Figure 1 – Research framework

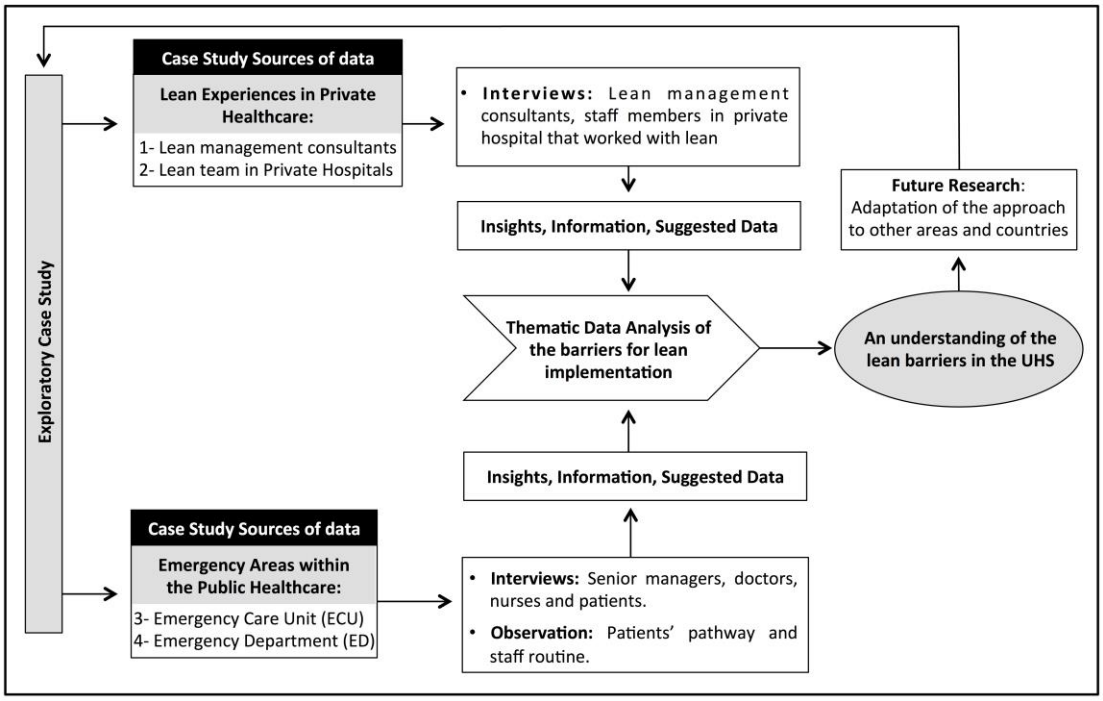
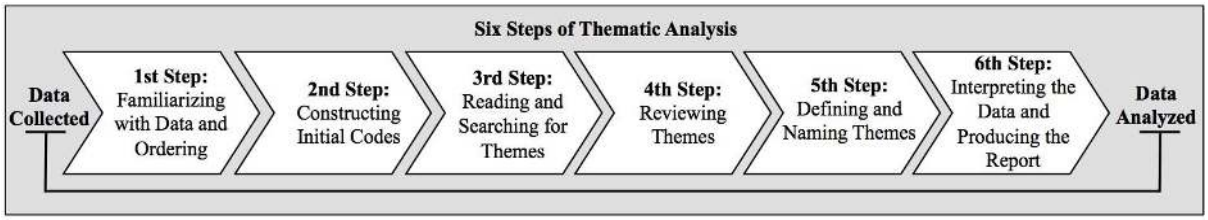


Figure 2 - Data analysis steps



Source: Adapted from Braun and Clarke (2006) and Radnor (2002)

