

# **WORK-LEAVE ROTATION PATTERN & INCIDENCE OF WORKPLACE INJURY IN OFFSHORE OIL & GAS WORKERS**

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**OGUK EXAMINING DOCTORS CONFERENCE 2018  
GLASGOW**



## Dubai 1965

Photo: Dubai Petroleum



## Dubai 2015

Photo: Dubai Department of Tourism and  
Commerce Marketing

# OFFSHORE PLATFORM



# OFFSHORE DRILLING RIG



# LIFE AT AN OFFSHORE PLATFORM



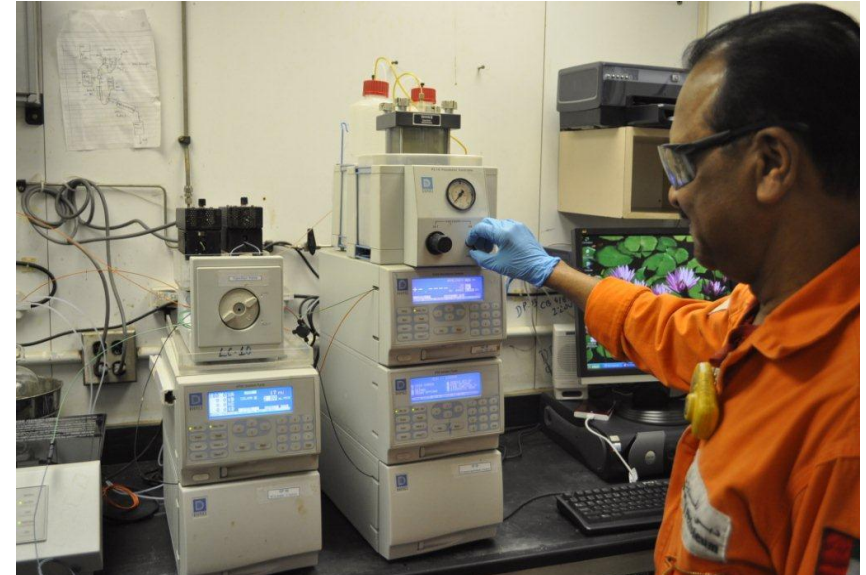
WATER FLOOD-2				
PUMP	VALVE	LEFT PUMPS	RIGHT PUMPS	RUN DATE
P-281A	V-281A	P-281A	P-281A	11-11-11
P-281B	V-281B	P-281B	P-281B	11-11-11
P-281C	V-281C	P-281C	P-281C	11-11-11
P-281D	V-281D	P-281D	P-281D	11-11-11
P-281E	V-281E	P-281E	P-281E	11-11-11
P-281F	V-281F	P-281F	P-281F	11-11-11
P-281G	V-281G	P-281G	P-281G	11-11-11
P-281H	V-281H	P-281H	P-281H	11-11-11
P-281I	V-281I	P-281I	P-281I	11-11-11
P-281J	V-281J	P-281J	P-281J	11-11-11
P-281K	V-281K	P-281K	P-281K	11-11-11
P-281L	V-281L	P-281L	P-281L	11-11-11
P-281M	V-281M	P-281M	P-281M	11-11-11
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P-281O	V-281O	P-281O	P-281O	11-11-11
P-281P	V-281P	P-281P	P-281P	11-11-11
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P-281R	V-281R	P-281R	P-281R	11-11-11
P-281S	V-281S	P-281S	P-281S	11-11-11
P-281T	V-281T	P-281T	P-281T	11-11-11
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P-281V	V-281V	P-281V	P-281V	11-11-11
P-281W	V-281W	P-281W	P-281W	11-11-11
P-281X	V-281X	P-281X	P-281X	11-11-11
P-281Y	V-281Y	P-281Y	P-281Y	11-11-11
P-281Z	V-281Z	P-281Z	P-281Z	11-11-11



# LIFE AT AN OFFSHORE PLATFORM



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# LIFE AT AN OFFSHORE PLATFORM



# COMMUTING TO OFFSHORE PLATFORM

- Located 2 to 200 miles into the sea
- Sea depth of 80 to 5000 feet
- Daily commute is not possible or not practical
- Crew movement is by choppers or boats



