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Investigating the laundry logistics system of small-sized public hospital: Can the efficiency of operations be improved under the constraints of Thailand's administrative culture?

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Abstract

Purpose

All internal logistics systems contribute to the overall success of healthcare service delivery; laundry management (as a closed loop logistics system) is a critical system which facilitates patient recovery and rehabilitation. Studies indicate that applying efficiency measures/improvement tools in such systems, can deliver financial savings and strengthening of in-house competencies (Banerjea-Brodeur et al. 1998; Golden et al. 2008). This study focuses on the review and improvement of laundry management systems in a Thailand Hospital and the organizational culture underpinning this. This hospital was awarded the highest level of hospital accreditation¹ (high level of quality and environmental compliance within this site). Despite this, problems existed at a very basic level with the laundry management, which can undermine patient dignity and respect and increase risk infection and health complications. This study contributes to the Thai healthcare agenda, a core mission of which is to “Develop efficient and equitable integrated health service system for both normal situation and emergency with emphasis on basic rights, specialized service and emergency medicine, surveillance system, disease prevention and control and health threats” (MOPH 2003).

Research Approach

The key research methods employed include literature review, in-depth interview, observation, documentation and content analysis. A mixed methods methodology was considered appropriate for this study for a number of reasons including a lack of previous insight into this system and the number of actors involved. To this end a triangulated view of the laundry management system was realized.

Findings and Originality

Delays in the provision of linen and patient clothing (1-4 days bottleneck) were adversely affected by unstructured laundry operations, insufficient personnel, poor job design and worn-out equipment. As a result of this analysis several solutions were steadily implemented which led to: (i) linen shortage was reduced by 12.12% - 28.48%, and (ii) the total cleaning time per cycle was reduced by 130 minutes (45.12%). The impact of the improvement practices in place were perceived to be undermined by cultural factors such as very high internal conflict, the new hospital Director with relatively low power, and limited budget allocated to purchasing linen.

Research Impacts

Very few studies have explored a closed-loop supply chain of hospital laundry management systems, fewer collected data from key users using a mixed methods methodology. Reverse Exchanges (RE), a new theoretical framework, was adopted to examine the laundry processes. This study attempts to this study fill

¹ This system provides structure and process for ensuring continuous improvement in the quality of healthcare and appropriate development (WHO 2003).

these gaps. Although this research studied one district hospital; the practices can be greatly generalized; and the diagram of laundry operations and this research design can be replicated.

Practical Impacts

Improvement measures have been identified which directly impact on the effectiveness and efficiency of this operation. Whilst this is once case study site analysis, this can offer a positive contribution to the healthcare agenda within this country.

Introduction to Healthcare Laundry Management

The laundry service within a hospital environment is seen as one of various operational supporting activities. The management of this service aims to provide an effective and efficient closed loop logistics service, delivering adequate supply of clean linen whilst conforming to the highest standards of cleanliness and hygiene immediately and constantly available for routine and emergency use (Ranjan 2008; HSHRC 2017). A laundry system in the developed nations can meet this goal, as stated by Fijan & Turk (2012), and there is an increasing interest in the infection controls over the last decades (Dancer 2009; Dancer 2014). Linen in this study refers to all hospital textiles such as patient's clothes and bedding (pillows, sheets etc) (Gajuryal 2014).

Empirical research on such systems in developing countries/economies shows an entirely different level of development. As reported by Sundari (1992), in the study entitled, 'The untold story: how the health care systems in developing countries contribute to maternal mortality' the author claimed that one of the many deficiencies in this closed loop system is the lack of its key resource, clean linen. Interestingly, the unavailability of linen and/or equipment failure resulted in 14% of cancellations and delays of surgical procedures in a developing country, such as Barbados which is a small island of the English-speaking Caribbean (Jonnalagadda et al. 2005) and as a system which has a robust hygiene and infection risk controls as it requires the highest standards of cleanliness, Fijan & Turk (2012) exposed that linen is one of the possible vehicles to spread of infections. So one has to question *how hospitals in developing nations achieve this goal and how does organisational culture impact on this objective?*

Whilst undertaking a detailed literature review on this area, it became apparent that there are a very limited number of publications, which focus on this closed-loop service. To all intents and purposes this system, purpose, design and execution sits firmly within a number of supply chain camps, relating to Supply Chain Management (SCM), Reverse Logistics (RL), Closed-Loop Logistics (CLL) and Reverse Exchanges (RE). It is the concept of Reverse Exchange that appears to be the most relevant grounding for this study, yet this is an immature area of study within the wider logistics field and hence there are currently no laundry management studies available within it.

