Brazilian Navy Field Hospitals in Humanitarian Missions: A Case Study

Marcus Torezani; Master Student
Student in the Full-Time Master in Business Administration Program at COPPEAD/UFRJ
Marcus.torezani@gmail.com

Leonardo Marques; PhD in Business Administration
Professor/Advisor at COPPEAD/UFRJ
leo.marques@coppead.ufrj.br

Abstract:

Annually, a high and concerning number of 250 million people are affected by disasters in the world, which generates an astounding global combined loss of 300 billion dollars. Both numbers are on an increasing trend, what causes a great surge in necessity for humanitarian aid. The complexities and dynamic environments involving those almost unpredictable catastrophes have given rise to new challenges that defy even the most experienced logisticians. This context has drawn researchers' and practitioners' attention to the need of alternative and innovative solutions, giving birth to the relatively new and promising field of Humanitarian Logistics. In disaster scenarios, where the most required and valued assets are healthcare facilities, the military have been stepping in this humanitarian logistics reality, bringing with them highly trained logisticians and medical personnel to the equation. Because of the implied time constraints involved when minimizing human lives loss, during the immediate response phase in disaster relief, innumerous humanitarian organizations, military included, have been struggling over the years to develop and improve different models of mobile field hospitals. Those have experienced enhancements especially in deployment speed and operational flexibility, notably through the use of light weighted and compact modular structures and the ongoing standardization of materials and processes, resulting in global guidelines and allowing for international collaboration. The Brazilian Navy, as one of those organizations pursuing these trends, has also been adapting to this reality, but not without facing operational difficulties and fighting to surpass procedural obstacles. Reflecting over these has the potential to awaken new insights that can, ultimately, contribute to enrich humanitarian logistics theory building, while helping other humanitarian organizations to evolve towards more efficient operations, and allowing Logistics as a whole to harvest the benefits of alternative and innovative solutions.

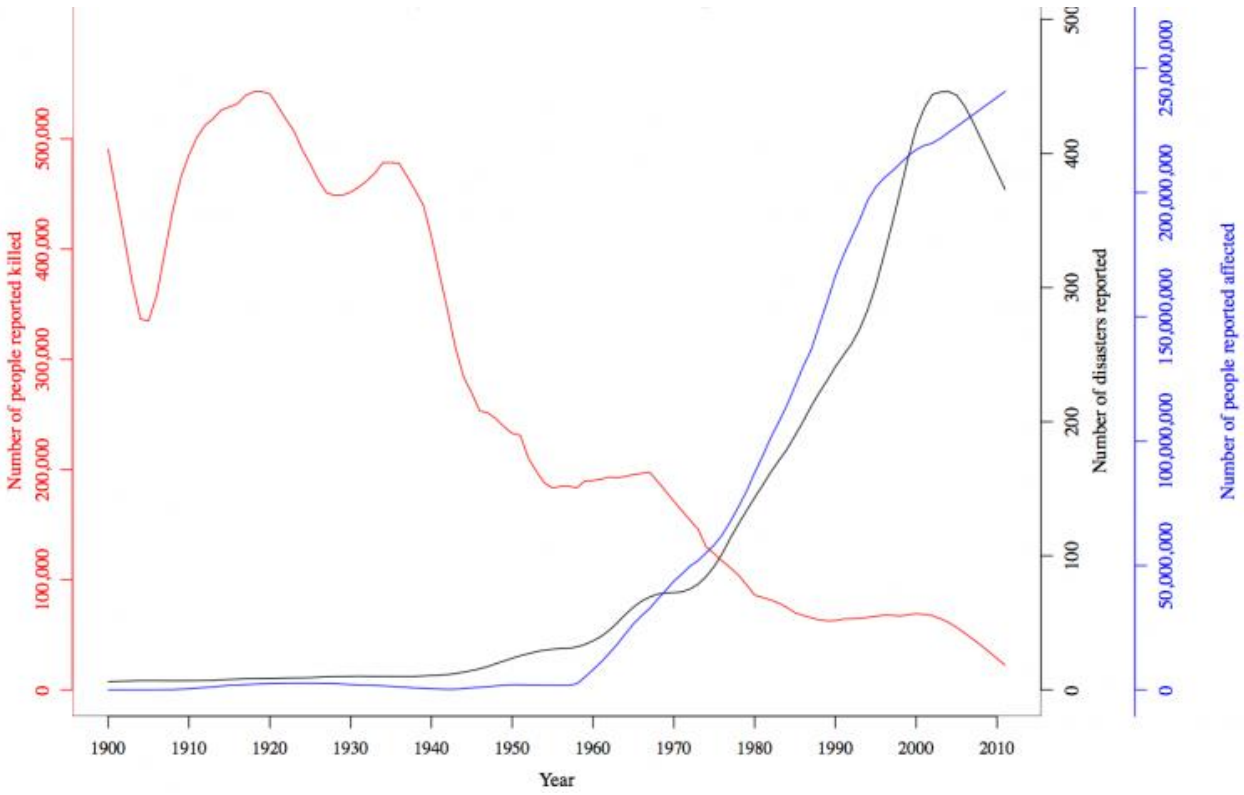
Key words: Humanitarian logistics; temporary hospitals; mobile hospitals; field hospitals; military hospitals.

1. Introduction

Humanitarian Logistics (HL) is a relatively new field of research (Altay & Green, 2006; Van Wassenhove, 2006). At the same time, it is also a very exciting one that has been drawing a lot of attention from researchers and practitioners in the last few years (Apta, 2009; Pedraza-Martinez & Van Wassenhove, 2016). The reason for that is that humanitarian operations are most reliant on logistics and supply chain support during the immediate response phase of disasters, in quite complex and dynamic scenarios that challenge even the most experienced logisticians (Akhtar et al., 2012; Rutner et al., 2012).

Many are the disaster types, man-made and natural: hunger, infectious diseases, terrorism, armed conflicts and war, weather catastrophes related to climate change and the scarcities implied in population growth. There are trends that show an ongoing and future increase in the disasters impact on human life (Pedraza-Martinez & Van Wassenhove, 2016). Currently, there has been registered an alarming statistic showing that around 250 million people are affected by disasters every year and 13 million people die from infectious diseases (IFRC, 2016).