# WORK - LEAVE ROTATION PATTERN

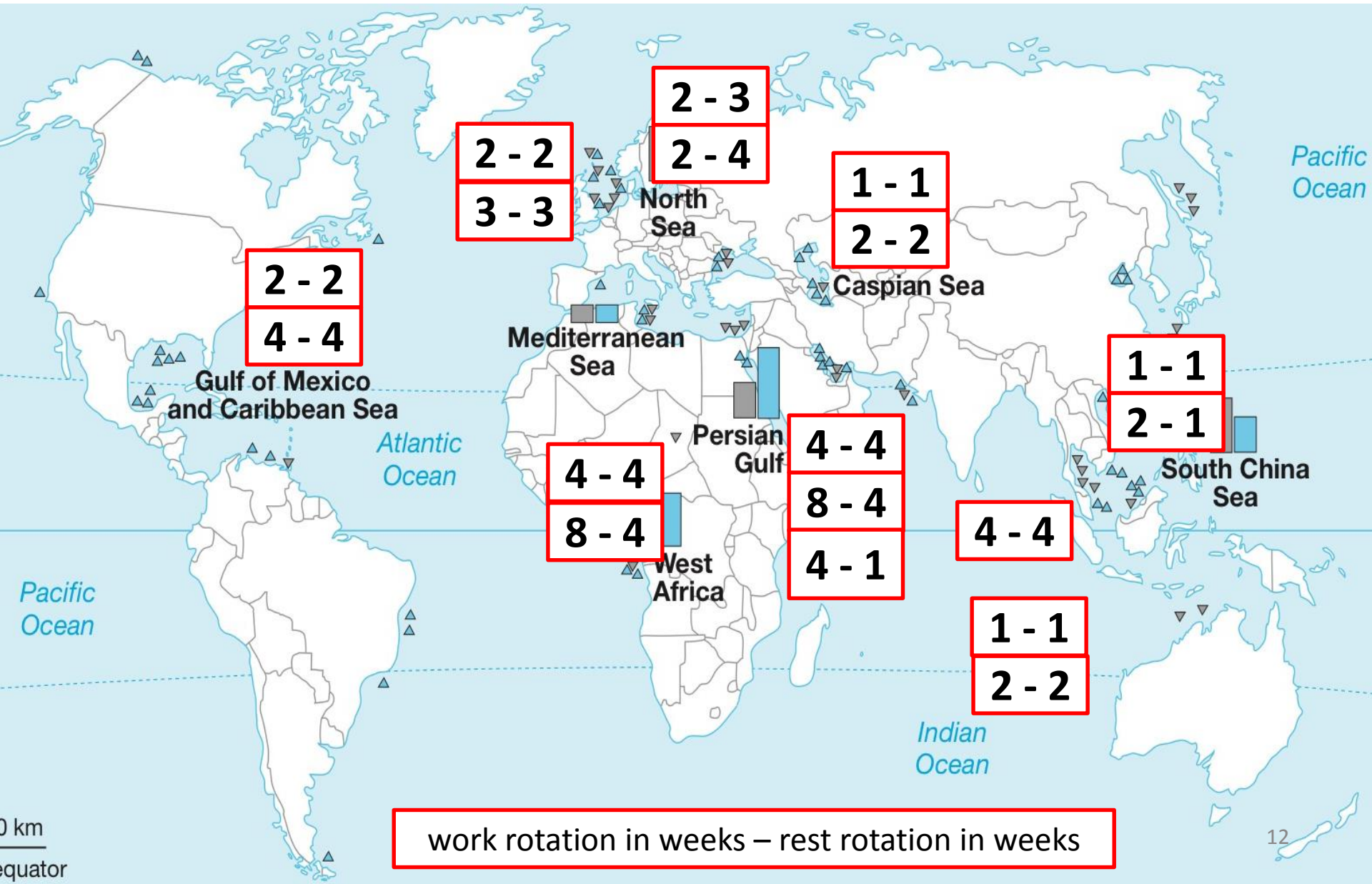
Workers stay and work at the offshore facility continuously for a certain number of days - **work rotation**

... and then avail leave for a certain number of days - **leave rotation or rest rotation**

Work rotation is daily 12 hour shift

Statutory annual leaves (vacation) are part of this rest rotation.