Figure 3 - Field of forces to influence healthcare value added

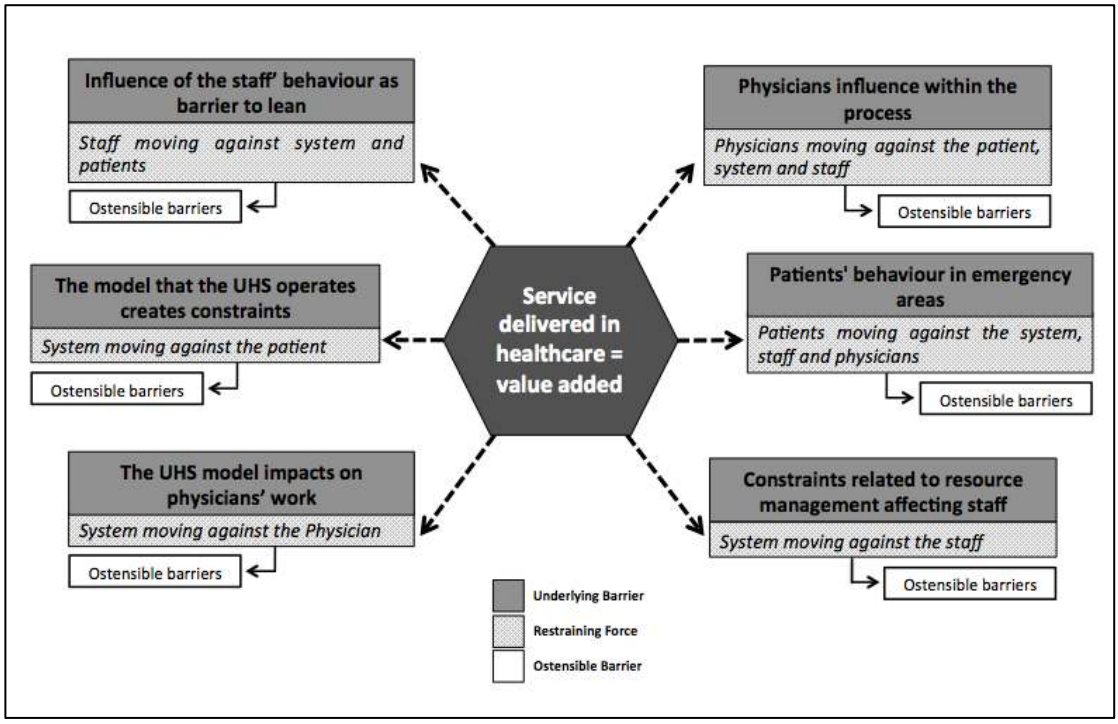


Table 1 – Main barriers to implementing lean philosophy

Barriers	Sources
People's lack of attitude and commitment to change the process	Kinder and Burgoyne (2013) Poksinska (2010); Radnor et al. (2006)
Lack of understanding of the approach in different organisation levels/lack of lean knowledge	Bhasin (2012a); Deloitte and Touche (2002); Zimmermann and Bollbach (2015);
Lack of understanding of the potential benefits	Andersen, Røvik and Ingebrigtsen (2014); Bhasin (2012a); Marodin and Saurin (2015)
Terminology; something new among the employees	Albliwi et al. (2014); De Souza and Pidd (2011);
Fear of job losses; lean becomes a threat	Jadhav, Mantha, and Rane (2014); Kim et al. (2007); Malmbrandt and Ahlstrom (2013)
Leadership failure/misunderstanding and lack of commitment and support	Bateman and Rich (2003); De Souza and Pidd (2011); Massey and Williams (2005); Sim and Rogers (2009)
Resistance to change to something new/scepticism, including leaders' resistance.	Albliwi et al. (2014); De Souza and Pidd (2011); Jadhav, Mantha, and Rane (2014)
Lack of investment (intern and extern)	Mostafa, Dumrak, and Soltan (2013); Radnor (2010);
Lack of resources and budget constraints	Albliwi et al. (2014); Bateman and Rich (2003); Kundu and Manohar (2012); Radnor et al. (2006)
Financial value not recognized	Lean Enterprise Institute (2007); Marodin and Saurin (2015); Mehta, Mehta and Mehta (2012)
Poor communication	Kundu and Manohar (2012); Marodin and Saurin (2015); Radnor et al. (2006); Sim and Rogers (2009)
Weak link between improvement programmes and the organisational strategic level.	Bhamu and Sangwan (2014); Hines, Holweg and Rich (2004); Radnor et al., (2006)
Lack of long-term strategy	Albliwi et al. (2014); Bhasin (2012a); Marodin and Saurin (2015): Yadav and Desai (2017)
Personal and organisational cultural issues	Bhasin (2012a); Boyer and Sovilla (2003); Kim et al. (2006); Kundu and Manohar (2012); (2017); Yadav and Desai (2017)
Organisational momentum and pace	De Souza and Pidd (2011); Marodin and Saurin (2015); Radnor et al. (2006)
Lack of ownership;	Bhasin (2012a); Marodin and Saurin (2015); Radnor et al. (2006)
