentations and Actual State of the Service

The PR and his équipe have demonstrated great commitment in spreading the use of informatics and technology within medical activities, already when many others colleagues have not perceived their potential contribution. At the beginning of the 1980s, in fact, a process of computerization of the medical Unit started, since the PR perceived them as a possibility to enable the management of patients at distance; therefore he coped with a computer company the conception of a first net of computer inside the Unit.

Afterwards, in 1978, Regione Veneto asked the PR to perform an epidemiologic study, aimed at evaluating the prevalence of chronic respiratory pathologies on the population; the survey has been completed around 1985 and showed that the potential candidate for a service of domiciliary tele-assistance were almost one person out of 10.000. Therefore, once assessed the relevant incidence of the pathology, a stronger commitment in structuring a quality service to satisfy this need has been developed. More in particular, the lung specialists of the structure tried to arrange to perform some visits to the patients at domicile on a voluntary base. Nevertheless, though the attempt was admirable, the elevate number and the precarious conditions of this kind of patients raised many questions about the actual efficacy of the service delivery.

In 1990 Regione Veneto and the National Research Center decided to acknowledge the usefulness of the service and therefore consented to sustain financially its structuring. Moreover,

four years later, the PR, that officiated the Regional Government as a councilor, succeeded in rendering active a law decree contemplating the assignation of a specific economical reimbursement for Home Hospitalization (HH), which is a sort of hospitalization performed at home through the technology devices that allow it. The amount of the tariff given to the Unit corresponds to the sum of the tariffs of two hospitalizations for Chronic Obstructive Disease (about 4.500,00 Euros), which is less than the average amount of money saved thanks to the missed hospitalizations for exacerbations determined by the telemedicine service.

The service is now active in the district and its model is currently object of studies worldwide. Before the law became active, the service has been sustained by voluntary benefactors.

The service, that won the twentieth European Award in 2004, has now reached its third release.

Patients' description

The patients involved at the moment in the service are 240, 70 of which in intensive or continuous ventilation; since the beginning of the service, more than 800 people have been reached. The considerable amount of patients is due both to the prevalence of COPD and other chronic respiratory illnesses on the territory and by the fact that Hospital district is very wide (260.000 people).

Access criteria deal with serious respiratory insufficiency and, with it, oxygen therapy in continuous/partial ventilation.

Services Description

When the Regional Decree became active, the Unit leaded by the PR became responsible for the evaluation of the potential access of each patient in the service. If a GP or a lung specialist belonging to any other structure of the LHC comes in contact with a patient that may require the activation of the HH service, he contacts the Hospital Unit that plans a meeting with the patient. During the meeting, the lung specialist, aided by the nurses, checks the effective appropriateness of inclusion, effectuates the oxygen prescription (dose and duration) and opens the medical record of HH. Once defined the type of intervention and therefore the technological devices required to support home care of the specific patient, the technology provider is alerted and a nurse starts the training path of the patient and his/her caregiver. Once the technology is available and the patient is able to deal with technology, the service starts.

A graphical description of the processes is available in the flowcharts in Table 5.8, 5.9 and 5.10.