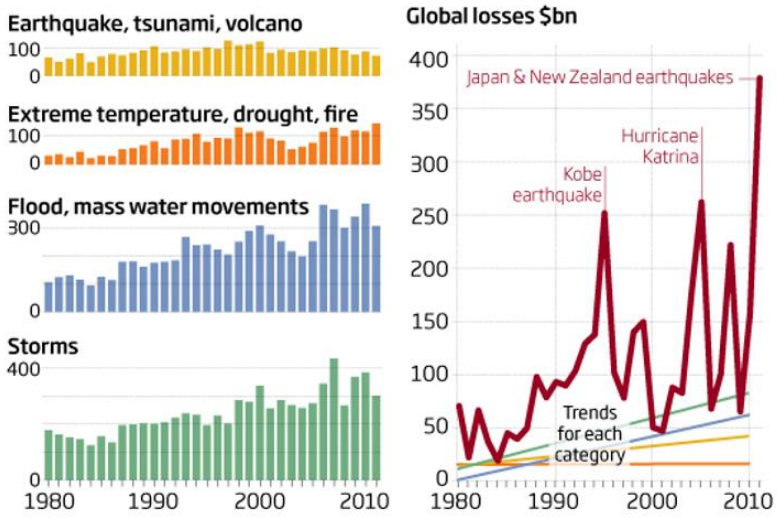
Figure 1 - Natural Disaster Summary 1900-2011 (linear interpolated smooth lines)



Source - EM-DAT: The OFDA/CRED International Disaster Database - www.emdat.com - Université Catholique de Louvain - Belgium

On top of that, UNISDR estimates that only the natural disasters combined, not considering man-made catastrophes, generates an yearly impact of US$300 billion globally (UNISDR, 2016).

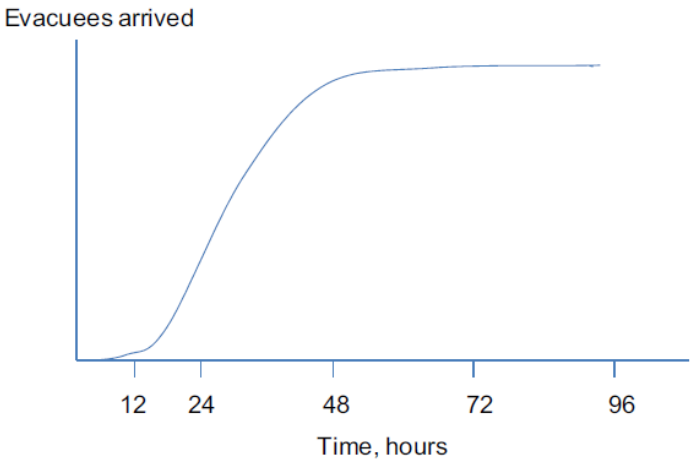
Figure 2 - Number of natural disasters and the cost in losses



Source - https://www.newscientist.com/article/mg21328474.200-last-year-costliest-on-record-for-natural-disasters/

In this context, the assets considered to be of utmost importance are healthcare facilities and personnel, especially considering that the strongest surge of victims arrival in a disaster occurs in the first 48h after the event (Rawls & Turnquist, 2012).

Figure 3 - General pattern of arrivals at hospital facilities



Source - Adapted from Rawls et al. 2012

Healthcare facilities are among the most complex and critical in any country (Achour et al., 2014) and pose as the most valuable and required potential military resources regarding humanitarian purposes (Kelly, 1996). Therefore, both mobile field hospitals and military involvement are becoming increasingly important in humanitarian logistics, especially for disaster relief purposes (Heaslip & Barber, 2014).

Military forces around the world have been increasingly participating on humanitarian aid and disaster relief missions, with the advantage of available funding, since "military mission normally dictates accomplishment despite the cost" (Apta, 2009, pp.21). Those types of humanitarian operations (or peacekeeping operations) are established by the United Nations Security Council (UNSC). Brazil has been significantly active on participating in United Nations peacekeeping operations (UNPKO) as a strong branch of Brazilian diplomatic efforts (Cervo, 2008). Its participation in peace operations goes way back in 1948 by sending military personnel to the United Nations Special Commission for the Balkans (UNSCOB), which operated in Greece from 1947 to 1951. Since then, Brazil has participated in 53 peace operations and special political missions under the aegis of the UN (Aguilar, 2015).

One of the most critical assets to be deployed in that phase, especially in the first 12 to 48 hours on humanitarian missions is health care (Kelly, 1996; Bechtel et al., 2000; Owens et al., 2005; Rawls et al., 2012). Because of that, it's desirable that field hospitals are immediately available, easily transportable and flexibly useful. In that context, we lean over the Brazilian Navy's capabilities on an attempt to determine to what extent its current field hospitals model is fit for international humanitarian missions and why, especially regarding deployment timeliness (speed), flexibility and compliance to UN standards. The environment in international disaster scenarios are extremely complex and dynamic. Because of that, added to the fact that there are still not enough officially and properly registered cases in literature to support empirically based grounded theory in HL, we found ourselves compelled to fulfill that gap by providing practice-near research results through a single case study which could bring to academia the practitioner's level of understanding to boost new researches.

The remaining of this work is organized as follows: Section 2 approaches the existing literature presenting definitions, gaps and trends. Section 3 shows an overview on the proposed methodology we have used to carry on the research. Section 4 displays the main findings stemming from the case study and Section 5 brings some topics to discussion while drawing useful conclusions.

2. Literature Review

2.1 Definitions

Humanitarian logistics is defined as "the processes and systems involved in mobilizing people, resources, skill and knowledge to help vulnerable people affected by disaster" (Van Wassenhove 2006, pp.2).

"Humanitarian logistics encompasses very different operations at different times, and as a response to various catastrophes. All these operations have the common aim to aid people in their survival." (Kovács & Spens, 2007, pp.3)

As said before, Humanitarian Logistics (HL) research field is a quiet recent one and there are still several important research gaps in it (Pedraza-Martinez and Wassenhove, 2016; Heaslip, 2014; Kovacs and Spens, 2011). Besides academia, there are also almost no tools, frameworks or softwares to help emergency managers on training and operating crisis scenarios, mostly because the requirements are relatively new (Berkoune et al, 2012). Besides HL gaps in research, practice and education, gaps between them were also revealed (Kovacs and Spens, 2011). There is a call for further empirical and practice-near research for theory building in HL (Pedraza-Martinez, 2016). There is an urge for product, packaging and process standardization to enable HL global

guidelines implementation (Jahre & Fabbe-Costes, 2015). However, uncertainty plays a significantly big role, especially in international humanitarian aid logistics (Altay and Green, 2006). The myriad of participating stakeholders and the complex and dynamic multitude of different environments, scenario variables and cultural specificities, make standardization tasks into one of HO's greatest challenges (York & Le Roy, 2010; York & Malcorra, 2011).

