

# Keep Your Move in the Tube™

## Breaking Down the Restricted Walls of Movement

Presented by:

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# Disclosures

None

# Outline

Discuss the median sternotomy approach used in open heart surgery and the history behind sternal precautions

Discuss the current sternal precautions, the challenges and the evidence

Introduce and understand a new approach to movement post-sternotomy - **“Keep your Move in the Tube”**

Our journey for change!

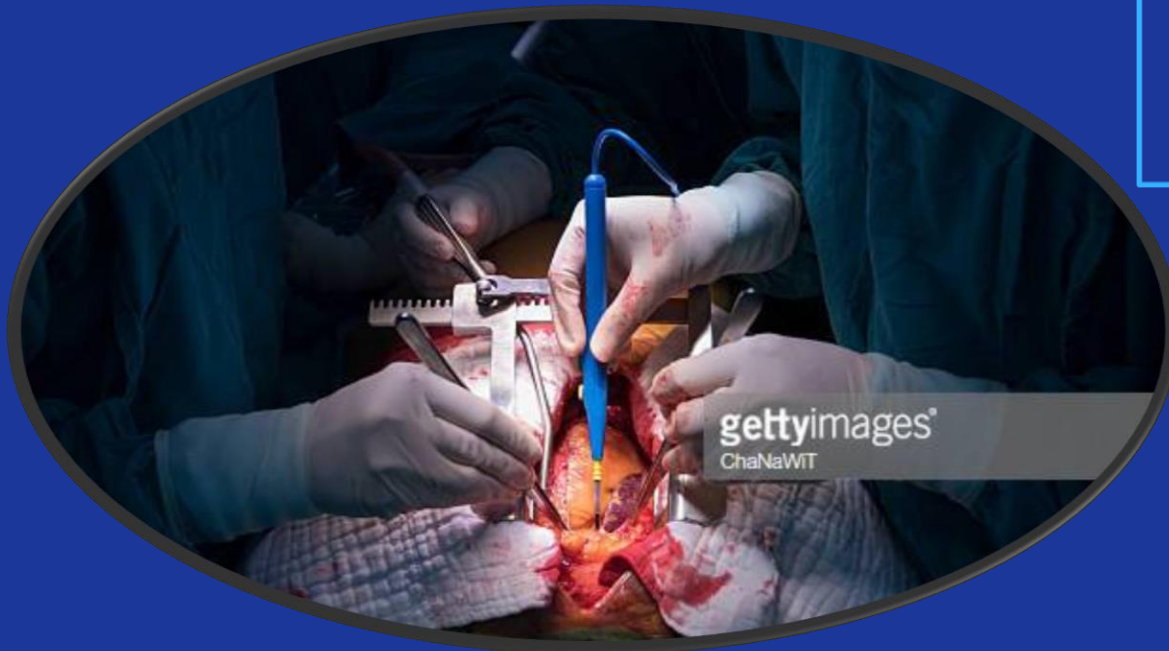
# Median Sternotomy

Cardiac surgery via median sternotomy is pervasive

Sternal precautions

Intended to help protect patients from wound complications

- Incidence between 1-8%



# Median Sternotomy and Physiotherapy

## Role of Physiotherapy

pulmonary and physical rehabilitation following sternal precautions to enable safe discharge from hospital

## Goal

return to baseline function  
return to daily activities





# Sternal Precautions – A Historical Perspective



CABG treatment



Improved  
Surgical site  
Mortality by 14-30% when  
infected

seven years in order to have a reliable follow-up outcome; Dr. Garrett and colleagues believed that it was not enough simply to perform the operation, but to also make sure the patient did well postoperatively.<sup>125</sup> Once results were published in the *Journal of the American Medical Association*, the demonstration of long-term success gave high credibility to the concept of coronary revascularization and the procedure became widespread to the benefit of millions of patients with blood clots and blocked coronary arteries.<sup>126</sup>