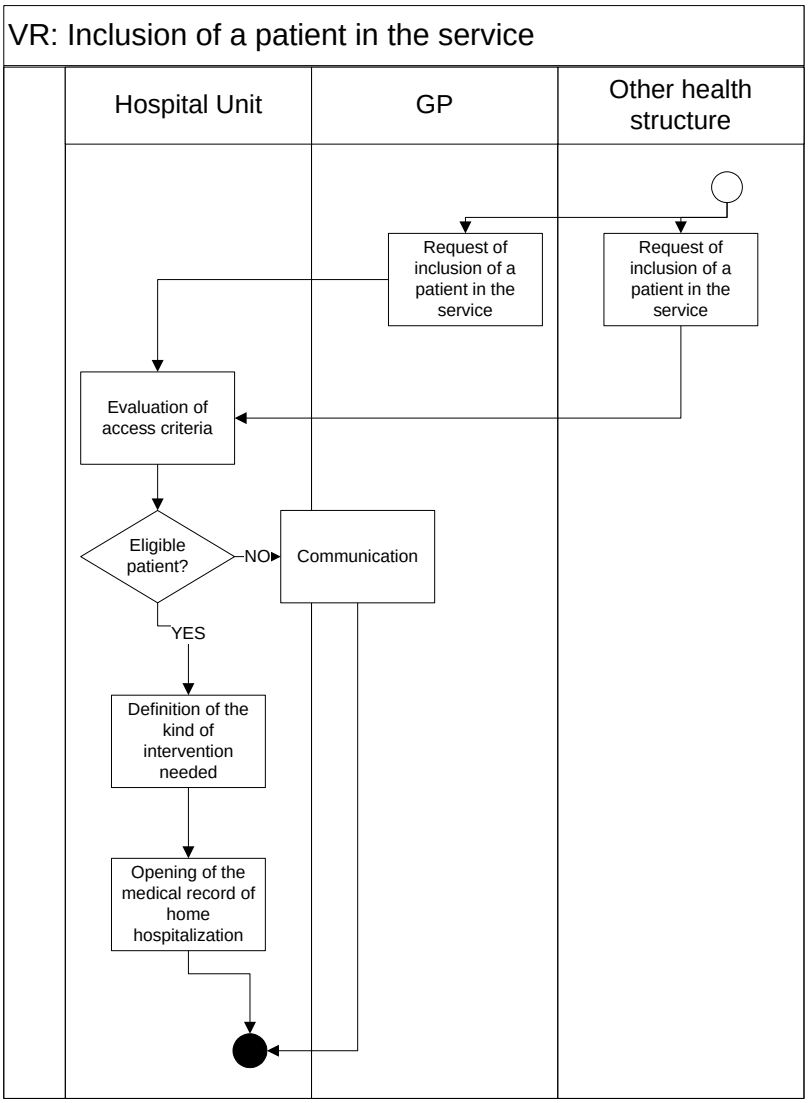

Table 5.8 – Inclusion of a patient in the service

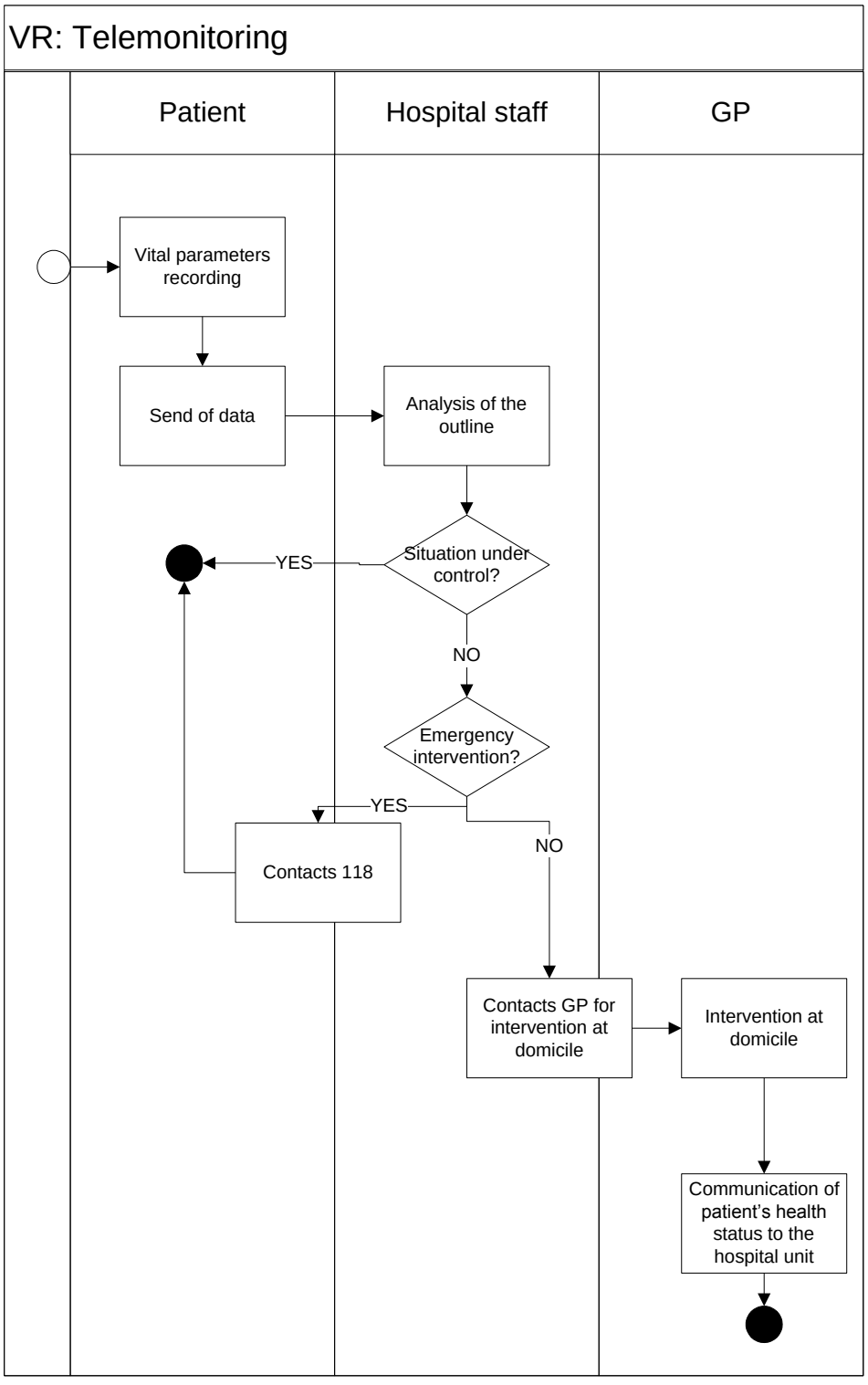

Table 5.9 - Telemonitoring

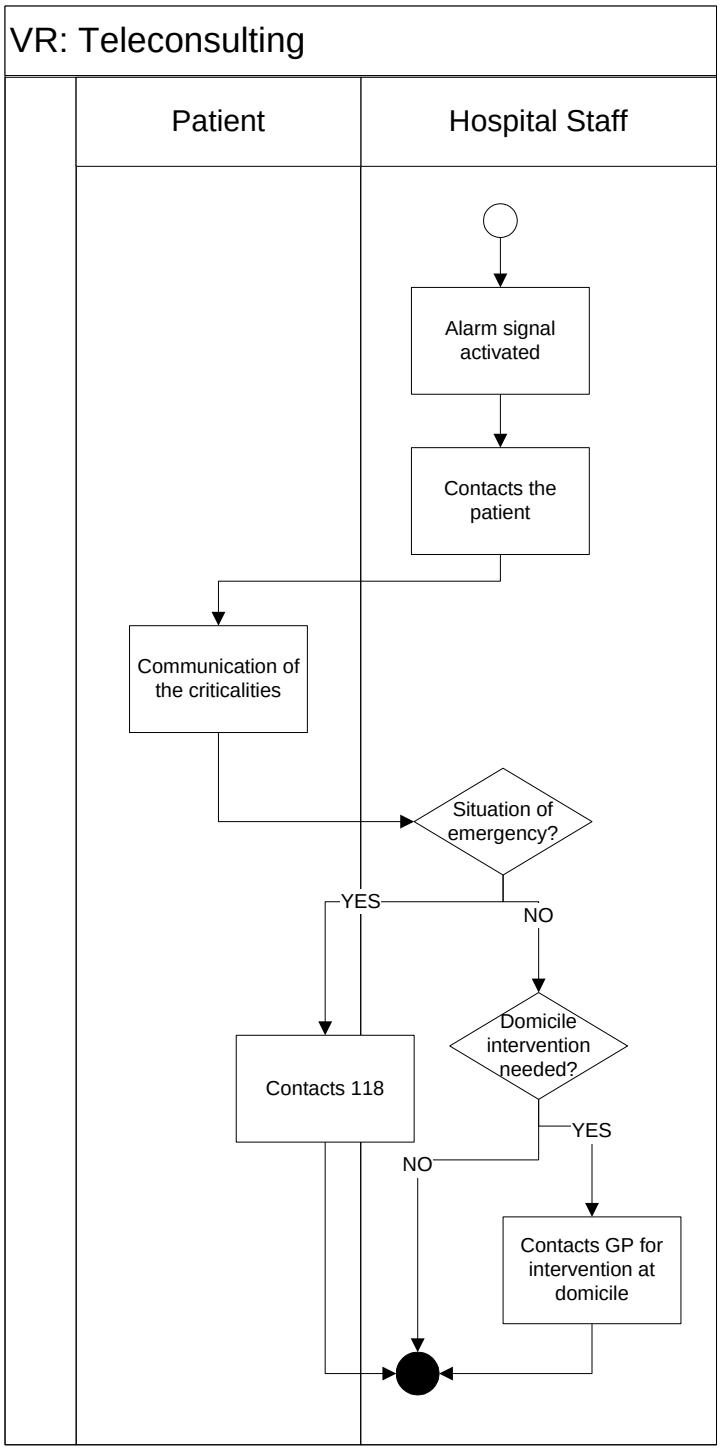

Table 5.10 - Teleconsulting

The duties that the service leaded by the PR provides in the context of the home care assistance are:

TELEMONITORING: Patients receive at domicile an electronic sensor that allows them to record the main vital parameters (blood pressure, pulse, saturation) at some predefined deadlines. In the

office of the Unit ward sister some computers are available and always active in receiving the outlines coming from the patients; daily the specialists or the nurses read the outlines and evaluate the patients' health conditions. If they detect any parameter out of normal, the clinician takes it upon himself to contact the patient to evaluate a potential necessity to perform an emergency intervention. In some cases a domicile visit is enough to solve the problem; if so, the specialist proceeds in contacting the GP and this last performs the intervention.