Daugherty et al. (2005) asserted that because of high asset values involved the potential impacts on customer service organisations need the capability to effectively handle RL activities, including product returns, remanufacturing, source reduction, material substitution, and waste management (Rogers and Tibben-Lembke 1998). Reverse Exchanges as a sub-dimension of RL, whilst an immature area of logistics study, moves the concept of returns forward to focus on product exchanges (those which are used as part of a service process for a given period of time, so 'on loan to someone for a specific purpose' but will have to be exchanged within a given period of time or when they are no longer needed). RE has been examined in a number of different sectors and operational foci: medical device exchanges (Xie et al. 2016); service supply chains (Kumar et al. 2016); Internet of Things (Parry et al. 2016); public service SCM (Esain et al.

2016) and customer motivation (Yuan et al. 2016). RE can be applied to a laundry management service when considering the provision of bed linen per patient and gowns/pyjamas etc per patient. These items are used by the patient for a given duration and then returned to be cleaned and reallocated. The patient in this instance may not require a further product from laundry (leaving the hospital) or may require further products (in-patient). The concept of RE as applied to healthcare operation can be different from the generic understanding of RL as it is more person/patient centric. This is most certainly the case in laundry operations. Other products requisition from this service will however be more bulk product provision (towels etc for general ward stocks).

Most of the papers, which are available on laundry management, focus on aspects such as: cost per unit (of products or the service?), user satisfaction, hygiene, and occupational health and safety. Authors such as Boonthanomwong (2014) and Bamroongchoo (2011), Boonthanomwong (2014) compared the unit costs of an in-house laundry service at the Police General Hospital versus outsourcing to a 3rd party, revealing no significant difference. There are a minority of these studies which examine the operational improvement of laundry management. Kullasar (2006) explored the key strategies in employed in laundry management at Khon Kaen Hospital (a Central Hospital). His results demonstrated that the local requisition of stock by wards (as opposed to a requisition system under centralized control) led to wasteful deployment of resources. This study also revealed that by adopting a 'one stop service' system which was managed by a centralised Laundry, could reduce operating time from 9 to 5 hours per day. However within this study, unclear improvement solutions were provided, and very limited information from all levels in the organization was explicitly presented. Due to the lack of focus on the area of laundry management and its direct contribution to a number of prevalent agendas: healthcare design and delivery; patient safety; patient dignity and respect; infection risk and control and operational improvement, therefore this hospital system is ripe for further exploration.

Research Methodology

The fieldwork research method is mainly employed to observe sophisticated system, like laundry services, and using tools such as interview, observations and documentations for data collection (Johl and Renganathan 2010). A hospital visit was taken during 1st February, 2016 and 15th May, 2016 with the permission of the Hospital Director and the Dean of Khon Kaen Business School, University of Khon Kaen. The tools above were used to collect data regarding laundry management and standards, personnel perception and understanding, statistical data, failure identification and root cause analysis and problem resolution. Identified solutions once in place were monitored and measured for efficacy and impact. Due to internal politics within the hospital, only 5 out of 14 departments volunteered to be involved in this phase of the study: (i) Male Medicine Ward, (ii) Female Medicine Ward, (iii) Orthopedic Surgery, (iv) ICU and Pediatric, and (v) Central Sterilization Unit. After that the outcomes were evaluated by a number of key metrics: speed of task (minutes), volume of linen (a piece of linen or kilogram), percentage of shortage, user's satisfaction and cost.

Results (i) – Operational site analysis Hospital "A"

This study focuses on the review and improvement of laundry management systems in a Thailand Hospital and the organizational culture underpinning this. In order to do this a detailed analysis of the current

laundry management operations was undertaken on this site based on site visit and supporting documentary analysis.

Hospital “A” is a City hospital (or general hospital) located in the North-East of Thailand, and is governed by the Ministry of Public Health (MOPH). In the year 2016 (February-May), which this study was conducted, the hospital had 14 physicians and 134 other personnel including pharmacist, nurse, and medical technologist. A City hospital provides several specific services containing pediatrics, rehabilitation, medicine and obstetrics and gynecology (MOPH 2013). With the bed size of 120, this hospital has an average daily patient capacity of 361 cases (outpatient) and 134 cases (inpatient). The laundry service is managed by the Administration Department, which is directly controlled by the Director. The laundry is located at the back of the hospital, and has 5 personnel (1 head, 3 full-time personnel, and 1 part-time staff). It services 14 different departments. Table 1 presents the volumes of linen used by key departments during December 2015 to February 2016. According to the hospital records, approximately 277.26 to 301.14 kilograms of dirty linen was managed on a daily basis.