# What are Sternal Precautions?

Guidelines implemented following procedures involving median sternotomy

Focus on restricting loads for varying time periods

## ARTICLES

### Physical Therapy Management for Adult Patients Undergoing Cardiac Surgery: A Canadian Practice Survey

*Tom J. Overend, Cathy M. Anderson, Jennifer Jackson, S. Deborah Lucy, Monique Prendergast, Susanne Sinclair*

# Goal of Sternal Precautions?

**PREVENT**

wound  
complications  
which result in

**Instability  
Non-union  
Infection**



Morbidity/mortality,  
healthcare costs



Quality of life

Prolonged or  
repeated  
hospitalization



# Wound Complications



**Table 4. Risk Factors Associated with Sternal Wound Complications**

Primary Risk Factors	Secondary Risk Factors
Obesity/high body mass index Chronic obstructive pulmonary disease Internal mammary artery grafting (bilateral) Diabetes mellitus Rethoracotomy Increased blood loss/number of transfused units Higher disability classification (CCS or NYHA) Smoking Prolonged cardiopulmonary bypass/surgical/time Prolonged mechanical ventilation Peripheral vascular disease Female gender with large breast size	Osteoporosis/decreased sternal thickness Longer intensive care unit length of stay Time of surgery Antibiotic administration > 2 hours presurgery Staple use for skin closure Impaired renal function Immunocompromised status Closure by noncardiovascular surgeon Cardiac reinfarction Inadvertent paramedian sternotomy Emergency surgery ACE inhibitor use Use and duration of temporary pacing wires Septic shock Depressed left ventricular function

*CCS = Canadian Cardiovascular Society Anginal Classification; NYHA = New York Heart Association Heart Failure Classification*



Dehiscence



Sternal Wound Vac  
Dressing

**Do you see MOBILITY?**

***No direct evidence***  
linking activity level or  
arm movement to  
increased risk of sternal  
complications

Cahalin *et al* (2011)

# Sternal Precautions Practiced at Foothills Medical Center in Calgary

Don't lift, push, or pull more than 5 lbs for 6-8 weeks after surgery

Don't do anything that could strain the sternum

With surgeon approval, resume usual activities after 3 months



Protective? Or  
**RESTRICTIVE?**

```
graph LR; A[Protective? Or RESTRICTIVE?] --- B[May impede recovery]; A --- C[Hinders optimal sternal healing due to insufficient stress on the chest wall]; B --- D[Leads to substantial muscle atrophy that occurs with disuse]; B --- E[Impaired pulmonary/chest wall function]
```

May impede  
recovery

Leads to  
substantial  
muscle atrophy  
that occurs with  
disuse

Impaired  
pulmonary/chest  
wall function

Hinders optimal  
sternal healing due  
to insufficient stress  
on the chest wall

# What Else Is Wrong With These Sternal Precautions?

Reinforces patient's fear of activity and injury

Decreases quality of life

Can delay/prevent return to work

May be unable to return home

- Delaying discharge
- Increasing burden on secondary facilities
- \$\$\$





# How Might this Compare Elsewhere?

Review

## Are Hip Precautions Necessary Post Total Hip Arthroplasty? A Systematic Review

Lara Barnsley, BApSci (Occupational Therapy) Hons, BMBS<sup>1</sup>,  
Leslie Barnsley, BMed (hons), Grad Clin Epi, PhD, FRACP, FAFRM (RACP)<sup>2</sup>,  
and Richard Page, BmedSci, MBBS, FRACS, FAOrthA<sup>1</sup>

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& Rehabilitation  
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Precautions after hip  
cause

- Loss of condition
- Delay return to
- Fall risk
- Nursing care of

Rate of  
dislocation after  
anterolateral  
THA is low and  
**NOT** improved  
by hip  
precautions

Although  
theoretically  
sound, there is  
limited evidence  
to support this  
practice

# Is There Evidence for Sternal Precautions?



# Where Did a Weight Restriction of 5 lbs Come From??

What is the weight of a single arm?



What about a cough?



What about a sneeze?