The frequency and scheduling of the records-sending may be modified and programmed in relation with the clinical conditions of the patient.

TELECONSULTING: The hospital Unit is equipped with an alarm that activates automatically when the software detects any parameter out of normal or in case in which the patient, perceiving an exacerbation of his conditions, contacts the call center. When the alarm rings, a nurse or a specialist reaches the office where the computers are located and check the outlines or perform a telephone call to the patient in need. The service is active during the work time of the Unit.

Organizational Sustainability of the Service

The answers given by the PR to the questions regarding his opinion about the organizational sustainability of a service show that he thinks that sustainability is often seen as an economical matter, though he is convinced that a health care system should consider much more factors to be sustainable, even though economic resources are doubtless important. In general, he assessed that sustainability is doing the maximum with the minimum resources, always protecting the ethical content of choices performed; if ethics is forgotten, disparities and iniquities are easily verifiable.

The drivers that policy makers and professionals involved should utilize in order to create this kind of service are figured in the form of a tree, whose roots are culture, resources, data, R-D and learning attitude, while leaves are organizational empowerment, risk management, audit and evaluation, technology assessment, accountability and performance measurement, e-based practices and policies; the lymph flowing through the trunk is the quality of the systems. The telemedicine services conducted in the structure represent an example of the correct balance of these drivers.

SATISFACTION: Both patients and medical professionals involved feel satisfaction about the service. Patients' compliance has always been high since the service has been implemented the first time and the incidence of complaints is now totally negligible (3 alerts on 193 patients last year); moreover, the perceived invasiveness of the service in patients' lives has appreciably decreased. Nevertheless the most surprising datum concerning patients' appreciation is that the result of a survey conducted when the patients join the service and some years later; in fact, the survey shows that the perceived quality of life increases a lot in time and, moreover, three years later the joining of

the service a percentage of patients equal to 17% expects a total recovery from COPD, which is impossible, being COPD degenerative, but it represents a strong signal of the satisfaction of patients. This surprising result is driven mainly by the fact that being treated at home, the probability of bacterial infections decreases and, as a consequence, exacerbations and hospitalizations are seldom avoided.

Nurses play a basilar role in the service, since they manage the care plan and are responsible for the training of patients and for the evaluation of their level of comprehensiveness of the disease, which is one of the main scopes of the service. This revaluation of their competences and professional is source of great satisfaction for them.

EFFICIENCY: The efficiency of the service is witnessed by a panel of indicators that shows a considerable decrease in the episodes of hospitalization (both for exacerbation and for the inability of the patient to live together with the pathology), a despondency of costs related to drugs, a decrease in the prevalence of embolisms and infections, since staying at home the patient avoids to come in contact with bacteria.

Moreover, the service is demonstrating a serious improvement in the control of costs too, given the decrease in hospitalization and the diminution of their average duration. Besides, since the technology system is modular, it allows to give to every patient the correct solution for his problems, avoiding costly waste connected to the over-dimensioning of the service.

COORDINATION: The efficiency of delivery is assured by the Institutional commitment to the service. A specific reimbursement fee has been identified when the HH service has been defined and this is almost the unique existing relationship between the Regional Government and the Unit, since the former has delegated all the organizational aspects of care to the latter.

The level of coordination with the GPs is considerable too, as they plays an active role in the service by performing interventions at domicile when needed.

Table 5.11 reports the empirical framework fulfilled with the information gathered through the interview.

VERONA	rialignement of skills	role of nurses	nstitutionalizatio	coordination spec-nurses	coordination LHC-hospital	stability of financing	psychological support	technology reliability	demonstrability of results
organizational sustainability	(+) predefined training path (+) evaluation of the level of comprehension of the disease	(+) perform much of the service autonomously	(+) included in the Regional Health Plan	(+) interchangeable duties	(+) GPs implicated in the service	(+) included in the Regional tariffs	(+) 2 psychologists included in the unit staff	(+) great competencies (since 1980)	(+) many articles/pubblications (experience studied worldwide)

Table 5.11 – VERONA: Empirical Framework

5.3 Evaluation of the Empirical Framework

The test of the Empirical Framework, which resulted from the reconsideration of the conceptual one, was performed on the experiences of Mantova and Verona. The choice fell on these two, since they are the most affirmed, as the service has been active in Verona since the 1980s and in Mantova since 1994, the most significant in terms of number of patients involved (Verona counts 240 and Mantova 160 patients), the most completed and institutionalized (i.e. they are the unique among the investigated experiences that possess shared protocols and guidelines for risk management).

The empirical framework appears complete, as it includes all the distinctive features making these two experiences more successful than the others.

In particular, Mantova showed 4 main critical success factors:

1) The compilation of a Personal Care Plan, that comprehends everything a clinician or nurse needs to know about the patient, from the family background to the typology of care he is subjected to; this tool is of great importance, since it can be easily shared among the actors dealing with the patient for any diverse reason. It represents, therefore, an effective enabler of the coordination among hospital and LHC and a potential aid for the realignment of skills within the hospital Unit.
2) The massive involvement of nurses in the service management: they hold the roles of tutor, case manager and managers of the service of teleconsulting.
3) The presence of a complete and updated database, that allows to maintain the clinical situation of the patients under control and to perform statistical analysis to assess the trend of the service.
4) The recent involvement of psychologists in the service, welcomed by the patients and their families with great enthusiasm.
5) The high level of coordination among the DRA and emergency services, assuring a correct management of risk connected with the treatment of unexpected exacerbations.

As it can be easily verified, the drivers embedded in the empirical framework contemplate and explain these 5 success factors: the PCP is an example of tool allowing the *realignment of skills*, the *institutionalization* and the *coordination LHC-hospital* and *specialists-nurses*; the number and importance of the activities performed by nurses go in the direction of the reconsideration of their role in care delivery (*role of nurses*); the presence of databases and software to perform analysis on data allows a quantitative *demonstrability of results*; the presence of *psychological support* is actual; the active interface of the service with the others figures involved in care, the emergency service in particular, increases the *continuity of care*.