Measurement framework; performance management;	Andersen, Røvik and Ingebrigtsen (2014); Kundu and Manohar (2012); Mostafa, Dumrak, and Soltan (2013); Yadav and Desai (2017)
A need to convince shareholders/board	Albliwi et al. (2014); Bhasin (2012a); Lucey et al. (2005);
Viewed as a fad	Crute et al. (2003); Lean Enterprise Institute (2007); Lucey, Bateman and Hines (2005);
Failure of past lean projects	Bhasin and Burcher (2006); Lean Enterprise Institute (2007); Lucey, Bateman and Hines (2005);
Personal/professional skills of healthcare professionals; lack of know-how.	Bhasin (2012a); De Souza and Pidd (2011); Lean Enterprise Institute (2007)
Training and Skill Building	Kundu and Manohar (2012); Malmbrandt and Ahlstrom (2013); Sim and Rogers (2009)

Table 2 – Outline of the case study sources

Case Study Sources	Number of patients seen per day (average)	Number of Interviews	Job Titles	Number Patient's Pathway of Observations
Emergency Care Unit	400 average	8	Nurse	5
		6	Physician	
		1	Social Care	
		5	Patient	
Emergency Department	200 average	11	Nurse	5
		4	Patient	
Lean Management Consultants	N/A	4	Management Consultants	N/A
Lean Private Hospital	250 average	1	Project Manager	N/A
		2	Nurses	
		1	Doctor	

Table 3 – Interview questions by sources

Interview Questions	Lean Management Consultants	Lean Team private hospital	Staff in UHS	Patients in UHS
What kind of barriers do you identify in the UHS in terms of lean implementation?	**X**	**X**	**X**	
Is it possible to overcome these barriers in the UHS? If yes, How? If not, please justify.	**X**	**X**		
To what extent do you think that lack of knowledge and experience (know-how) can influence the lean implementation in the UHS?	**X**	**X**		
What do you perceive as issues at the UHS emergency level?	**X**		**X**	**X**
In your point of view is it possible to ease these issues with a lean implementation in UHS? If yes or not, please justify.	**X**	**X**		
How can the bureaucratic management style of the Brazilian public healthcare influence the lean implementation process in UHS?	**X**	**X**	**X**	
The lean philosophy has a strong base on leadership engagement and staff empowerment, how can this be achieved in this public environment in the UHS?	**X**			
To what extent do you perceive lean philosophy as relevant for the UHS?	**X**	**X**	**X**	