# The Impact of Coughing on the Sternum

## Current Activity Guidelines for CABG Patients are too Restrictive: Comparison of the Forces Exerted on the Median Sternotomy during a Cough vs. Lifting Activities Combined with Valsalva Maneuver

### Authors

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Comparison of forces exerted on a median sternotomy during a cough and 5 weighted activities

Measured internal pressure, internal force on sternotomy and total force on sternotomy

**Table 1** Descriptive summary statistics of measured internal pressure, internal calculated force on sternotomy, external force on sternotomy and total force on sternotomy associated with coughing and lifting weights in 9 healthy volunteers

		Range	Mean	SD
Cough	measured internal pressure (cmH <sub>2</sub> O)	61.0–97.3	74.8	12.1
	internal calculated force on sternotomy (kg-mass)	22.4–35.8	27.5	4.5
	total force on sternotomy (kg-mass)	22.4–35.8	27.5	4.5
5-lb weight	measured internal pressure (cmH <sub>2</sub> O)	2.3–20.7	7.4	5.8
	internal calculated force on sternotomy (kg-mass)	0.9–7.6	2.7	2.1
	external force on sternotomy (kg-mass)	2.3–2.3	2.3	0.0
	total force on sternotomy (kg-mass)	3.2–9.9	5.0	2.1
30-lb suitcase	measured internal pressure (cmH <sub>2</sub> O)	10.3–27.3	17.1	6.8
	internal calculated force on sternotomy (kg-mass)	3.8–10.0	6.3	2.5
	external force on sternotomy (kg-mass)	13.6–13.6	13.6	0.0
	total force on sternotomy (kg-mass)	17.4–23.6	19.9	2.5
2 × 20-lb weights	measured internal pressure (cmH <sub>2</sub> O)	8.0–28.3	13.8	6.3
	internal calculated force on sternotomy (kg-mass)	2.9–10.4	5.1	2.3
	external force on sternotomy (kg-mass)	18.2–18.2	18.2	0.0
	total force on sternotomy (kg-mass)	21.1–28.6	23.3	2.3
25-lb grandchild	measured internal pressure (cmH <sub>2</sub> O)	8.7–24.7	16.1	5.9
	internal calculated force on sternotomy (kg-mass)	3.2–9.1	5.9	2.2
	external force on sternotomy (kg-mass)	11.6–11.6	11.6	0.0
	total force on sternotomy (kg-mass)	14.8–20.7	17.5	2.2
Milk to counter	measured internal pressure (cmH <sub>2</sub> O)	7.0–34.3	16.4	8.9
	internal calculated force on sternotomy (kg-mass)	2.6–12.6	6.0	3.3
	external force on sternotomy (kg-mass)	4.1–4.1	4.1	0.0
	total force on sternotomy (kg-mass)	6.7–16.7	10.1	3.2

1 kg-mass = 9.8 N; 1 cmH<sub>2</sub>O =  $9.8 \times 10^{-2}$  kPa. \* Each of the 9 study subjects performed each activity 3 times. The internal pressure measurements were taken with an Ashcroft Inc. expiratory pressure gauge (model N10-120CMW). SD = standard deviation

(Parker R et al 2008)



Coughing exerted the ***largest*** mean total force on the sternotomy at 60lbs.

Parker R, *et al* (2008)

# The Impact of a Sneeze on the Sternum

## **Comparison of Force Exerted on the Sternum During a Sneeze Versus During Low-, Moderate-, and High-Intensity Bench Press Resistance Exercise With and Without the Valsalva Maneuver in Healthy Volunteers**

Jenny Adams, PhD<sup>a,\*</sup>, Jack Schmid, BSc<sup>a</sup>, Robert D. Parker, PhD<sup>a</sup>, J. Richard Coast, PhD<sup>b</sup>, Dunlei Cheng, PhD<sup>c</sup>, Aaron D. Killian, PharmD<sup>d</sup>, Stephanie McCray, RN<sup>a</sup>, Danielle Strauss, MSN, RN<sup>a</sup>, Sandra McLeroy DeJong, BSN, RN<sup>e</sup>, and Rafic Berbarie, MD<sup>f</sup>

Evaluated the forces exerted on the sternum during bench press resistance exercise and sneezing

# The Impact of a Sneeze on the Sternum

**No statistically significant difference**  
between the mean force from a sneeze  
and the mean total force exerted during  
moderate intensity bench press exercise

Both equate to **90lbs**  
force on the sternum

**So it's ok to lift  
60-90  
lbs?**

# So Why Are We Still doing This???

A CASE  
FOR  
CHANGE!