Concerning the critical success factors of the experience of telemedicine service delivery conducted in Verona, they can be summarized in:

1) The setting-up of the service on the basis of a concrete and well-founded epidemiologic analysis, that assures the adoption of correct measures, suitable for the heath care needs of the population.
2) The employ of high quality technologies, whose functionalities are defined by the clinicians themselves.
3) The ability of nurses to perform most of the activities that the specialist performs in the sphere of the telemedicine service.
4) The definition of a specific tariff with the regulator for the reimbursement of the service.

Each of the four success factors listed above have been included in the framework, as defining the characteristics of the service on the basis of an epidemiologic analysis assures since the beginning the *demonstrability of results*; the high quality of technologies goes together with their *reliability*; the centrality of nurses is in line with the re-discussion of the *role of nurses* and the presence of a predefined tariff demonstrates a high *institutionalization* of the service.

The test has made it therefore possible to detail completely both the experiences and without raising the need to add any driver to describe the experiences.

6. IMPLICATIONS

As it has been shown in the previous paragraph, the empirical framework appears complete and exhaustive, since it comprehends all the elements reported in the two sample-interviews (Mantova and Verona): none of the drivers useful to describe the experiences has been added or further explained. Moreover, all drivers seemed to exercise a positive influence on the last two experiences and to explain their success in a complete way.

In general, the interviews, that were aimed at defining the empirical framework, contributed to the reaffirmation of a concept that had already been raised during the analysis of literature: the complex interactions among the actors involved in the experimentations need some organizational efforts to make them cohabit. The drivers highlighted through the analysis represent the main typologies of these organizational efforts; a lack of commitment on these topics would make the organizational sustainability of the service unquestionably precarious.

Since no scale of importance or priority among the drivers has been settled during the process of analysis, it would result inopportune at this point to define a sensible score for each driver. Nevertheless, it would be useful for decision makers to know at least on which drivers they should start concentrating their efforts in increasing the organizational sustainability of an existing or ready-to-start service or to be aware of which drivers they can more directly influence. Conscious of these priorities, they should in fact perform more effectively in a context with limited resources.

The present paragraph reports evidences of the overriding implications underlined by the most committed professionals in the context of telemedicine applications for the treatment of COPD.

The subjects of this further analysis have been chosen according to the needs of a telemedicine service. In fact, the organization of this kind of service requires an adequate commitment of the institutions (*Regulators, Institutions and Policy Makers*), the presence of satisfactory medical staff (*Professionals*), the availability of technological devices (*Technology Suppliers*); lastly, some hints about the desirable future focus of the analysis aimed at gaining evidence about the topic are reported in the paragraph (*Researchers*).

Regulators, Institutions and Policy Makers

A further reconsideration of the results gathered from each experience allowed to detect the influence of these actors on 4 out of the 9 drivers composing the empirical framework:

(1) *Role of nurses*: regulators and policy makers hold the possibility to discuss about the contents of the training path followed by nurses, that would require to be questioned, since at the moment nurses do not possess any skill to perform the activities of tutoring or case managing, that is the core of the activities connected with the telemedicine services. The

exigency to develop these competences has been underlined in almost all the experiences. An explanatory example is the case of Mantova, where the need for new personnel is high, but few possess the requirements to take part to the service; for this reason, the nurse holding the role of responsible of the service would suggest the Institutions to create an education program that allows applicant nurses to develop additional skills in the treatment of chronic illnesses and in the management of the pathology at distance. Part of this renewed education program can be the inclusion of the hospital units hosting telemedicine services among the actual potential choices of internship for the student, so that the future nurses can join the nurse case manager and learn the skills directly.

Together with the competences useful in order to manage the chronic disease, the Institutions should discuss about how to give the nurses the opportunity to become more used to the employ of computer technology, which is the base of telemedicine devices. Moreover, the close relationship with the patients, required within the experimentations of telemedicine, asks the nurses to reach some communicative skills that would make it easier for them to relate with the patients.

Until a definitive solution will be found, the institutions should at least start to encourage the participation of nurses to training courses, in order to promote the achievement of the competences (clinical, informatics, relational) they need.

(2) *Institutionalization*: the almost entirety of the interviewees is concerned about the lack of guidelines defining the legal responsibility and the absence of shared measures to undertake in order to manage the risk of care delivery at distance. Regulators and institutions should therefore take in consideration the experiences of telemedicine applications that actually possess and follow an effective system of rules (i.e. Mantova and Verona) and consider them as an example to diffuse among the others. Doubtless this path is not easy to follow, since the Italian regulatory system foresees that many of the decisions regarding health care delivery depend upon the Regional Government and this is a source of unavoidable differentiations.

(3) *Coordination LHC-Hospital*: given the actual effectiveness of these kind of services in the treatment of COPD in terms of appropriateness of care, employment of professionals and financial savings, the institutions should promote the use of these technologies and induce the professionals to undertake this kind of experiences. This is the case of Varese, which takes part to a project that Regione Lombardia finances through the LHC, with the aim to make clinicians aware of the adequateness of telemedicine for the treatment of chronic illnesses. The increased awareness for both the LHC and the Hospital would lead them to a

deeper comprehension of the potential positive effect of telemedicine in service delivery. Moreover, a correct level of coordination may facilitate the definition of some transversal paths of care, making it easier to complete the service by giving the patients the possibility to be treated at the same time even for all the pathologies from which they suffer. If the coordination is high, in fact, it is not difficult (as it is witnessed by many examples where the service is active already, i.e. Roma) neither to replicate the service nor to include some additional figures (i.e. cardiologists) in it.

(4) *Demonstrability of results*: if the Institutions required a periodical report composed by a panel of indicators and defined a strict system of measures aimed at evaluating through quantitative data the trend of the service, the staff involved in the service would be pushed to perform more effectively. This is the case of Rieti, where the administrative director demonstrates great enthusiasm towards the system since the elaboration of its results shows a positive trend from both the economical and organizational point of view. An effort in increasing the control on the service would therefore turn out to positively influence this driver.

Professionals

The introduction of telemedicine services among the routine of the Unit requires the professionals to question their duties, since the new system demands them to restructure and reorganize their jobs. The principal professionals involved in the experimentations are specialists, nurses and GPs. Each of these actors may influence the drivers differently and the present paragraph treats them one by one.

In particular, **specialists** are the most concerned with the following two drivers:

(1) *Coordination among LHC and Hospitals*: specialists are required to restructure and reorganize the number and type of mansions they perform, as a consequence of a deep understanding of the implications of the services. Nevertheless, if they are not aware of these implications, negative dynamics may break out. This is the case of Arenzano, where clinicians do not understand the potential positive inference of the training of GPs in diagnosing COPD through telemedicine on their work; therefore they looked at the service with the suspect that the increased autonomy of GPs would have impoverished their professionalism. On the contrary, the Project Referral was truly convinced that the service could actually represent an opportunity for clinicians to concentrate only on their core activities and therefore to perform them better. Reconsidering their professionalism in the light of evidence-based considerations about the care needs of the population and the resources at their disposal, specialists would exercise a positive influence on this driver.