Table 1: Volume of Used Linen by User Departments.

Department	Volume of Used Linen (Kg)			Total (kg)	Percentage
	Dec 15	Jan 16	Feb 16		
1. Operating Theatre	2,566	2,265	2,301	7,132	27.84
2. Male Medicine Ward	1,511	1,387	1,601	4,499	17.56
3. Female Medicine Ward	1,366	1,282	1,483	4,131	16.13
4. Orthopedic Surgery	747	982	931	2,660	10.38
5. ICU and Pediatric	948	775	931	2,654	10.36
6. Delivery Room	794	714	560	2,068	8.07
7. Emergency Department	457	459	451	1,367	5.34
Total	8,389	7,864	8,258	24,511	95.68

Source: Hospital “A”.

The actual volumes of used linen varied by date. Between 13th to the 19th March 2016, the trend increased from Sunday (201 kg) to touch the highest point on Friday (444 kg) and fell on Saturday to reach 254 kg. This trend appeared to be a normal weekly occurrence. “A” often faced the greatest shortage on Thursday and Friday where the required volume are relatively high. On examining the types of linen exchanges and laundered, 88.40% or 7,500 kg per month was uninfected linen, called general linens, whilst the rest 11.60% or 981.50 kg was infected (contaminated with blood and other bodily fluids (WHO 1999)) .

Interviews with staff and scrutiny of the hospital documentation and site visit analysis yielded the following problems in laundry stock availability:

1. *Limited capability to respond to stock requests* – both the Hospital Deputy Director and Head of Laundry commented on this issues. For example, out of within 23 requisitions by user departments, the laundry could only successfully respond on 7 occasions. The MOPH hygiene standards advocated hospitals having 4-6 sets of linen, but this laundry has only 1-2 sets, so stock rotation is severely restricted. It means one is with patients, while another is being cleaned or delivered, and there is no/a very small safety stock. This tells that there are huge pressures to quickly launder stock.

2. *Use of Patient’s own stock* - due to the dearth of stock availability, nurses reluctantly asked patients to wear own clothes (or bring more clothes from home) and uses bed sheet more than a day. This contravenes hygiene policies and has led to increased dissatisfaction and inconvenience in patients, relatives and wards, and led the internal conflicts between user departments and laundry staff.

3. *Extended laundry working hours* - Although the government office hours are 08.30 – 16.30 Monday – Friday, the laundry works every day with the working hours of 06.00 – 20.00 because of their high workload.

4. *Lack of financial investment in laundry operations* – Hospital “A” received more than million GBP in 2016, however the majority of this budget as allocated to the construction of new building rather than purchasing new linen.

Results (ii) – Laundry management system inefficiencies and solutions

By applying the concept of Reverse Exchanges (RE) to the laundry operation and focusing on the linen exchanges within a given period of time, various causes of inefficiencies as well as alterations were as shown in Table 2. The results indicated that the soaking of linen consumes the greatest time (2-3 days), followed by drying linens in the air (2.5 hours to a day), with one cleaning cycle (from receiving used linen to distributing clean linen to users) taking up to 3 days or more. From interviewing other hospitals, one cycle requires only 3 – 5 hours; thus solving this problem is very important.

From Table 2, several practices were steadily implemented since it needed high cooperation from laundry staff, hospital users, patients and relatives. For instance, staff on the wards and relatives of inpatients were asked to untie the knot of bed sheet before disposing. This is a known general practice which is easily undertaken, but it saved 15-30 minutes per washing cycle. The results of practice improvements show the impact on key departments. For example, before instigating improvements the fulfilment rate for the delivery room was 19.61% but after it was 33.33% of requisition. As a result of which patients no longer need to bring in and wear their own clothes. Improvements were also seen in the fulfillment rates for the Intensive Care Unit and Pediatrics Ward (31.09 % to 59.57%) and in Orthopedic surgery (32.26 % to 59.72 % fulfillment, an improvement of 27.46 %).

Table 2: Laundry management system inefficiencies and solutions.