Sternal  
precautions are  
intended to  
protect the  
patient but may  
in fact be  
impeding patient  
recovery

No evidence for  
load and time  
based  
movement  
restrictions

Is there a better way of moving post-sternotomy?

# Our Journey At FMC

20 bed unit

9 cardiac surgeons

6-8 cases /day

10+ years traditional sternal precautions

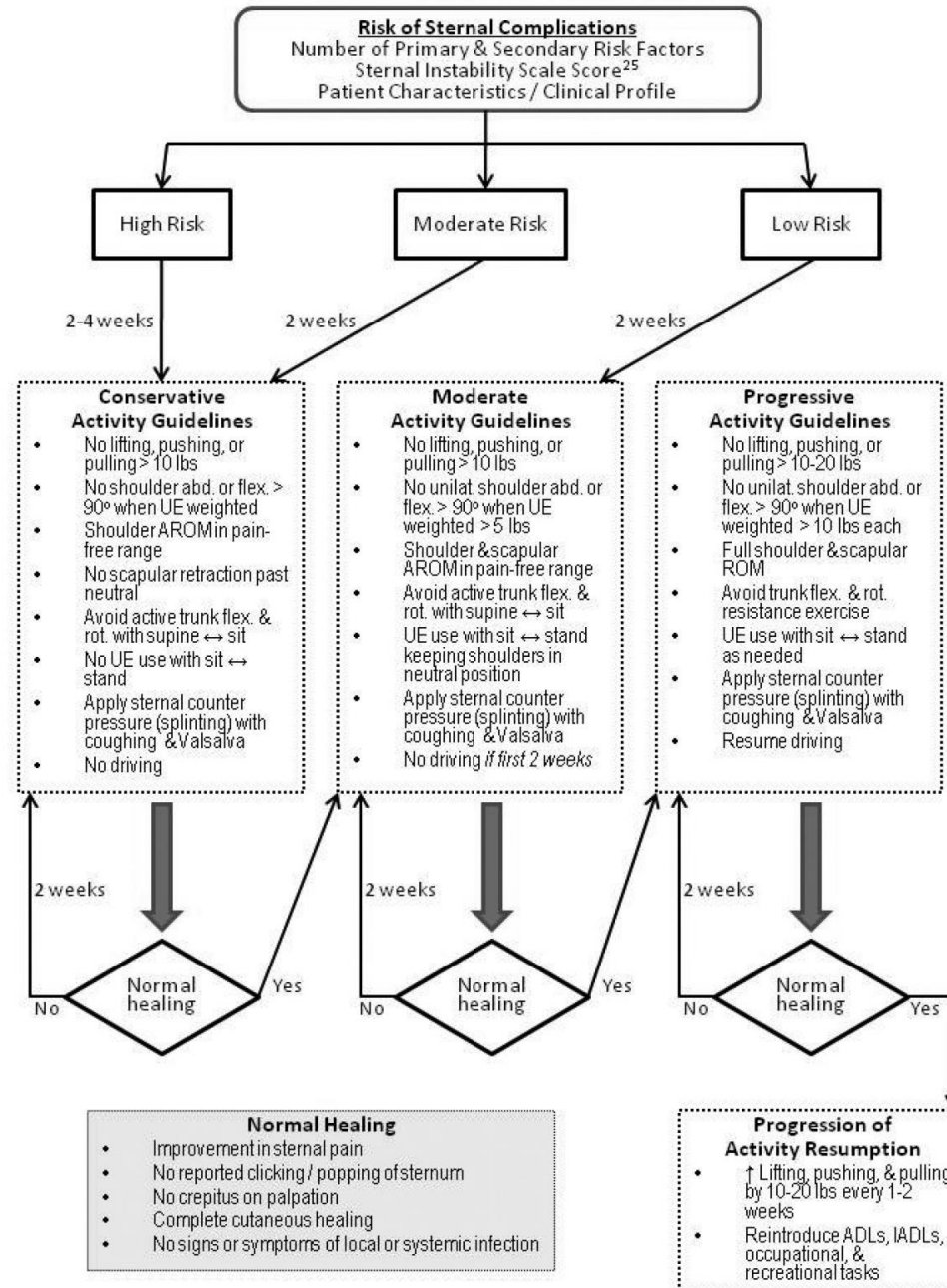
Summer 2017 – something better?