Since Humanitarian Logistics deals greatly with disaster relief, it is also important to remark that there is a great deal of differences between what is considered to be an everyday or routine emergency and the major emergencies frequently called catastrophes and disasters (Drabek, Hoetmer, & International City Management Association., 1991; Fischer, H.W., 2003). There is a common understanding on dividing emergency management in four main phases: mitigation, preparedness, response and recovery (Altay & Green, 2006; Berkoune et al., 2011; Haddow, Bullock, & Haddow, 2009; Resteigne & Soeters, 2012; Şahin, Ertem, & Emür, 2014). The first two take place at pre-disaster moments, while the latter two refer to in-disaster and post-disaster actions (Drabek et al., 1991; Green, 2002; Waugh, 2000; Waugh & Hy, 1990). This approach is an improvement to Tufekci & Wallace's (1998) work with a more well-structured framework regarding the practical needs and consequences of emergency management actions *per se* (Altay and Green, 2006).

"Response is using resources and emergency procedures as dictated by emergency plans to preserve life, property, the environment, and the community's social, economic, and political structure." (Berkoune et al., 2011, pg. 1).

Military involvement in humanitarian missions for disaster relief purposes (natural or manmade) is not something new (Aguilar, 2015). Nevertheless, the perception of humanitarians about military participation has drastically changed over time from finding it inadequate or unnecessary (Kelly, 1996), to recognizing the military forces' strong ability in logistical and organizational structure as key assets to provide support and relief in disaster situations (Apte, 2009; Heaslip et al., 2012; Heaslip, 2013; and Barber, 2011 apud Heaslip, 2014). But, of course, because the use of military forces in humanitarian aid was so philosophically different than the military's fundamental purpose of existence, both the humanitarian organizations and the military themselves have found the need to perform doctrinal adjustments (Heaslip, 2014). One of the most valuable and required potential military resources regarding humanitarian purposes is healthcare. This particular kind of aid asset is normally deployed as "acute and specialized medical care", whether through the use of mobile field hospitals, the provision of medical equipment and temporary duty specialists, or caring for patients at specialized military hospitals (Kelly, 1996).

2.2 Field Hospitals

2.2.1 Definition and Importance

According to WHO-PAHO (2003), the countries affected by those so-called major disasters have provided experience that showed the need for very specific humanitarian resources in the health sector. In most cases, the ultimately important set of equipment and supplies presented to the international donor community is the field hospital. The UN Glossary of Peacekeeping Terms define Field Hospitals as structures that "includes full accommodation (tented or prefabricated), ambulances, vehicles, operating theatre, sterilizer, x-ray, dentist, equipment workshop, intensive care unit, examination rooms, mortuary etc.; as a standby forces standard component, the field hospital provides second and limited third line medical support to military units: beds, clinical,

surgical and dental services, sterilization and lab facilities, ambulance and catering services." (UN, 2017)

Driven by that fact, Watson et al. (2013) discusses the creation of prefabricated modular mobile hospitals that could be transported where needed as a solution to the short lead-time required in disaster response phase, as integrated truck trailer-bed units. This idea not only agrees but also complements the research conducted by Achour et al. (2014) regarding hospital resilience to natural hazards. In that occasion, this author pointed out how complicated and critical healthcare facilities are to every country, and focused on showing how their complexity and dependency on external structure add up to scale-up their vulnerability. Those facts represent extra contribution to understanding why field hospitals are becoming increasingly important assets to humanitarian aid (De La Torre et al., 2011; PAHO, 2001), but also show how big is the challenge to plan, transport and deploy such complex, critical and fragile facilities in usually inhospitable scenarios where the most important infrastructure, systems and supply chains are likely to be down (Bar-On et al., 2013; Owens, et al., 2005)

2.2.2 The Urge for Speed and Flexibility

De la Torre et al., (2012) points out that the matter of transportation and distribution is key to deploy field hospitals as fast as possible. Additionally, when it comes to medical attention (field hospitals) there is usually not enough time to make a very realistic needs assessment and the mortality rate might increase much faster because of lacking of medical treatment than because delayed food distribution (Leichman, 2016). What seems to be more reasonable in disaster situations and humanitarian missions is to prioritize the types of aid and prepare a flexible medical structure that is at the same time usable by any professional in the world (standardization of processes and technology) and that is ready to function in most geographies and climates (Blackwell & Bosse, 2007; Chakravarty, 2011; UN, 2008).

Previously learning what resources are available on-site and how to use effectively use medical materials and personnel already existent at the disaster location might also work well as a speed booster in disaster-response phases (Rawls et al., 2012). Prepositioning healthcare supplies in several strategic point spread all over the world has also been discussed as an alternative to transporting every resource to the disaster location only when needed (Rawls et al. 2012; Campbell and Jones, 2011). However, there is a trade-off implied in prepositioning healthcare relief resources near potential disaster locations (Rawls et al. 2012). If on one hand it can significantly reduce the response time on distributing emergency goods, on the other hand there is the risk of the disaster itself destroy (partially or completely) the materials and facilities, or even rendering those inaccessible (Campbell and Jones, 2011; Heaslip, 2014).

Because of the urge for flexibility (Bar-On et al., 2013; Farfel et al., 2011) while providing field hospitals, a contingent model (Chakravarty, 2011) may come at hand to combine acquisition and maintenance cost reduction, increased speed of deployment and high service levels. Chakravarty (2011) suggests that both reactive and proactive models have their downsides when dealing with disaster response. Therefore, he proposes a model where one acts proactively only to a certain (calculated) point, henceforth activating a reactive *modus operandi*. In a proactive model the costs are high in building robust infrastructure, inventory and storage facilities. This approach will easily lead to underutilized resources, which implies more unnecessary costs. On the other hand, acting reactively requires agility (speed and flexibility), what may also skyrocket real-time procurement and transportations costs (e.g. 9/11 reactive response costs reported around US$2.5

billion_ Haddow et al., 2009 apud Chakravarty, 2011). Therefore, a well-weighted contingent model could bring the best of both worlds into humanitarian emergency healthcare aid, while trying to minimize its costs.

2.2.3 Different Approaches to Field Hospitals

In order to better cope with that challenge, different HO's, governments and companies have been creating, testing, and using innumerous types of field hospitals (Owens et al., 2005; Balckwell and Bosse, 2007; Burgos et al., 2013; Cheng et al., 2015; Farfel et al., 2011). A fundamental aspect for field hospitals is, of course, mobility, what brings us to mind several considerations regarding modularization and transportation (Fabbe-Costes, 2015; Sahin et al., 2014), which will ultimately affect the deployment speed and usage flexibility. Because of the added particularities and complexities existing on disasters sites, researchers and practitioners are struggling to develop specific models for each type of situation (IFRC, 2017; De la Torre, 2011; UN, 2008).