(2) *coordination among specialists and nurses:* the need to create an adequate team to support the service would turn out to be a decisive factor enabling the organizational sustainability of the service, as it can affect the acceptance of the staff and therefore allow the organization to last longer.

Nurses can instead increase the organizational sustainability of a telemedicine service affecting two drivers:

(1) *realignment of skills*, as they should reach the skills to perform the activities related with the management of chronic patients, acquire competences in the use of devices and software and in the ability to communicate with patients in the most kind but effective way.

(2) *role of nurses*, as they could also increase the confidence of the institutions in assuring higher importance on the *role* that *nurses* may play, showing interest in learning and commitment in staying updated. This is the case of Mantova, where the nurses that had been involved since the beginning in service delivery provisionally, showed such a high interest and ability to learn and to perform skills in a short time of period that clinicians reconsidered the idea to leave the management of the service to them.

Concerning **GPs** it is evident that, while the contribution of nurses and clinicians has been highly investigated through the cases of study, their role has mainly been the source of numerous debates. In fact, while some of them demonstrated interest in the services and decided to hold an active role, performing some of the interventions at domicile and taking care of the patients at domicile, on the contrary others showed total indifference or, even, discouraged patients in joining the service (i.e. Rieti). In any case, GPs play a significant (positive or negative) role in the *coordination between the LHC and the hospital*.

Technology Suppliers

A further reconsideration of the results gained from each analyzed experience allowed to detect the influence of technology suppliers on 3 out of the 9 drivers:

(1) *Technology reliability*: in order to increase the reliability of the devices and therefore the safety of the service, the technology suppliers should be committed in managing the activities of maintenance and control of technologies, being available to ensure the service 24h every day, since a black out or spoil in the equipment may turn out to be fatal to patients, especially if they are in continuous ventilation. An example of the safest system structure is the experience conducted in Cremona, where the personnel responsible for the service, decided to admit and follow at distance patients affected by ALS, a pathology that

makes people dependent on the ventilator and therefore requires a very high level of safety, that would be impossible in case of lack of involvement of technology suppliers in the service. This effort to increase the reliability of the technologies and the involvement of technology suppliers in the operation of maintenance of the devices discharge the project referral, his staff and the administrative direction of the structure hosting the service from a high - and often discouraging - responsibility burden.

(2) *Stability of financing*: an excessive involvement of technology suppliers in the management of care has generally turned out to be damaging for the experimentation as, once the test of the technology is finished, the supplier is not interested in the service anymore and therefore stops the service (i.e. Arenzano); for this reason, the stability of financing, considered as a driver that increases the organizational sustainability of the service, is generally set against the excessive influence of the technology suppliers on the service delivery. Actually, if the degree of involvement is correct, the suppliers on the contrary can play a significant role in giving stability to the service: for example, if the suppliers manage at least part of the activities of call center, they help the staff involved in the service to handle the amount of information and data concerning the patients, often excessive and initially unexpected; moreover, the involvement of the suppliers can help the structures to offer a continuative service, as it happens in Varese, where the nurses of the center are available during the day, while during the nights and on festivities the technology supplier offers a service of call center to manage the emergencies. Therefore, though the excessive involvement of suppliers can be detrimental as often as not, sharing the organizational burden of the service with them, especially in the initial phases, may represent a significant possibility for the clinical staff to increase the stability of the service.

(3) *Demonstrability of results*: technology suppliers can act indirectly on this driver through the development of software connected with devices that makes it easy for the operator (generally a nurse) to store data and even to perform statistical analysis connected with the patients in the light their health status. A remarkable case of a software that is user-friendly and therefore effective for this scope is the one employed in Rieti: in fact, the nurse that took part to the interview cited many of the available applications and showed high confidence with its use.

Researchers

This sub-paragraph presents a structure that is slightly different from the previous ones, as the implications for researchers is not concentrated only on some of the drivers and the power that researches have on the deployment of the services influences almost all of them. Therefore, an

analysis of implications less focused on the influence on each single driver would turn out to be more effective.

The analysis of the concrete cases of study raised a matter that had already been detected through the literature analysis: improvements in care cannot be achieved by further stressing the current system of care, but they require a serious change, that should be driven by more evidence on the efficacious tests and treatments. Though many attempts have been made in order to increase the level of visibility and the expansion of more adequate models, it is commonly suggested that the essential reason explaining the low clinical use of telemedicine is the insufficient evidence of its efficacy in terms of both clinical and organizational impact on the health care sector: a serious commitment in giving a solid theoretical base to the pursued evidence is therefore required to researchers. This awareness leverages on an international political consensus. Recently, in fact, even the US Congress highlighted the need to establish standards and processes "that yield credible, unbiased and understandable syntheses of the available evidence" about clinical practices effectiveness (IOM, 2008).

This study confirms that the increasing effort in clarifying the concept of organizational sustainability is a useful base to support policy makers to design and introduce effective telemedicine-based services. The comparison of the theoretical model with the specific context of telemedicine applications allowed to analyze the practice as a whole and helped to identify and discuss a list of drivers affecting the success of a service previously not clearly stated (realignment of skills, role of nurses, institutionalization, coordination specialists-nurses, coordination LHC-hospital, stability of financing, psychological support, technology reliability, demonstrability of results). Nevertheless, though the drivers have been detected, a further explanation of them is needed.

Moreover, since the identification of the design principles is a relevant field of research as it might promote the sustainability of a telemedicine-based service over time, there is need for further investigation by both the academicians and healthcare practitioners. In particular, three main directions for future researchers might be relevant.

First, the analysis of the nine experiences formalized leverages that might help the design of effective telemedicine-based services, as it has been specified above. The role and relevance of these leverages should be deepened and verified by means of further research. The understanding of their factual contribution to the organizational sustainability of a service would have significant impacts on policy makers and healthcare professionals. For instance, the discussion about the role that nurses may play obliges wide and severe studies about how to reshape the command (and responsibility) chain in healthcare.

Second, the ways by means of which the command chain is reshaped among doctors, nurses, healthcare assistants and technicians should be investigated in order to enhance the current understanding of how promoting changes in healthcare. Two useful perspective for this research stream might be, on the one hand, the one provided by Abbott (1988) with respect to the clash among different professions, or, in the other hand, the one provided by Carrol and Edmonson (2002) about the relevance of a context of psychological safety to facilitate change and improve organizational learning.