Cleaning Stage	Minute/Round	Explanation	Solution	Outcome
1.Stocking*	N/A	"A" has 1-2 sets of linen circularly used, which the standards require 4-6 sets.	- There is no solution because it highly involves with budget and politics.	N/A
2.Collecting used linen	35 mins (3 rounds)	All used linens should be sorted from sources, but users did not sort them well.	N/A	N/A
3. Receiving linen 3.1 Weigh linen 3.2 Count linen* 3.3 Sort linen* 3.4 Untie knot of bed sheet*	(3 rounds) 10 mins 15 mins 50-65 mins 15-30 mins	3.2-3.4 All dirty linens should not be manually segregated/contacted in the laundry (Siriraj Hospital 2014). But staff still needs to sort/untie them, and remove all small medical devices off before soaking.	- Provide ongoing education for nurses, inpatients and their relatives, but found to be ineffective - Staff on the wards, and relatives of inpatient were asked to untie the knot of bed sheet	-Untying the knot saved 15-30 minutes per washing cycle.
4. Washing infected linen 4.1 Soaking linen* 4.2 Washing in 90C water*	2-3 days (in 7 barrels) 90 mins or more (7 rounds)	4.1 To remove stains (e.g. blood and human fluids), the label on a disinfectant product says, taking only 30 minutes per wash cycle. Manual soaking linen increases the risk of splashing body fluids onto the skin or mucous membranes (HPSC 2005).	- 4 barrels were removed from the soaking system. - Washing time of infected linen was reduced to only 40-45 minutes in hot water, and linen was filled in the full capacity of the machine.	- Soaking took only 1 day. - Washing time was reduced more than half.
5. Washing general linen*	45 mins (11 rounds)	Large-sized washing machine (200 pounds) was broken. Therefore, at least 180 kg was unwashed a day.	- The director of "A" approved that the machine be fixed, when this was reported by researchers not his staff.	- It can reduce unwashed linen of 180 kg a day.
6. Shaking linen*	15 mins/round	It reduces wrinkles and the drying time.	- Shaking was removed.	- It saved 15 mins.
7. Drying 7.1 Use drying machine* 7.2 Dry in the sun*	35 mins (12 rounds) 2.5-24 hours	- Large-sized drying machine (200 pounds) was broken. Drying takes 3 hours a day and requires 3 persons for hanging linens in the sun. Thick and/or large-sized linens (e.g. blanket and bed sheet) are hung in the sun	- The director of "A" approved that the machine be fixed, when this was reported by researchers not his staff.	- It saved time in drying linen in the sun.
8. Folding & Packing	2-3 hours/day	The quality of clean linen is assessed.	N/A	N/A
9. Stocking & Linen Delivery	30 mins (5-6 rounds)	Linen is distributed according to requirement.	N/A	N/A

*inefficient practice identified. Source: Hospital "A"

Discussions

It is clearly seen that “A” has several challenges similar to other hospitals in developing nations (Jonnalagadda et al. 2005; Fijan and Turk 2012). In this event, the theoretical grounding of Reverse Exchanges (RE) facilitated the exploration of this laundry management system and more so the exchange of the laundry stock items which were needed to process patients, hence adopting a patient centric focus. Moreover, this study strictly followed the guidelines/practices of such as Siriraj Hospital (2014) and HPSC (2005) which delivers efficient outcomes as in Tables 1 and 2. Inefficiencies were apparent within the system and investigations confirmed multiple causes for this including: (i) insufficient staff and/or (ii) inappropriate duty segregation and control, and/or (iii) high politics. By considering hospital bed-size (120) and the volume of linen (200-450 kg/day), staff levels of 3-5 were found to be sufficient. The most senior management (the Deputy Director) was unaware of problems within the laundry management system; hence no action was taken to resolve issues. Still, having several limitations hinder “A” adopting a ‘one stop service’ system as suggested by Kullasar (2006).

Conclusions

The aim of this study was to review and improve the laundry management systems in a Thailand Hospital and examine the organizational culture underpinning this. In response to this a hospital practice within this system was improved yielding the results as presented above. The role of organizational culture and the general management of hospital “A” was considered to be a key limitation in the effective management of this operation. Internal conflicts and poor duty segregations resulted in operational inefficiencies (such as a slower cleaning process), which led to patient and staff dissatisfaction, but undermined the efficacy of patient treatment and care, the very ethos of this service operation. Information channels between tiers of the organization was found to be weak and ineffective, so important information was either blocked or badly disseminated. This plus a lack of investment in the laundry operation indicated that the service itself was not performing well as a RE system but also that it was not sustainable in its current form. Hospital management was therefore asked to consider the improvements made in the course of this study and take action accordingly.

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