In the matter of the required field hospitals' mobility and flexibility (UN, 2008), some other approaches have arisen. The innovative Carolina MED-1 was a prototype in tests in 2002 designed and developed by North Carolina Medical Center (USA), funded by US Department of Homeland Security at the cost of US$1.5 million (Blackwell and Bosse, 2007). It was deployed to aid the Gulf Coast region of Mississippi after the devastating effects of Hurricane Katrina in 2005. Designed to be highly flexible and mobile, it comprises two 53-foot tractor-trailers, one serving as patient treatment facility and the other as equipment storage and support. The results rendered empirical data that showed how a mobile hospital could be forged to fit any type of disaster, either natural or manmade. Its unique "concept and design" provided it the "ability to become task-specific depending on the incident". Despite the apparent high cost, it is shown that its "portability, durability, comprehensive functionality, and rapid deployment efficiencies" pay for itself in human lives (Blackwell and Bosse, 2007).

Another example is the Chinese mobile emergency surgical hospital developed by Chongqing Medical Center. The idea was inspired by the mobile hospitals sent by Germany and Russia to Sechuan province (China) after the 8.0 (Richter) earthquake in 2008 (Cheng et al., 2015). In that occasion, it took between 9 and 11 days for those medical facilities to reach the disaster site. With that in mind, the Chinese model was developed according to the principles of "mobility, flexibility, timeliness, and efficiency in disaster relief actions" adjusting or/and selecting all hospital equipment to be: "(a) concise with high-tech supplements; (b) all-weather reliability; (c) mobility and quick deployment; (d) compatibility for transportation; (e) self-supplying requirement" (Cheng et al., 2015).

An important advancement on the Chinese model was processes improvement that brought extra speed to deployment. Besides making smaller compact vehicles that better adapt to deteriorated terrain conditions (Yue et al., 2012 apud Cheng et al., 2015) _unlike the huge Carolina MED-1's_they also separated the medical aid teams in smaller groups and incorporated minimum staff turnovers and hard continuous training as cornerstones to field hospital's deployment doctrine (Domres et al., 2000; Hou and Fan, 2007 apud Cheng et al., 2015). This may also pose as something important to keep in mind, given that pursuing lean processes might bring the extra speed required in disaster relief healthcare (Cozzolino et al., 2012; Silva et al., 2015).

Hospital ships have also shown to be good alternative when disasters occur and sudden scale-up in surge healthcare capacity is needed (Burgos et al., 2013). There have been reported several advantages of using hospital ships for humanitarian aid and disaster relief operations such as their "high level of capability, versatility and mobility" (Mattonen, 2006). One of the greatest speed advantages over other commonly used types of field hospitals, again according to Mattonen (2006, pp. 7), is that "hospital ships are fully capable upon arrival in theater and do not require any set-up time". This last author also shows how those benefits effectively outweigh the disadvantages of "concerns for safety, financial burden, and manpower issues". Additionally, lower transportation costs, higher cargo capability and flexible capillarity are also extra upsides of using a water mode (Bowersox et al., 2002; Hu, 2011).

2.6.6 Standards and Modularization

The issues of field hospitals modularity and standardization are also calling for attention (Fabbe-Costes, 2015). That is exactly why an important mobile hospital model to consider for humanitarian purposes is a containerized one (Sahin et al., 2014). The inter-modal and multimodal capabilities achieved by the use of containers (Bowersox et al., 2002) can ultimately facilitate transportation providing deployment flexibility. Modular healthcare facilities are prone to provide the adaptive characteristic needed for the complex and uncertain disaster relief environment, as it has been suggested that this approach will reduce supply network risks and increase flexibility (Squire et al., 2009).

As the international humanitarian community becomes aware that standards are absolutely key in every logistics network (Fabbe-Costes et al., 2006) they also become progressively more concerned about standardization (Fabbe-Costes, 2015). The increasingly call for responsiveness in humanitarian operations is causing an augmented focus on modularity, which has a two-way relationship of complementarity and dependence with standardization, and both have "complex impacts on integration and flexibility" (Fabbe-Costes, 2015, pp.7).

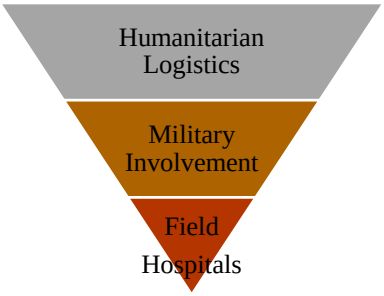
In the matter of standardization on international humanitarian operations, one of the greatest challenges is to deal with cultural particularities, especially those that can cause dominance one organization or country over the others, either because of technology superiority or political power (Resteigne and Soeters, 2015). After performing a systematic review on humanitarian logistics, Fabbe-Costes (2015) remarks that, especially in this last 15 years, literature presents a humanitarian community's growing concern on developing and applying standards to increase responsiveness. The Sphere Handbook (2011), as a grand HO's collaborative effort, is a good example of that (De La Torre et al., 2011, pp.3). First established on 1997, the Sphere Project is a permanent standardization initiative for humanitarian aid purposes. UN itself has leaned over the standardization problem and created the New Horizon Initiative (UN, 2009), directly addressing issues such as modularization to improve the speed and development baseline capability standards to help bolster performance on the ground" (UN, 2010, pp.16).

2.4 Research Gaps

The systematic literature review performed recently by Heaslip was very effective in demonstrating that the most under-researched area in logistics literature is military involvement in humanitarian logistics and studies involving phases in disasters (Heaslip, 2014). Adding up to that, Altay and Green, through a research review in disaster operations, show that the biggest bulk of the research in the emergency logistics field was done in mitigation and preparedness (pre-disaster phases that precede response and recovery) and concluded that very little attention was given to

response activities (e.g. medical care) in which are included field hospitals. Therefore, further research on the topic has remained a gap, as much as a need, to fulfill in the best interest of the humanitarian logistics and the emergency logistics fields (regarding disaster operations management) (Altay and Green, 2006).

Additionally, in 2016, Pedraza-Martinez and Wassenhove have made a call in for a special issue regarding empirically grounded research for Humanitarian Operations Management. Their main concern was that, as said before, literature in the humanitarian logistics, emergency logistics and similar research fields are still to scarce and detached from practitioners. Their claim is that the challenges involved in such research fields are fundamentally practical and the existing optimization models are based solely on abstract problems lacking on empirical observations and grounded theory. Therefore, the methods and models currently suggested by academia still offer "limited insights to practice". More importantly, the authors remark how failure to grasp full understanding of practice will chronically lead to troubles while trying to build solid and relevant theory in humanitarian fields of research (Pedraza-Martinez and Wassenhove, 2016). That fact responds precisely to why should we observe and study practitioners' experience, difficulties, failures and successes in the theory building process, and also why researches are responding to that call and producing empirically grounded academic content (Acimovic & Goentzel, 2016; Berenguer et al., 2016; Holguín-Veras et al. 2016; Jahre et al., 2016; Jola-Sanchez et al., 2016; Morrice et al., 2016; van der Laan et al., 2016)



Presented in an inverted pyramid framework, what we did so far was trying to bring the reader inside this research's environment by providing grounded basis on top of what we intend to build the next sections.

