



# ENHANCING PATIENTS' EXPERIENCE: BONE FOAM APPLICATION IN MANAGING LOWER LIMB SWELLING

Chen Qiu Yan Joyce  
Ji Calderon Demaisip  
Shirhan S/O Shikandar Mydin

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## Background

Injuries to the lower limbs, resulting from surgery, trauma or other acute conditions can result in serious undesired complications if the limb is not supported and elevated appropriately. Current equipment to achieve this has, to date, been confined to a metal frame (known as Brauns Frame), with fabric stretched over the cradle. However, patients experience and clinical evidence suggests that the frames are cumbersome to assemble and uncomfortable for long term use. This is due to the fact that the fabric that was stretched over the frame's cradle tends to lose its tautness and become lax after extended use. Due to this discomfort, patients become non-compliant and frequently had their pressure points (i.e. heel and calcaneal) rested on bed surface and this promotes the formation of pressure ulcers. Pressure ulcers require lengthy time to treat and they contribute greatly to the extended length of hospital stay. With it weighing approximately 5kg, Brauns frame is heavy and bulky. In the process of setting it up occupational hazards and accidental injuries frequently occur due to the usage of sharp requisites such as safety pins and metal pieces. An average duration of 25-30 min is required to set up Brauns frame. This excludes the time required for further adjustments. As a result, nurses are deprived of precious time to provide proper care for patients.

### Glimpse of patient using the Brauns Frame



Diagram A: Patient with lower limb injuries that are of heavy exudates, elevated limb on Brauns frame. Bulkiness and untidiness were seen.

Diagram B: Close up view of patient's lower limb using the Brauns frame showing unsafe outcomes.



Diagram C: Close up view of patient's lower limb using the Brauns frame showing unsafe outcomes.

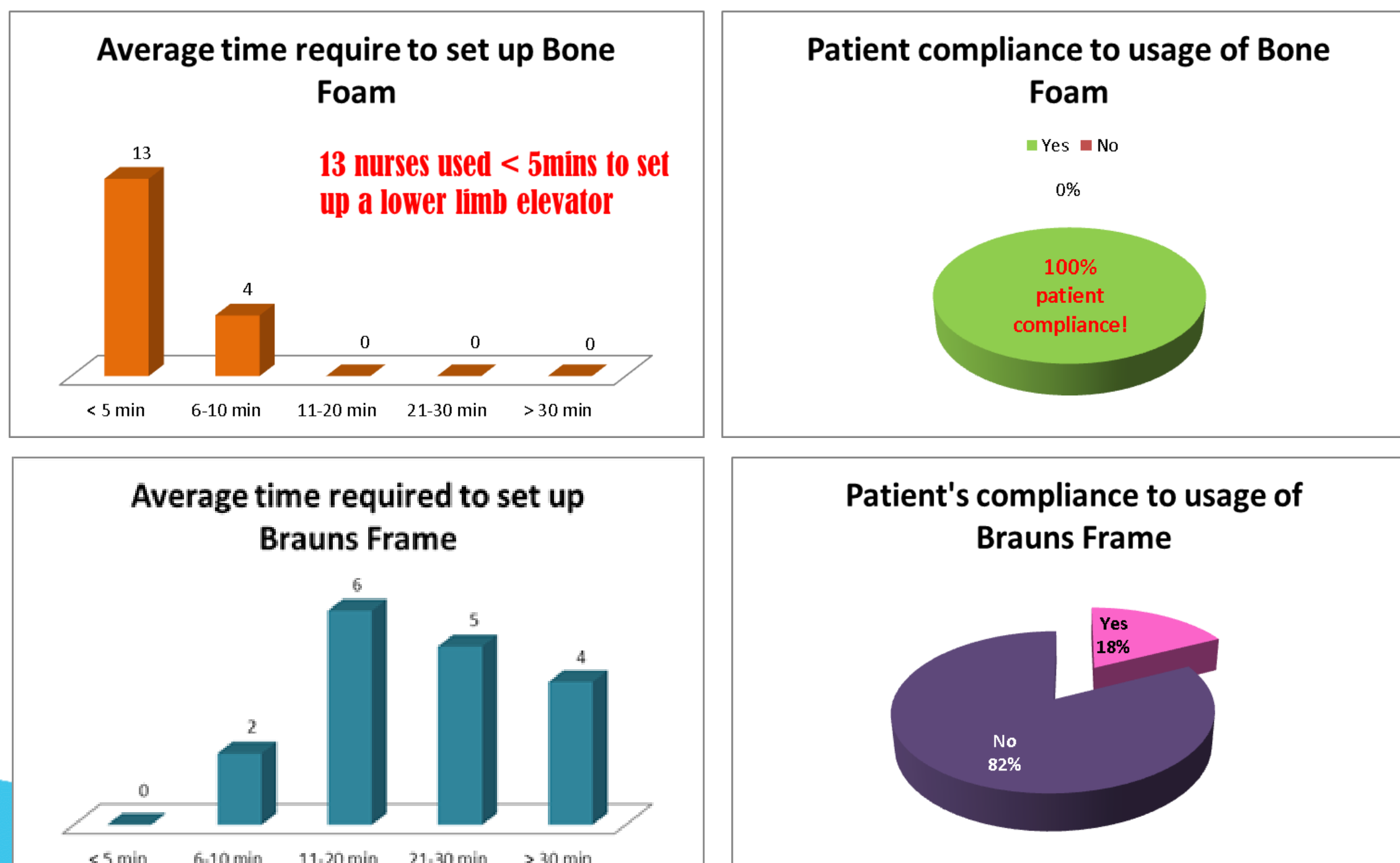
Diagram D: Nurses (especially of small physique) are at higher risk of occupational hazard such as back or shoulder strain