Finally, our study and results refer to the specific context of telemedicine-based services for patients affected by COPD in Italy. Thus there are at least two contingencies that should be explored by further research to understand whether the results can be generalized or not. On the one hand, telemedicine-based services for patients affected by other pathologies (i.e. chronic health disease) should be investigated in order to collect evidence about how (and if) the peculiarities of a specific pathology could affect the design of the service. On the other hand, healthcare delivery is largely affected by institutional contingencies. In this view, it would be value adding to explore to what extent the results of this analysis could be translated in other Countries, such as US or UK.

7. CONCLUSIONS

This chapter aims at retracing step by step the workflow, in order to give evidence to the achieved results and to answer to the research questions.

Scope of the work

The scope of the analysis performed in this thesis is the definition of the factors and drivers that may positively affect telemedicine applications for the treatment of respiratory chronic diseases and influence their sustainability.

To reach this aim, an exhaustive literature research has been initially conducted in order to frame the state-of-the-art knowledge on the topic. Once the analysis of articles and publications concerning telemedicine applications has been completed, it has been clear that telemedicine services, though potentially useful for a more effective treatment of chronic pathologies, are difficultly going to become part of the routine treatment without an accurate organizational effort (De Bont, A. and Bal, R., 2008): this is the reason why the successive analysis did not focus on the sustainability of telemedicine services in general, but rather on its organizational facet.

RQ 1: What does organizational sustainability of telemedicine applications mean?

The first research question guiding the study required to define what does the organizational sustainability of a telemedicine service mean. The literature analysis allowed to assess that *organizational sustainability* is the collective name employed to indicate the efforts to make the complex interactions between technical equipment, infrastructure, human and socio-political context cohabit, as a telemedicine application involve all of them (Gagnon et al., 2008) (De Bont, A. and Bal, R., 2008). Moreover, the organizational sustainability consists in creating the conditions for both the patients and the clinical staff to accept the changes that the actuation of the services requires (Obstfelder et al., 2007) (Whitten and Love, 2005). The study cases subsequently conducted fostered the perception of the accuracy of this definition.

Then, a further and more focused literature research has been performed in order to define the factors and drivers that positively affect the organizational sustainability of a telemedicine service aimed at treating chronic disease.

RQ 2.1: Which are the factors/drivers affecting organizational sustainability emerging from a literature analysis?

The second research question required to define the drivers reported in literature. A first stage of the analysis revealed three major issues concerning the organizational sustainability: 1) the need of a redistribution of roles and duties; 2) the need of operating changes in processes and procedures; 3) the need of varying the productivity and performance of the model of care. These factors, though concerned with the matter, were not detailed enough and therefore induced to perform a deeper study to appoint them better.

The further examination of literature available on the topic allowed to delineate a list of seven general drivers eventually candidate to be part of the conceptual framework, some of which had already been detected by Whitten et al. (2010), while others are totally new: 1) Patient/caregiver characteristics; 2) Professional characteristics; 3) Organizational characteristics; 4) Actors/networks and alliances; 5) Change management and responsibilities; 6) Political factors; 7) Cultural factors. These drivers, conveniently renamed, became the basis for the creation of a conceptual framework. The need for renaming has grown when the framework has been lowered on the reality of telemedicine services for the treatment of COPD, as this further definition of the topic required a better definition and major detail and the drivers previously mentioned turned out to be too unspecific. In particular, the patient/caregiver characteristics have been changed into *patients' education*; professional characteristics needed to be further specified and therefore changed into *role of nurses*; the organizational characteristics has been named *guidelines*; actors/network and alliances has been split in two: *continuity of care and suppliers/backers involvement*; change management and responsibility has been modified into *technology reliability*. Lastly, political and cultural factors have been excluded from the framework, since all the study cases included in the analysis were settled in Italy and therefore the political and cultural scenario should be considered as a constant and not a variable driver.

RQ 2.2: Which are the factors/drivers affecting organizational sustainability emerging from experience/case studies?

Once defined the framework of factors affecting the organizational sustainability of the telemedicine applications for the treatment of chronic diseases, the theoretical results have been tested on the most remarkable Italian experiences of telemedicine services, through the conduction of a significant number of interviews to people involved in their delivery. This second part of the study was performed in order to find an answer to a further research question, that required to detail the drivers coming from the experience, to test whether they are suitable to describe the reality of facts or, on the contrary, if they are adequate to describe theoretical scenarios only.

The multiple case study (Yin, 2003) has been performed through the conduction of some interviews to people committed in the nine most emblematic Italian experiences of the employment of telemedicine technologies for the treatment of chronic illnesses. In particular, the first step of the study has been performed on seven out of the nine experiences and its aim was to check if the conceptual framework suited the requirements of description of the organizational sustainability of the service, to modify part of it and eventually to insert some new unexpected drivers. In fact, the empirical framework resulting from the further analysis turned out to be only partially similar to the conceptual one: the majority of drivers has been confirmed, though just partially, as a further specification (or generalization) has been required. In particular, patients' education has been modified into *realignment of skills*, since not only patients are required to gain new skills and reconsider their duties but also each other professional involved in the service; guidelines have been generalized into *institutionalization* of the service; continuity of care has been split in two: *coordination among specialists and nurses* and *coordination among LHC and hospital*; finally, the suppliers/backers' involvement was turned into *stability of financing*. Besides, while the denomination "*role of nurses*" remained unchanged, the driver concerning the technology employed has been excluded, since technologies employed in the different experiences were very similar even if the suppliers were diverse and therefore they do not represent a reason of diversification among them all.

Moreover, since some common criticalities detected in the experiences remained unexplained, the empirical study forced to include three additional drivers: the *psychological support*, the *technology reliability* and the *demonstrability of results*. The test performed on the two experiences excluded from the first part of the analysis gave evidence of the solidity of this empirical framework, that actually explained the factors that affect the organizational sustainability of their telemedicine experimentations.

RQ 3: When a telemedicine application may be considered organizationally sustainable?

The last research question was aimed at defining when a telemedicine service may be actually considered organizationally sustainable. In effect, once defined the empirical framework and once assessed that the framework suits the characteristics of the two most complete and solid study case (Mantova and Verona), it can be affirmed that a service is sustainable if it possesses a significant correspondence to the drivers embedded in the empirical framework.

Moreover, one of the drivers (*demonstrability of results*) possesses in itself the key to the answer: if the popularity rating of the service for both the staff and the patients can be reasonably and quantitatively demonstrated and it is high, then the service can be considered sustainable from the organizational point of view. An example of demonstration of good results is the survey

conducted in Verona, which is one of the most successful Italian experiences, when the patients join the service and some years later; in fact, the survey shows that the perceived quality of life increases a lot in time and, moreover, three years after the joining of the service a percentage of patients equal to 17% expects a total recovery from COPD, which is impossible, being COPD degenerative, but it represents a strong signal of the general goodness perceived about the service and, therefore, of the positive cohabitation and interactions among all actors and structures involved in the service. Given the definition reported at the beginning of this chapter, the service conducted in Verona can therefore be considered organizationally sustainable.