Definitions and historical information on Humanitarian Logistics, Military Involvement in humanitarianism and Field Hospitals were established as well as their importance to disaster relief operations.

Studies regarding the "response phase" of disaster, military involvement in humanitarian logistics and practice-near research were all identified as gaps in the literature. Multiple models and approaches were shown to follow the recent trends of standardization and modularization as means to achieve speed and flexibility in field hospitals deployment for humanitarian purposes.

With the intention of fulfilling the literature gaps presented and providing extra basis for future research, in the following sections we lean over the Brazilian Navy field hospitals deployment capabilities against the main trends commented above. By doing so, our aim is to achieve a deeper understanding on how do the military deal with humanitarian missions through the provision of mobile health care facilities. Therefore, the research question we are proposing ourselves to respond is:

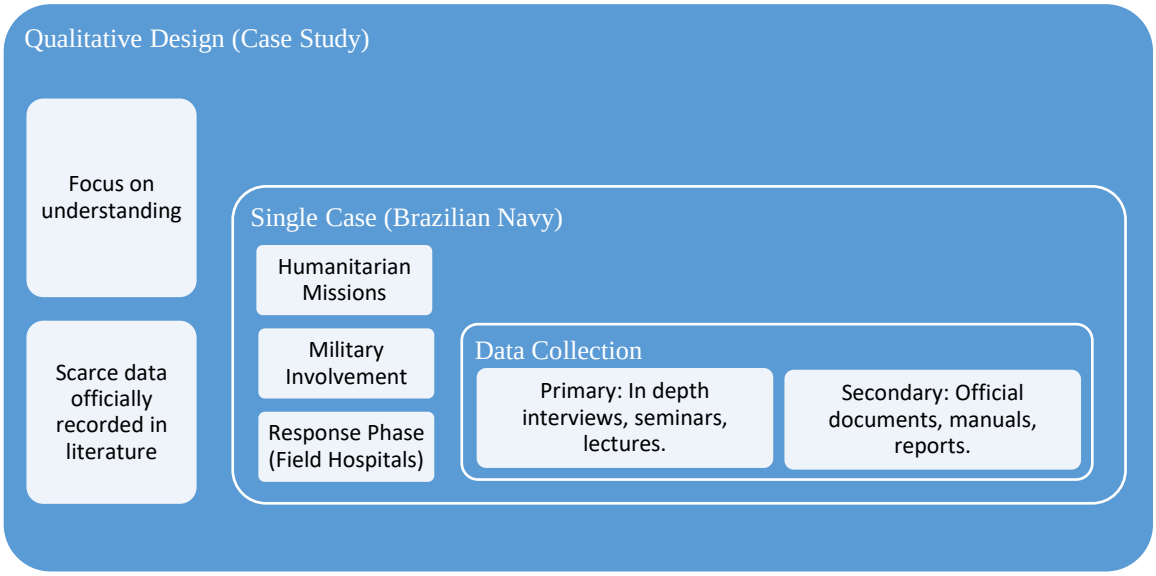
RQ: To what extent are the Brazilian Navy field hospitals fit for humanitarian missions?

3. Research Methodology

This research aims to understand the use of military field hospitals for international humanitarian purposes, more specifically focusing on the existing fit between the resources that

the Brazilian Navy is capable of providing and the context of missions coordinated by the United Nations. As it was stressed before, literature regarding military involvement in humanitarian logistics is quite scarce and the bulk of researches in this field focuses on the "mitigation" and "preparedness" disaster phases (Heaslip, 2014; Altay and Green, 2006). Additionally, the mobile healthcare structure (field hospital) is considered to be the most valuable and required military potential resource for humanitarian purposes (Kelly, 1996). These facts brought up the existence of a literature gap that posed as an opportunity to dive into an in-depth single case study where both field hospitals and the "response" phase of disaster are protagonists.

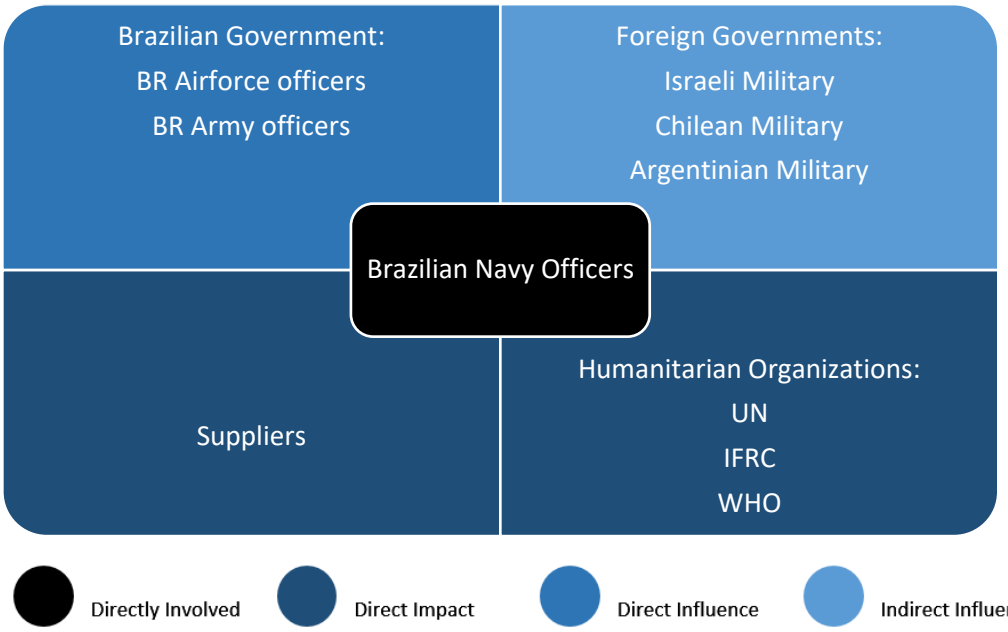
Figure 1 - Research Design Framework



Because data was not abundant, there was an urging need to design this research as a qualitative one. Therefore, in-depth interviews were conducted with different stakeholders in order to achieve an immersion in the reality of military field hospitals and humanitarian aid. This process has generated the window to grasp data and information in the detail level needed to provide a reasonable understanding of the subject, which ultimately would allow for a consistent analysis (Creswell, 2014; Stake, 1995).