### Existing work process:



## Aims and Motivation

To reduce total time taken for setting up a lower limb elevator by 80% and to achieve 100% patient's compliance rate to lower limb elevation.



## Methodology

In the management of lower limb swelling, a lower limb elevator called Brauns Frame is commonly used to reduce swelling and pressure on the limb surface area. It is a tedious process to set up by using safety pins to achieve the tautness of the fabric when it is wrapped. Its bulky, heavy frame restricts user's movement when on bed, thus resulted in poor patients' compliance which can increased patients' risk in serious complications such as compartmental syndrome. Pre-implementation survey was carried out in a 40-bedded orthopaedic ward and the results showed 82% of the patients were non-compliant to use Brauns Frame. The average time to set up was 31 minutes

Adopting Delphi technique, ideas from experts were gathered. We chanced upon a product called Bone Foam, which was commonly used in overseas. It is lightweight, fluid proof, latex free and ensures contour support from patient's thigh to the foot. Bone Foam was brought in and its usage was trialed out in one orthopaedic ward for a period of 6 weeks. 17 patients participated in the trial.

### New work process:



## Results

Results of the post-implementation survey indicated that there was 100% patient compliance rate to the usage of Bone Foam. It was ready to be used in just 4 minutes with a 87% time reduction in setting up a lower limb elevator. All nurses in the ward liked and preferred to use Bone Foam. The usage of consumables was significantly reduced by saving \$1579.20 in a year.

### i. Cost saving (consumables items)

Consumable Item	Unit Cost	Qty. Required	Total Cost
Safety pin (12 pack)	\$0.30	2	\$0.60
Lint fabric (Per roll)	\$7.70	2	\$15.40
1" micropore tape (per roll)	\$0.52	1	\$0.52
Crepe bandage, 15cmx4.5cm (per roll)	\$1.50	3	\$4.50
Incontinence pad (per sheet)	\$0.24	2	\$0.48
<b>Grand total:</b>			<b>\$21.50</b>

### ii. Cost of ONE version b bone foam

Items	Unit Cost	Qty. Required	Total Cost
Plastic wrap (per pc)	\$1.92	1	\$1.92
Scotch tape (per roll)	\$0.28	1	\$0.28
Linen cover (per pc)	\$0.00	1	\$0.00 (F.O.C.)
<b>Grand total:</b>			<b>\$2.20</b>

### cost saving (nurses' wages)

Estimated cost of Nurse Time (assuming nurse wage at \$2500 per month)	Cost
Using Brauns Frame: 50.26 x 31 mins	\$8.06
Using Bone Foam: 50.26 x 4 mins	\$1.04

### cost comparison between brauns frame and bone foam

Total cost for setting up Brauns Frame	Total cost for setting up Bone Foam
Cost of consumables - \$21.50	Cost of consumables - \$2.20
Cost of Nurse Time - \$8.06	Cost of Nurse Time - \$1.04
<b>Total cost - \$29.56</b>	<b>Total cost - \$3.24</b>
<b>Total cost saved per Bone Foam usage</b>	<b>\$29.56 - \$3.24 = \$26.32</b>
<b>Total cost saved in a month (based on the average of 5 patients requiring lower limb elevation in a month)</b>	<b>\$26.32 x 5 = \$131.60</b>
<b>Total cost saved in a year</b>	<b>\$131.60 x 12 = \$1579.20</b>

## Conclusion

The end users benefited from applying Bone Foam in managing lower limb swelling by enhancing patients' safety. Patients were more compliant due to its comfort and support which reduced the risk of serious complications. It is recommended that Bone Foam application be used in other disciplines in Changi General Hospital to experience similar benefits.



The metal frame looked like a post WWII relic which belonged in the museum. The bone foam is definitely more comfortable. Mr S



I just placed the Brauns' frame on the floor. It was just not comfortable to use as it was poking on my calf. The bone foam however was much more suited to my leg and really alleviated my pain and swelling. Mr M