- Patients with increased co-morbidities
- High patient volume without good flow through system





# Sternal Precautions Algorithm



Introducing...

**Keep Your Move in The  
Tube™**

# Introducing...

## Keep Your Move in The Tube™

First described in Jan 2016 from Baylor Health in Texas

- Implemented in 4 centers including Memorial Healthcare System (Hollywood, Florida)

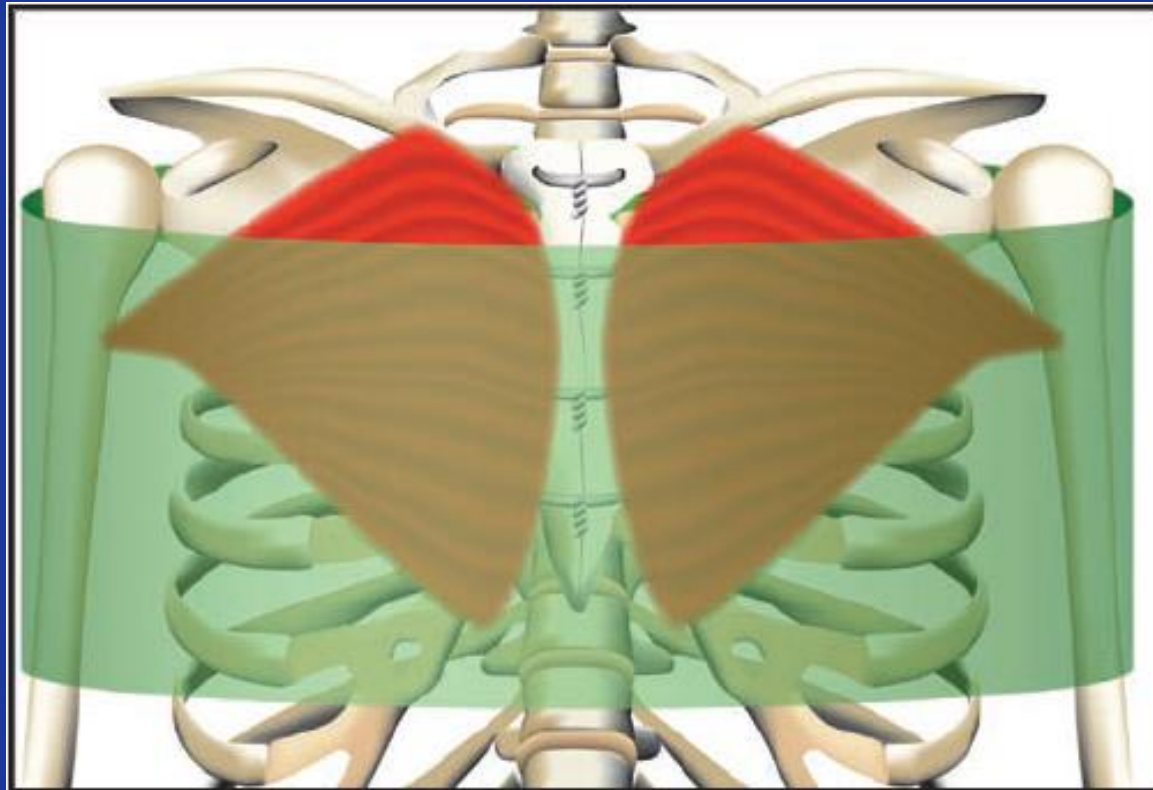
# Keep your Move in the Tube™

Shift in thinking from load and time restrictions to standard kinesiology principles