In order to support our research, the stakeholders presented in Figure 6, involved directly or indirectly in Brazilian Navy field hospitals deployment, were considered as potential data sources.

Figure 3 - Stakeholders/Data Sources Map



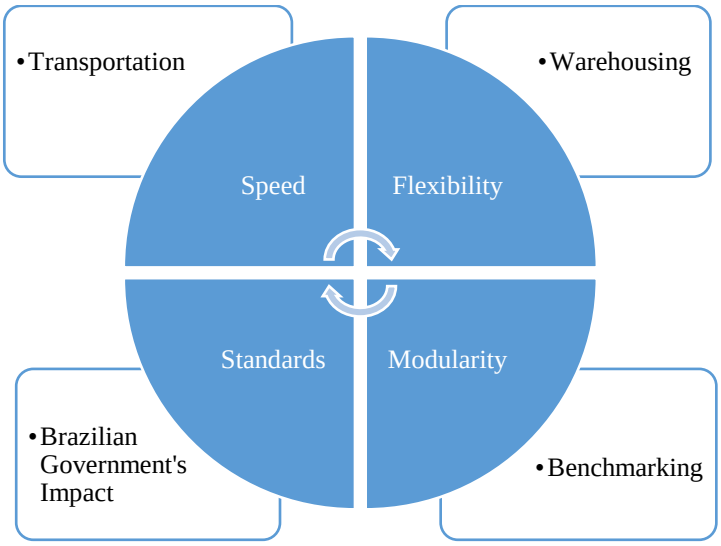
A process of primary data collection was conducted through in-depth interviews guided by a semi-structured script (Stake, 1995). Secondary data was gathered from official organizations' documents available or provided on demand. These served as support to the primary data or to verify the existence of contradiction.

Twenty-four (24) persons were invited to be interviewed, among which seven (09) were selected out because of possible redundancies with other interviewee's data. Twenty-one (15) interviews were completed from April 4th to July 7th 2017. In order to provide a holistic understanding on the subject, the interviewees included nine (09) Brazilian Navy officers of different ranks, specializations, organizations, age and gender. Additionally, were interviewed two (02) Brazilian Airforce officers, one (01) Brazilian Army officers, one (01) Argentinian Army officer, one (01) Israeli Defense Forces officer, one (01) Alaska Structures official (field hospital supplier). More details about the interviews are available on Table 1.

The main analysis approach to the data gathered was the interviews content analysis mostly by direct interpretation. Although categorical aggregation was possible at some points (Stake, 1995). Skepticism and interviewer curiosity drove the parallel processes of gathering and analyzing data. This helped finding new data gaps, confirmation and contradiction. The semi-structured interview script and the approach towards the interviewees shifted as each interview occurred. This flexibility had the advantage of enhancing the exploratory potential of each interview. On the other hand, interviews might not be fully comparable among each other.

4. Findings

The information stemming from the analysis of collected data converged toward the following topics aggregated in categories and how they cross-relate to each other:



4.1 Brazilian Government's Impact

Brazil has been taking part on UN's peacekeeping missions since they started in the 1940's (Ziemath, 2016). Nevertheless, Brazilian Navy's Field Hospital (BR Navy FH) has only recently been considered to be put in use for international humanitarian purposes, namely after the earthquakes in Haiti and Chile. There is a number of reasons for that, some of which we address below, while realizing that those have also a negative impact on the field hospital's improvement over the years. Brazil's participation on United Nations Peacekeeping Operations (UNPKO) was nearly paused during military government terms from 1964 to 1985 and only came back to the spotlights in the late 1990's. Financial and political crises also affected both the country's credibility and drained precious financial resources from several critical areas, including public health. Besides these facts, Brazil has been struggling over decades with an insufficient public health system that could more broadly bring comfort and assistance to its people. This lacking in public health structure has left Brazil in a poorer shape in terms of sending health support abroad in situations when humanitarian help was called for. That is because doing so would represent diverting health materials and human resources away from its own population, which is already ill assisted as it is.

Brazilian Military Forces have been working in silos structures for too long. Only after creating the Ministry of Defense (1999), the Federal Government showed the first signs of turning its eyes towards interoperability issues between the Navy, Army and Airforce. Despite the fact that it's been already 18 years since then, the standardization needed for joint operations and functioning is still very incipient in terms of training, equipment, logistics, purchasing and human resources management. Additionally, the dialogue between the Armed Forces and the Auxiliary Forces (firefighting departments, state polices, Civil Defense departments and Municipal Guards), especially in terms of disaster management and emergency logistics is nearly nonexistent.

The fact that the BR Armed Forces conduct their procurement processes independently from each other keeps them away from seizing the benefits of scale purchasing (which has the potential to generate millions in annual savings) and the standardization of materials and equipment (that would accelerate the pace toward interoperability). Beyond that, a joint procurement system could make place for more robust materials warehousing and distribution policies that would allow more efficient logistics. On top of that, Brazilian Federal Law #8.666 (bids and contracts) is

outdated (1993) and still dictates the pace for public purchasing processes almost 25 years later. Additionally to being somewhat bureaucratic, besides generating a bias toward the cheapest (and frequently not best) materials, equipment and consumables, and the quality and reliability provided by Brazilian suppliers is often questionable. Therefore, the Brazilian public procurement system impacts the development, maintenance and deployment of BR Navy's FH in speed, flexibility and conformance to UN standards. When putting together a field hospital to be deployed on a foreign country for disaster relief purposes, it is often somewhat hard to predict what kind of scenario will come up. One can rarely know previously what types of injuries and respective treatments will be needed. That's why it's necessary to facilitate an expedite acquisition of healthcare materials in emergency situations, especially because the alternative (purchasing and storing considerably large amounts of all types of equipment and medicine) would be very expensive.

4.2 Transportation

It is desirable that a field hospital, especially one to be deployed in another country, is as mobile as possible. The Brazilian Airforce is a bit ahead on that factor because their first field hospital model was already conceived to be transported by air. Therefore, there's always been a concern for volume and weight. As it evolved over the years, the main evolutions on the BR Airforce field hospitals were exactly on those characteristics. Namely, a good example of that would be the imaging equipment (x-ray) which gave away approximately 10 M^3 and 500 KG when was substituted by modern digital, compact and mobile models.