Implications

The definition of drivers and parameters that make a service organizationally sustainable puts the basis for the exposition of some implications that this framework implies for the professionals committed in telemedicine-based services.

The first subjects taken in consideration are regulators, institutions and policy makers; they are expected to affect at least 4 out of the 9 drivers: the *role of nurses*, as they hold the power to discuss about how to improve the competences of nurses about the treatment of chronic illnesses, the case manager activities and the relational skills, through the definition of a adequate academic path; the *institutionalization*, as they possess the power to set the best practices employed in some of the analyzed experiences as universal correct models of action; the *coordination LHC-hospital*, as they can foster the definition of transversal paths that require the effort of both the parts to assure better care for patients; the *demonstrability of results*, as if the authorities controlled the trend of the service more strictly, the staff would increase the commitment in demonstrating the results.

The second category of actors considered is clinical professionals as a whole. In particular, specialists may affect the *coordination LHC-Hospital,* as their degree of awareness of the influence that telemedicine exerts on their routine job may influence their ability to work together with GPs and with the others operators of the health care sector on the territory, and the *coordination specialists-nurses*, since they hold the possibility to build an adequate team to support the service. On the other hand, nurses may affect the *realignment of skills*, as they are the professionals more interested in learning new competences, especially about the management of chronic illnesses and about the employment of technological devices. They also support the discussion about the *role of nurses*, since if they demonstrated a satisfactory ability (and interest) to learn, it would result easier to convince the institutions to make their involvement in the service official. Lastly, GPs are the most discussed among the professionals involved; they can play an active (positive or negative) role on the *coordination LHC-Hospital*.

Third, the technology suppliers affect the *technology reliability*, as they are responsible for the maintenance of the devices; the *demonstrability of results*, as they can develop software that makes the analysis of data easier; the stability of the service, as they share the organizational burden with the staff involved.

The researchers are the last category taken into consideration. They are required to conceptualize further the drivers and to study whether the results of the analysis can be generalized even for other pathologies (Whittaker et al., 2004) and in other legislative contexts or if they are valid only for the Italian context and only for COPD.

APPENDIX

A. Framework of the Interview

Introduction: we are part of a research team of Politecnico di Milano conducting a collaborative project with Regione Lombardia, aimed at exploring strategies for sustainable healthcare delivery through telemedicine, whose title is "Compare and evaluation of effectiveness-usefulness of different domiciliary assistance paths characterized by the use of innovative technologies to assure continuity of care". The project is embedded in the *Strategic Program nr.8 – Respiratory Diseases : COPD* and promotes a reconnaissance of the Italian more remarkable experiences with the aim to detect the excellencies and to promote them in terms of operative practices and results obtained.

Background (about 5 minutes)

1. What is your current position in …?
2. When did you join …?

Background (about 5 minutes)

3. Describe briefly the key features of … (size, full time staff, departments, organization, chart…)?
4. What are the distinct success factors of …?
5. In your view, what are the major challenges?

Sustainability (about 5 munutes)

6. What does sustainability mean for you when referred to health care delivery?
7. How would you implement and develop a sustainable health care delivery model?
8. Might Telemedicine be a driver to promote and develop a sustainable healthcare delivery model?

Telemedicine experience (about 20 minutes)

Introduction: telemedicine service experimentations are often analyzed/evaluated from and economic-clinical perspective. Organizational point of view is seldom taken in consideration. Nevertheless, it is a diffused and shared opinion that it may become a vital driver to make the service sustainable in the long period.

9. Describe briefly the characteristics of the telemedicine experience taking place in you structure (duration, number and condition of patients involved, state of art…)
10. What have been the most remarkable organizational impacts?

11. What do you think about the experimentation on the whole? Would you support the adoption a regime? Which are the critical success factors and which the criticalities to solve?

Long term sustainability in telemedicine experimentations (about 10 minutes)

12. Which are the factors allowing an experimentation to be sustainable and surviving in the long period?
13. Which changes in processes and procedures are required to the experimentation to be sustainable?
14. Which changes in attitudes and behaviors are required to the experimentation to be sustainable?
15. Which factors slow down or forbid to reach this objectives?
16. Are structural changes required to reach one of the goals mentioned?
17. If we were to switch seats, you are the interviewer and I am the interviewee, what would you ask me that I did not ask you?

BIBLIOGRAPHY

Forget et al. (2008). Variations in Lifetime Healthcare Costs across a Population. *Healthcare Policy* , 148-167.

Keckley, P. H. and Fam, M. (2008). *Greening and Sustainablity in Health Care and Life Sciences.* Washington, DC: Deloitte Center for Health Solutions.

Tilden et al. (1987). Social Support and the Chronically Ill Individual. *Nurs Clin North Am* , 613-20.

Ulhoi, John P. and Ulhoi, Benedict P. . (2009). Beyond Climate Focus and Dsiciplinary Myopia. The Roles and Responsibilities of Hospitals and Healthcare Professionals. *International Journal of Environmental Research and Public Health* , 1204-1214.

Akazawa, M. et al. (2008). Economic Burden Prior to COPD Diagnosis: a Matched Case-conrtol Study in the United States. *Respiratory Medicine* .

Arena, M. (2009). A State-of-the-art of Industrial Sustainability: Definitions, Tools, Metrics.

Aymerich et al. (2005). Differences in COPD care among doctors who control the disease: general practitioner vs. pneumologist. Barcellona, Spain.

B.P.Yawn, P. W. (2008). Knowledge and attitudes of family phisicians coming to COPD continuing medical education. Rochester, Minnesota.

Bellamy et al. (2007). Role of Primary Care in Early Diagnosis and Effective Management of COPD. *Int J Clin Pract* , 1380-1389.

Bergmo, T. (2009). Can economic evaluation in telemedicine be trusted?A systematic review of the literature. Tromso, Norway.

Bloom, B. (2007). Sustainable Health: a New Dimension of Sustainability Science. *National Academy of Sciences of the USA* , 1.

C.Ruggiero et al. (1999). Home Telecare. *Journal of Telecare and Telecare* , 11-17.

Cazzola et al. (2008). Primary care of the patient with COPD in Italy. Rome, Italy.

Chang et al. (2009). Perspective and expectation for telemedicine opportunities from families of nursing home residents and caregivers in nursing homes. Taipei, Taiwan.

Commission of the European Community. (2008).