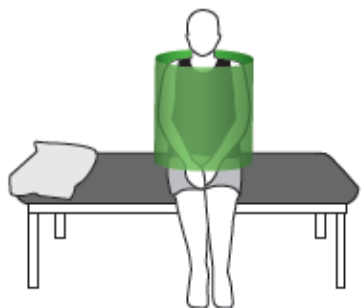
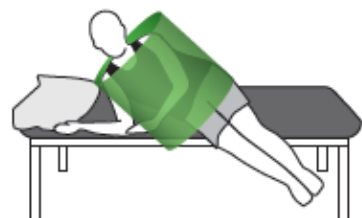
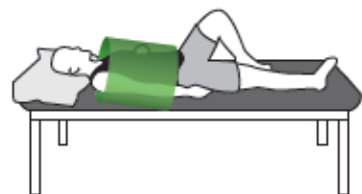
Focuses on lever arm reduction enabling patients to perform previously contraindicated movements

# Keep your Move in the Tube™

As long as patients stay “in the tube”, they can resume normal load-bearing activities at their own pace







# How Long Do Patients Stay In The Tube?

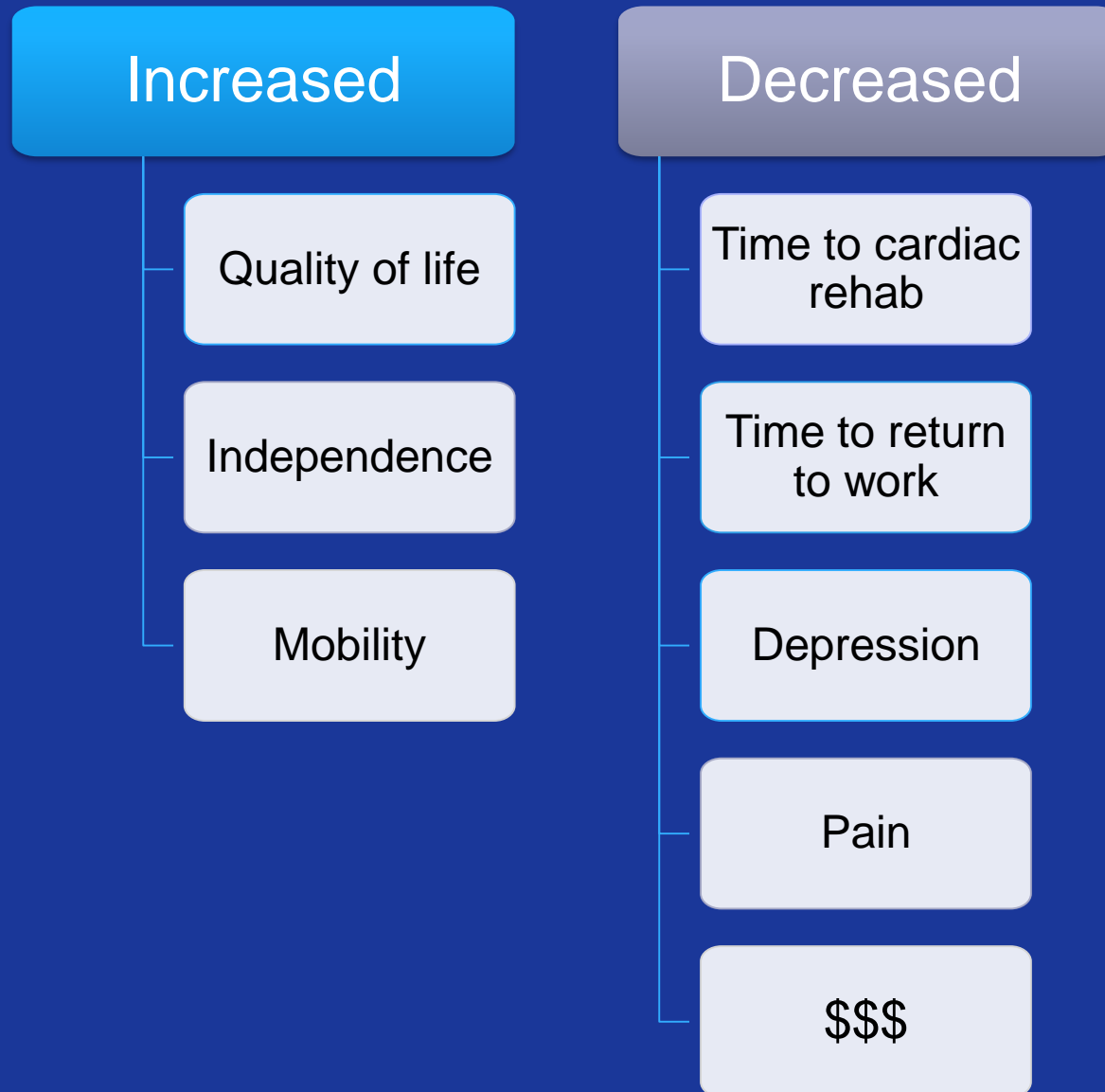
No specific time requirement

Pain is their guide

Other factors play a role

- Motivation
- Pre-op mobility
- Cultural influences

# So what are the *Anticipated Benefits*?



# What Do We Know about it's Implementation So Far?

## Fully implemented at Baylor & Memorial Hospitals, US:

- 3000 patients over 2 year period that have gone through both inpatient care and cardiac rehab
- Described drastic improvements in discharge home, functional status and cost savings

9 other facilities in US, 1 in Malaysia and 2 in New Zealand are currently considering adopting



# Journal of **PHYSIOTHERAPY**

journal homepage: [www.elsevier.com/locate/jphys](http://www.elsevier.com/locate/jphys)

## Research

### Standard restrictive sternal precautions and modified sternal precautions had similar effects in people after cardiac surgery via median sternotomy ('SMART' Trial): a randomised trial

Md Ali Katijjahbe<sup>a,b</sup>, Catherine L Granger<sup>a,c</sup>, Linda Denehy<sup>a</sup>, Alistair Royse<sup>d,e</sup>, Colin Royse<sup>d,f</sup>,  