Table 4 - Barriers to implement lean in UHS by source

Lean Barriers in UHS	Source Found				Category of Barrier		
	UHS Site 1 ECU	UHS Site 2 ED	Lean Management Consultants	Lean Private Hospital - Lean Team	Literature	UHS Context	Practitioners
Physicians lack of commitment	x		x		x	x	x
Lack of lean knowledge and experience	x		x	x	x	x	x
Poor management of resources	x	x	x	x	x	x	x
Fear that lean will cause job losses	x		x	x	x	x	x
Non-urgent patients create unpredictable demand in emergency areas	x	x		x	x	x	x
The administration or leadership can be a barrier to a new project		x	x	x	x	x	x
Staff resistance to change	x	x	x	x	x	x	x
Financial barrier to implement lean (lack of resources)	x				x	x	
Communication disruptions amongst staff and between shifts	x	x			x	x	
Physicians' resistance to change			x	x	x		x
Lack of long-term strategy			x	x	x		x
The structure of the system affects the physicians	x		x			x	x
Physicians spend time performing activities that are not core	x			x		x	x
The UHS bureaucratic style as a barrier to lean	x		x			x	x
Slow pace of changes in UHS	x	x	x			x	x
Performance management in UHS	x		x	x		x	x
Public system lack of interest/motivation in changing	x	x	x			x	x
Nurses performing different activities that are not core	x	x				x	

Emotional stress between patients, staff members and physicians	**x**	**x**		**x**
Public servant tenured career (physicians and staff)	**x**			**x**

Table 5 - Frequency of reference from data analysis

Underlying Barriers	**Frequency of reference from data analysis**
Physicians' influence within the process	9.6%
The UHS model impacts on physicians' work	10.3%
Constraints related to resource management affecting staff	14.4%
The model that UHS operates creates constraints	15.8%
Patients' behaviour in emergency areas	16.2%
Influence of clinical staff behaviour as a barrier to lean	33.7%

Table 6 – Restraining forces and lean implications

Underlying Barriers	Restraining Forces and Lean Implications
01 - Physicians' influence within the process	Physicians have strong influence in the co-production process, as they are the ones who deliver substantial value added to patients. Physicians can act as a restraining force affecting patients, staff and system, every time that they avoid process improvement across the patient's journey. This barrier presents an important implication for lean in UHS as people's commitment and understanding is a strong enabler of the lean journey in manufacturing and service areas (Bhasin, 2012b; Malmbrandt and Ahlstrom, 2013).
02 - Patients' behaviour in emergency areas	This stakeholder actively participates and affects the service delivered in healthcare and it is partially motivated by a dysfunctional healthcare system. Their behaviour across the system acts as a restraining force against the system, staff and physicians mainly increasing unstable demand and creating emotional stress against physicians and staff members. When bringing it to the lean context the patients might create hurdles for the implementation, creating difficulties to focus on value added activities, standardizing the process and sustaining the changes.
03- Constraints related to resource management affecting clinical staff	When staff members, especially the ones in the front-line of the co-production process do not have access to the right resources it starts to impact on their performance, consequently affecting the patients. Therefore the system that is the provider of the healthcare services acts as a restraining force against the staff. The implications of this on lean emerged in the form of ostensible barriers and were discussed based on the literature which stressed the importance of the resources available for the lean implementation (Jadhav, Mantha, and Rane 2014; Marodin and Saurin, 2015).
04 - The UHS model impacts on physicians' work	The UHS model and system can act as a restraining force by bringing legislations and bureaucratic processes to the physicians' daily activities making them spend time with bureaucratic activities (non-core) rather than seeing the patients. The implications for lean will be less focus on value add activities and generation of waste across the healthcare process.
05 - The model that UHS operates creates constraints	When attempts to implement lean fail because of UHS issues the patient will not benefit from the improvements thus, the system will act as a restraining force against the patient who will have to cope with poor quality of the service. Some hurdles to implement lean in UHS that emerged from this underlying barrier are related to the bureaucratic style of UHS, lack of interest in changing as well as lack of long-term strategy. These situations raise important implications for lean especially as lean is a long-term strategy (Bhasin and Burcher, 2006; Liker, 2004) and requires a level of interest in change.
06 - Influence of the staff behaviour as a barrier to lean	This underlying barrier brings inhibitors related to staff behaviour such as resistance to change, communication disruptions, lack of lean knowledge amongst others. This illustrates that staff can act against the system and patient as a restraining force that inhibits attempts to improve the process. This raises implications for lean implementation as people are key enablers for lean project sustainability (Radnor and Walley, 2008).