Besides that, one of the Airforce's greatest advantages over the Navy's field hospital is speed. The Airforce already have the cargo planes (e.g. C-130), which the Navy does not. Therefore, if the Navy was to transport its FH to another country, as fast as a disaster relief situation calls for, it would have to ask the Airforce for support. To do so, the Navy's material and human resources would have to be assembled and transported from warehouses and other original locations to the place where Airforce's planes are. That can also be a true problem considering that Brazilian transportation infrastructure does not leave much choice for that other than doing it by trucks, in a city (Rio de Janeiro) where traffic is chaotic. The Navy has helicopters but there aren't enough of them that can transport heavy cargo.

Also as a mean to surpass the transportation obstacle, but not exclusively, the Navy has been considering using a Hospital Ship as field hospital. There is already at least one ship currently been prepared and equipped for that purpose after been tested as a pilot project during the Olympic Games in 2016. Building a field hospital in a Hospital Ship can put a great deal of flexibility and mobility on the table. Since weight is not a big problem as it is with planes, it is possible to transport a very comprehensive and complete set of various equipment and medical personnel. It has also the advantage of being already set at any time, unlike tent-structured models that have to be assemble and disassembled in every situation. Another advantage of Hospital ships is patients' evacuation. Because a big ship has the capacity to carry a helicopter, it facilitates the in and out materials and personnel flow, also providing extra speed and flexibility to the processes.

4.3 Warehousing

The BR Navy's healthcare supply structure is heavily centralized in very few material centers in Rio de Janeiro. The main one is the Healthcare Material Deposit (HMD) and the others are inside Navy hospitals. Warehouse space is currently insufficient to maintain the whole list of items necessary to meet the field hospital's requirements in one place and handling personnel is lacking to achieve the desirable speed in case of emergency. This centralized structure, considering

the continental proportions of Brazil, is not useful either in case of sending a field hospital to international disaster relief or to assist domestic population inside our borders.

It was created a project by the BR Airforce, in 2008, to buy and distribute basic field hospital units across Brazil in all Airforce command centers. This was supposed to tackle this centralization issue that appears to be the Achilles' ankle in terms of speed. The BR Airforce is able to assemble a Basic Healthcare Unit (BHU) – the main and most important module of the field hospital, in 4 to 5 hours. Within 8 to 10 hours, they are able to assemble the whole tactical field hospital. However, in their experience it takes around 30 hours to get ready to go. Additionally, as it happens with the Navy, there is the transportation time to the disaster site, which could be significantly reduced if there were several BHUs spread across the country in strategical positions.

4.4 Benchmarking to Speed and Flexibility

Recently (November 2016) the IDF's field hospital was ranked by UN as Type 3, becoming the first only Type 3 hospital in the world and the only military one to be ranked by UN. Currently, Israel is known to have acquired the expertise to build a 12 hour-field hospital. Four main factors that made IDF evolve so deeply in emergency medical teams were identified. The first one was the understanding that humanitarian disaster relief happens in a yearly basis and not as extremely rare events like they used to think. This understanding changed the mentality of the high ranked military officials and politicians, what ultimately caused improvements in emergency policies and procedures. As this shift in mentality is still to take place in Brazil, the matter of field hospitals for humanitarian purposes has not been considered a priority for many years.

The second one is that the IDF realized that they had "islands of knowledge" which, if put together in a coordinated manner, would give them a higher ability level to work more quickly and efficiently and, therefore, to work also outside Israeli borders. This is something that Brazil still experiences, this disconnections of knowledge and lack of cooperation between public and private organizations and among the governmental institutions themselves. There is a growing urge to standardize, coordinate and train.

Thirdly, the international collaboration is seen as a major knowledge source. By working together with other nations, not only in humanitarian missions, but also in daily or war operations generates cross-field interactions, courses and lectures that grants broader and deeper knowledge otherwise unachievable. Brazilian Military Forces have had the opportunity to harvest the benefits of those types of interactions with friendly nations through joint UN humanitarian missions but also through joint war simulated drills. Probably, Brazil still has a lot to learn because the usage of its military apparatus outside its borders, healthcare and warlike, are very restricted to a few situations, unlike more interventionist-minded nations such as the United States. Increasing participation in humanitarian missions might as well be a promising path through which the BR Navy can achieve higher levels of expertise in field hospitals deployment for international disaster relief.

Finally, the civil war in Syria gave Israel the understanding that humanitarian missions are not always short time ones and that whoever proposes itself to send help should be prepared for the long run. This is actually a lesson that the BR Navy has learned after deploying a field hospital in Chile (2010) as disaster relief assistance to the earthquake victims. The hospital was there for less than one month. On the other hand, the Brazilian Armed Forces have been part of the UN mission to Haiti political stabilization since 2004. It was a peacekeeping mission but, in 2010, an earthquake strikes Haiti. The BR Military Forces had to quickly adapt and deploy a longer term field hospital

there that ended up staying for 4 months, during which attended over 24,000 patients, performed 36,000 medical procedures, performed 200 childbirth deliveries and 1,145 surgeries. The building of a humanitarian emergency mentality is also something in progress for the BR Navy. If for Israel, located at a very problematic geographical spot that is permanently under the threat of imminent war, is easy to feel the urge to be always prepared, in Brazil field hospitals training drills involving all three military forces do not happen very frequently.

4.5 Standardization and Modularity

As pointed out before in the literature review, modularization is a trend for field hospitals. However, there is an internal contradiction between being fast and flexible in the field and still having to comply with UN standards. The way Israel deals with those factors is through modularization. They assemble their field hospital as a LEGO. The first module they send (equivalent to the BR Field Hospital's BHU) represents the way they want to be flexible. That is because they put in it the result of what information their assessment team brought back in the first moment (what are geographic characteristics, how bad is the disaster site, what are the main types of injuries, is there a pressing need for any specific medical treatment). In that way, they manage to be flexible and fast. They have a strategy to "put their boot on the ground" as quickly as possible to assist to first (and often most severely injured) patients. Meanwhile, the following "pieces of the LEGO" (other field hospitals modules) are being loaded on other planes and flying to the site and these represent their commitment to what UN expects of them.

The BR Navy has recently began to follow a trend for using Alaska modular structured field hospitals. Despite the existence of some others recognized suppliers for this type of equipment, Alaska is a bit ahead in terms of technology and comprehensive support. However, Alaska materials may be cutting-edge and resistant, but they are also very expensive and dependent on a full load of technicians to maintain this huge hospital. Therefore, it is necessary to consider using lighter versions and less costly materials on field hospitals depending on the real needs presented, especially considering the Brazilian ongoing restricted budget and low governmental priority, the BR Military Forces might find a better fit in this materials and tactics diversification.