Rebecca Bates<sup>c</sup>, Sarah Logie<sup>g</sup>, Md Ali Nur Ayub<sup>h</sup>, Sandy Clarke<sup>i</sup>, Doa El-Ansary<sup>a,d,j</sup>

2 centre, RCT

72 adults who underwent cardiac surgery via median sternotomy

Control group: received usual restrictive precautions

Experimental group: received advice to use pain and discomfort as safe limits for upper limb use

## Outcome measures

- **Primary outcome:** physical function via Short Physical Performance Battery
- **Secondary outcomes:** upper limb function, pain kinesophobia and health-related Q of L

This trial highlighted that  
modifying sternal precautions  
**did not cause any harm or  
adverse events**

Katijjahbe *et al* (2018)



# Our Journey at FMC Continued...

First contact

Permission

Getting Section Chief on board

Invitation

Educational sessions

Coming up with roll out plan...now a study!



# In Summary...

Median sternotomy is a universally accepted surgical  
Sternal precautions to prevent wound complication

- imposed on patients without a foundation in science, anecdotal evidence only

Restrictive more than protective

Shift in thinking from time and load based precautions

Keep your Move in the Tube – pain is your guide!

Stay tuned for study results at FMC

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- Images sourced from [www.googleimages.com](http://www.googleimages.com)

# Questions?