# ROTATION IN DIFFERENT REGIONS



# RATIONALE FOR ROTATION PATTERN

SHORT ROTATION  
2 weeks or less



LONG ROTATION  
4 weeks or more

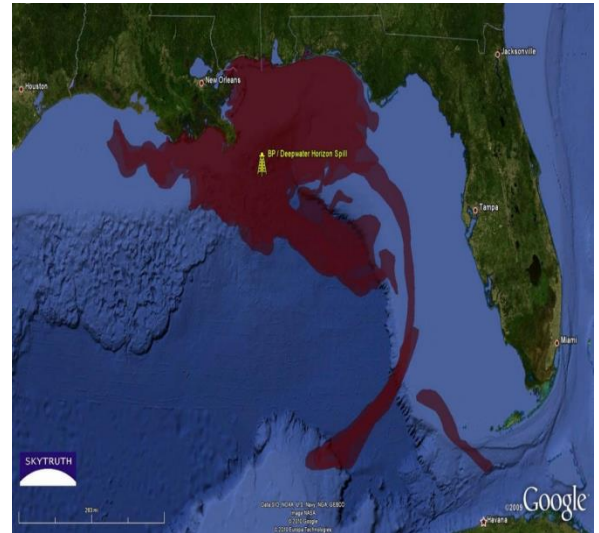
- Work stress
- Work fatigue
- Exhaustion

- Induction time
- Travel fatigue
- Logistic costs

Health and Safety

Accidents

# ACCIDENTS ON OIL&GAS PLATFORMS



# WHAT IS OPTIMAL ROTATION PATTERN



## Guidance for managing shiftwork and fatigue offshore

Offshore Information Sheet No. 7/2008

(Issued October 2008)

## Policy on working hours offshore

Offshore Information Sheet No. 8/2008

(Revised and reissued March 2009)

There are no Guidance / Policy / Recommendations on optimal work-leave rotation pattern from any source!

# WHAT DOES LITERATURE SAY

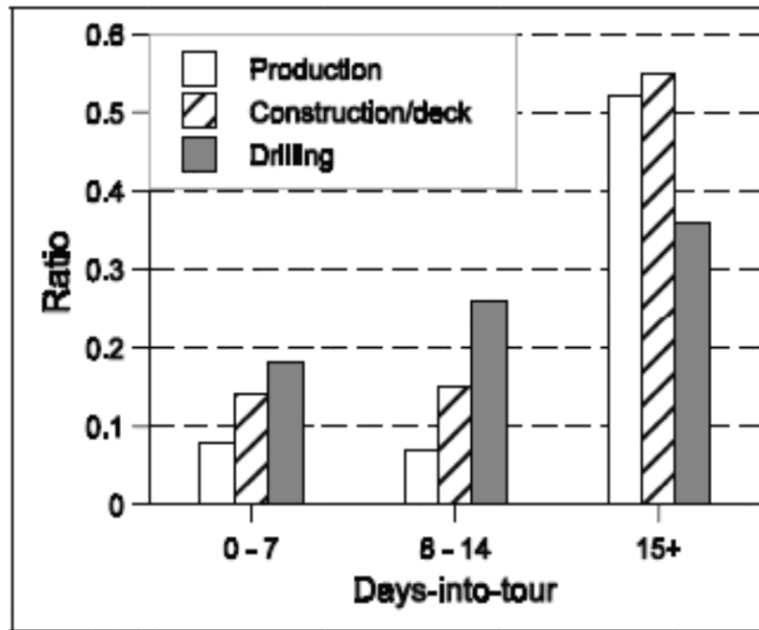
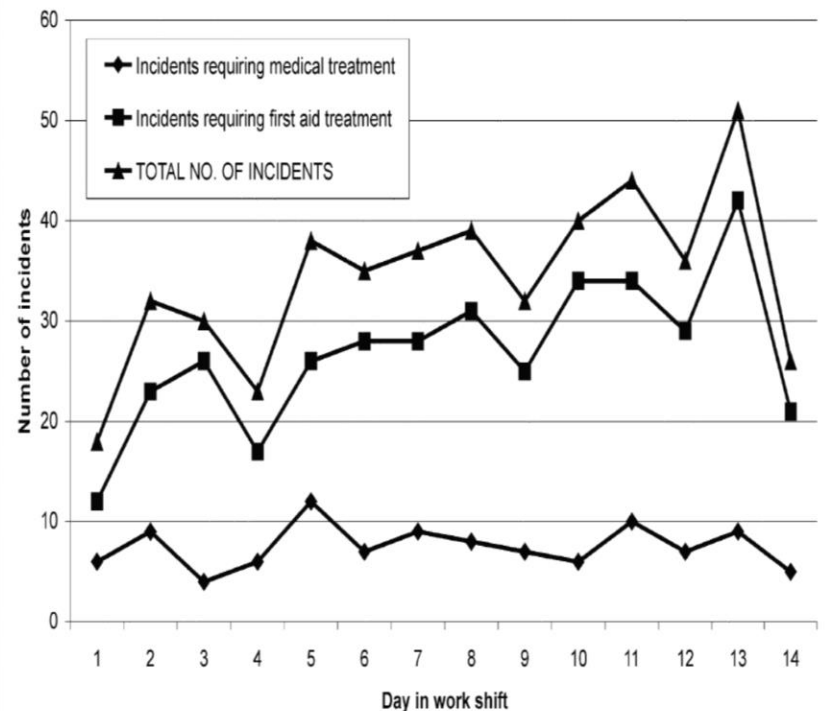