As said before, there is an ongoing and pressing effort for standardization in UN peacekeeping missions and humanitarian disaster relief field hospitals. Several publications have been created and updated by UN in order to fulfill this objective. A recent publication (2013) that has been game changer is the Handbook of Classification and Minimum Standards for Foreign Medical Teams (Norton et al., 2013), released by the WHO's Health Cluster. "It provides benchmarks for international teams that they should meet when offering their services to affected countries. The standardization of services allows countries requiring such support to better communicate their needs, while countries offering FMTs can clearly state the services and capacities that they are offering. The objective is lead to better coordination between aid providers and aid recipients." Nevertheless, in order to cope with UN standards, the BR Navy still has a great deal of internal regulatory standards updating and producing to do. BR Navy internal standard guidelines and regulations for field hospitals still moderately disconnected among each other. Publications, processes and procedures are often incomplete, outdated or conflicting with one. There is a Field Hospital Manual, which is good for the healthcare specifics, but there is still the urge for an internal regulatory standard to sew the operations, logistics and medical issues altogether with a single common thread. This step should be fundamental for the BR Navy in advancing toward getting an UN classification of its EMT field hospital.

5. Discussion and Conclusions

In this paper, we proposed ourselves to provide the literature with extra material to enlarge the basis on top of which empirically based theory can be built for Humanitarian Logistics. By verifying the current status of Brazilian Navy field hospitals, we could devise a few conclusions, which helped us finding an answer to our research question. First, it is necessary to streamline the bureaucracy out of the FH processes. For that matter, those should be treated differently as especial emergency protocols, unlike what happens now in Brazil. Additionally, there is more than enough space in such processes to apply lean and agile concepts, especially regarding inter-stakeholders communication. Secondly, one who proposes to deploy humanitarian aid for disaster relief must have fast access (but not necessarily ownership) to transportation assets. Of course, those change depending on the origin and destiny. Nevertheless, at least for the BR Navy, a good thought should be given into using heavy load cargo helicopters on deployment first movements toward airports or directly to disaster sites as a mean to surpass the highway roads-centered Brazilian transportation matrix. Additionally, using hospital-ships can be a good alternative to deploy humanitarian medical care because of its independent mobility, higher load capacity and readiness. However, it will not have the same speed or capillary distributive capability as the airborne vectors. Third, maintaining all the required medical materials and equipment stored until an emergency strikes is highly space consuming and, hence, very expensive. In order to cope with this challenge, creating processes were fast purchasing those materials is possible, instead of immobilizing inventory, can be a good way out. Besides that, countries with large territory such as Brazil should seriously consider having several deployment origin points, decentralizing the efforts to the nearest point to the disaster site, what will bump up speed and flexibility. Forth, benchmarking from other organizations inside a nation's own borders it's a first important step toward achieving higher efficiency in deploying FH, but working globally will provide an even broader and comprehensive sphere of knowledge. To get the best of it, joint coordinate drills, continuous training and the development of an emergency mentality is mandatory. Last, adopting modularized structures can help the humanitarian organization harvest the greater benefits from standardization of materials and processes, which will ultimately make the efforts occur in a much more flexible and fast manner.

Evaluating the topics above altogether brings us to find that the BR Navy field hospitals are, alone, fit to humanitarian purposes only in a limited spectrum of events, with moderate levels of external dependence and with a great deal of room for performance improvement in speed and flexibility. In the matter of UN standards, the BR Navy could only evolve, so far, to achieve Type 1 field hospital (the lowest UN level). Nevertheless, because Brazil is transitioning to an interoperable reality within the Ministry of Defense, the future considerations on this subject should not consider each military force individually anymore, but rather their combined capacities and skills. After all, when UN requests for a certain nation's collaboration, it does pay attention to what singular organizations can offer, but what the country as a whole is ready to provide.

This work's main limitation is being difficultly generalizable, mostly because of cultural and organizational particularities, added to the complexities and dynamic environments involved in humanitarian logistics. However, some topics and insights here enclosed might serve as benchmarking or starting points to other humanitarian organizations and researchers. Additionally, there was a limitation in scope by collecting most of the data from the BR Navy itself, what could increase the probability of biased results. Future research should focus on producing extra single case studies in different realities, to further allow for richer multiple-case analyses. Beyond that especially regarding the military involvement in HL and the response phase of disasters, it might

be interesting to crosscheck how the top ranked nations in the world conduct their field hospitals to verify if there are success factors that can be more broadly generalized in this context.

Appendix

Table 1 - Interviews Timeline and Information

	Duration	Date	Rank	Position	Field	Org.	Nat.
1	00:38:36	5-Apr-17	Colonel	Commander of the Military Medicine Academy	Medical/ Operations/ Education	Defense Forces	Israel
2	0:48:49	25-Apr-17	Lieutenant-Commander	Manager of Healthcare Material Inventory and Supply	Medical/ Logistics	Navy	Brazil
3	0:49:32	15-May-17	Commander	Head of Healthcare Material Strategical Division	Logistics	Navy	Brazil
4	1:11:42	5-Jun-17	Major	Commander of Field Hospital	Medical	Airforce	Brazil
5	0:48:27	6-Jun-17	Lieutenant-Junior-Grade	Responsible for the Emergency Rapid Pick Lists	Medical /Logistics	Navy	Brazil
6	0:30:42	6-Jun-17	Commander	Head of Procurement Department for Healthcare Material	Logistics/ Procurement	Navy	Brazil
7	0:53:46	14-Jun-17	Commander	Head of Division in the Marines Material Center	Operations/ Logistics	Navy	Brazil
8	0:22:34	14-Jun-17	Lieutenant-Colonel	Head of Doctrine Department	Operations/ Education/ Logistics	Airforce	Brazil

9	0:59:16	21-Jun-17	Lieutenant-Colonel	Exchange Officer	Operations /Education	Army	ARG
10	0:39:09	21-Jun-17	Colonel	Director of the Brazilian Joint Peace Operations Center	Operations/ Education/ Logistics	Army	Brazil
11	1:48:25	23-Jun-17	Captain	Ex-Commander of Field Hospital and Current Head of Audit Department	Medical/ Logistics/ Operations	Navy	Brazil
12	0:43:44	26-Jun-17	Lieutenant-Commander	Vice-Commander and Executive Officer of Field Hospital	Medical/ Logistics/ Operations	Navy	Brazil
13	1:00:21	27-Jun-17	Commander	Head of Logistics Department	Medical/ Logistics/ Education	Navy	Brazil
14	E-mail	29-Jun-17	Commander	Head of Military Strategy for Medical Operations Division	Strategy/ Logistics/ Operations	Navy	Brazil
15	E-mail	7-Jul-17	Civilian	Executive VP/Military Sales	Supply/ Operations	Alaska Structures	USA

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