Coomunication on Telemedicine for the Benefit of Patients, Healthcare Systems and Society. from eurolex.europa.eu/LexUriServ.do?uri=COM:2008:0689:FIN:EN:PDF.

De Bont, A. and Bal, R. (2008). Telemedicine in interdisciplinary work practices: on an IT system that meet criteria for success set out by its sponsors, yet failed to become part of everyday clinical routine. *BMC Medical Informatics and Decision Making* .

Decramer et al. (2003). Management of COPD According to Guidelines. A National Survey Among Belgian Clinicians. *Monaldi Arch Chest Dis* , 62-80.

Decramer et al. (2008). Targeting the COPD Exacerbations. *Journal of Respiratory Medicine* .

Docherty, P. and Forslin, J. (2002). Sustainable Work System. In J. A. P.Docherty, *Creating Sustainable Work Systems* (p. 213-225). London: Routledge.

Doktor et al. (2005). Oganizational Learning and Culture in the Managerial Implementation of Clinical E-Health Systems: an International Perspective. *38th Hawaii International Conference on System Sciences.* Hawaii.

Elkington, J. (2004). Enter the Triple Bottom Line. In J.Elkington, *The Triple Bottom Line: Does It All Add Up?* (p. 1-16).

Emtner et al. (2009). Impact of patients characteristics, education, knowledge on emergency room visit in patients with COPD:a descriptive and correlative study. Uppsala, Sweden.

Farrel, A. (1996/1997, Winter). Sustainability Theory and the Design of Knowledge Tools. *IEEE Technology and Society Magazine* , p. 120-129.

Forbes, A. and While, A. (2008). The nursing contribution to chronic disease mangement: a discussion paper. London, UK.

Fruitman, M. (2004). Sustainability of Health Care in Canada. *JAMC* , 1646-1647.

Gagnon et al. (2008). An Integrated strategy of knowledge application for optimal e-health implementation: a multi-method study protocol. *BMC Medical Informatics and Decision Making* , 8-17.

Gammon et al. (2008). An Overview and Analysis of Theory Employ in Telemedicine Studies. *Methods Inf Med* .

Garcia-Aymerich, J. et al. (2007). Effects of an Integrated Care Intervention on Risk Factors of COPD Readmission. *Respiraory Medicine* , 1462-1469.

Gardiner et al. (2009). Exploring the care needs of patients with advanced COPD: an overview of the literature. Sheffield, UK.

Heffner et al. (2003). The Guideline Approach to Chronic Obstructive Pulmonary Disease: How Effective? *Respir Care* , 1257-1266.

Hunter, J. (2002). Sustainable Tourism and the Touristic Ecological Footprint. *Environment, Development and Sustainability - Kluwer Academic Publishers* , 7-20.

La Pelle, N. and Zapka, J. (2006). Sustainability of Public Health Programs: The Example of Tobacco Treatment Services in Massachusetts. *American Journal of Public Health* , 1363-1369.

Luck et al. (2006). What is the Business Case for Improving Care for Patients with Complex Conditions. *JGIM* , 396-402.

Mair, F. et al. (2002). Randomized Controlled Trial of Home Telecare. *Telemedicine and Telecare* , 58-60.

Masella et al. (2008). Assessment Models for Telemedicine Services in National Health Systems. *Int. J. Healthcare Technology Management* , 446-472.

Montelpare et al. (2008). The Future of The Regional Training Centres: Planning for Sustainability. *Healthcare Policy* , 131-140.

Nicolini, D. (2006). The Work to Make Telemedicine Work: a Social and Articulative View. *Soc Sci Med* , 2754-2767.

Norman et al. (2004). Getting to the Bottom of the Triple Bottom Line Model. *Business Ethics Quarterly* .

Obstfelder et al. (2007). Characteristics of successfully implemented telemedical applications. *Implementation Science* .

Ohinmaa et al. (2002). A Cost-Minimization Analysis of Orthopedic Consultations Using Videoconferencing in Comparison with Conventional Consulting. *Journal of Telemedicine and Telecare* , 283-289.

Organisation for Economic Cooperation and Development - Health Data . (2008, June). Tratto da OECD.

Paré et al. (2006). Cost-Minimization analysis of a telehomecare program for patients with chronic obstructive pulmonary disease. Montréal, Quebec, Canada.

Pinnock et al. (2009). Is Multidisciplinary Teamwork the Key?A Qualitative Study of the Development of Respiratory Services in the UK. *Journal of the Royal Society of Medicine* , 378-390.

Savitz,A.W. and Weber. (2006). *The Triple Bottom Line: How Today's Best- Run Companies Are Achieving Economic, Social and Environmental Success and How You Can Too.* San Francisco: Jossey-Bass Press.

Silverman, R. D. (2003). Current Legal and Ethical Concerns on Telemedicine and E-medicine. *Journal of Telemedicine and Telecare* , 67-69.

Smith et al. (2009). Technology and its role in respiratory care. London, UK.

Stanberry, B. (2006). Legal and Ethical Aspects of Telemedicine. *Journal of Telemedicine and Telecare* , 166-175.

Stanberry, B. (2000). Telemedicine: Barriers and Opportunities in the 21st Century. *Journal of Internal Medicine* , 615-628.

Thompson, T.G. and Brailer, D.J. (2004). *The Decade of Health Information Technology: Delivering Consumer-centric and Information-rich Health Care.* Washington, D.C.: Department of Health and Human Services.

Valeri et al. (2010). *Business Models for e-Health.* Cambridge, UK: European Commission-ICT for Health Unit.

W.R. Hersh, et al. . (2001). Clinical Outcome Risulting from Telemedicine Interventions: a Systematic Review. *BMC Medical Informatics and Decision Making* .

Wagner et al. (2001). Improving Chronic Illness Care: Translating Evidence Into Action. *Health Affairs* .

Whittaker et al. (2004). Success Factors in the Long-Term Sustainability of a Telediabetes Programme. *Journal of Telemedicine and Telecare* , 84-88.

Whitten et al. (2010). Keys to a Successful and Sustainable Telemedicine Program. *International Journal of Technology Assessment in Health Care* , 211-216.

Williams et al. (2000). Safety and Risk Issues in Using Telecare. *Journal of Telemedicine and Telecare* , 249-262.

Woottoon, R. (1996). Telemedicine: a Cautious Welcome. *BMJ* .

World Commission on Environment and Development. (1987). *Our Common Future.* New York: Oxford University Press.

World Health Organization - COPD. (s.d.). February 24, 2009 da www.who.int/respiratory/copd/en/index.html.

Yin, R. K. (2003). *Case Study Research, Design and Methods.* Thousand Oaks (CA): Sage Publications.

Zwar et al. (2008). A cluster randomised controlled trial of nurse and GP partnership for care of COPD. Sydney, Australia.