Figure 6.1  
Ratio of fatalities/serious injuries to 3+ day injuries as a function of days into tour, for three areas of work



UK study, 2 Comp. & HSE; 6000+ injury;

- Serious and fatal injuries increase
- Other injuries decrease
- Sudden increase after 2 weeks

Norwegian; 3 yr data; 3 rigs; 481 injuries;

- First Aid injuries increase
- Serious injuries don't increase.



# GAP IN KNOWLEDGE



Health and Safety  
Executive

## Offshore working time in relation to performance, health and safety

A review of current practice and evidence

### 8.1.4 Extended offshore tours overseas.

In the UK North Sea sector, the maximum period that an individual can work offshore is normally 21 days; a shore break of at least one third of the time spent offshore must then be taken. However, expatriates working for multi-national oil/gas companies overseas may routinely work a 4-4 schedule. Currently, there appear to be no studies of the effects of four-week offshore tours on health and safety outcomes. Research into this work pattern (and others that involve extended offshore tours overseas) should be undertaken, so that appropriate measures can be put in place to manage any health and safety risks found to be associated with these demanding work schedules.

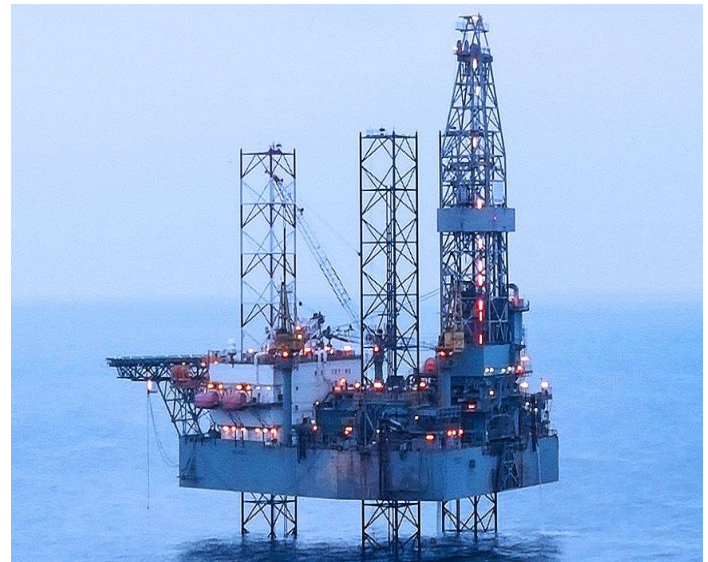
# GAP IN KNOWLEDGE

alertness across successive weeks was found. To date, there appear to be no empirical studies of the health and safety implications of the longer work/leave cycles (e.g. 4 on/4 off), typically worked by expatriate offshore personnel on overseas assignments.

performance, may increase safety risks. Similarly, little is known about the health and safety implications of tour durations of more than 2 weeks, although 3-week tours are worked by some UK offshore personnel, and overseas tours may be considerably longer. Both these issues would merit research attention.

# STUDY SETTING

- 4 offshore installations, two offshore Oil and Gas platforms and two offshore drilling rigs, operated / contracted by an upstream Oil and Gas Company in the Persian (Arabian) Gulf.
- 6 year retrospective data
- Work- leave rotation pattern varied from 4-4 to 24-4.
- 90 percent employees expatriates from Indian subcontinent



# STUDY POPULATION

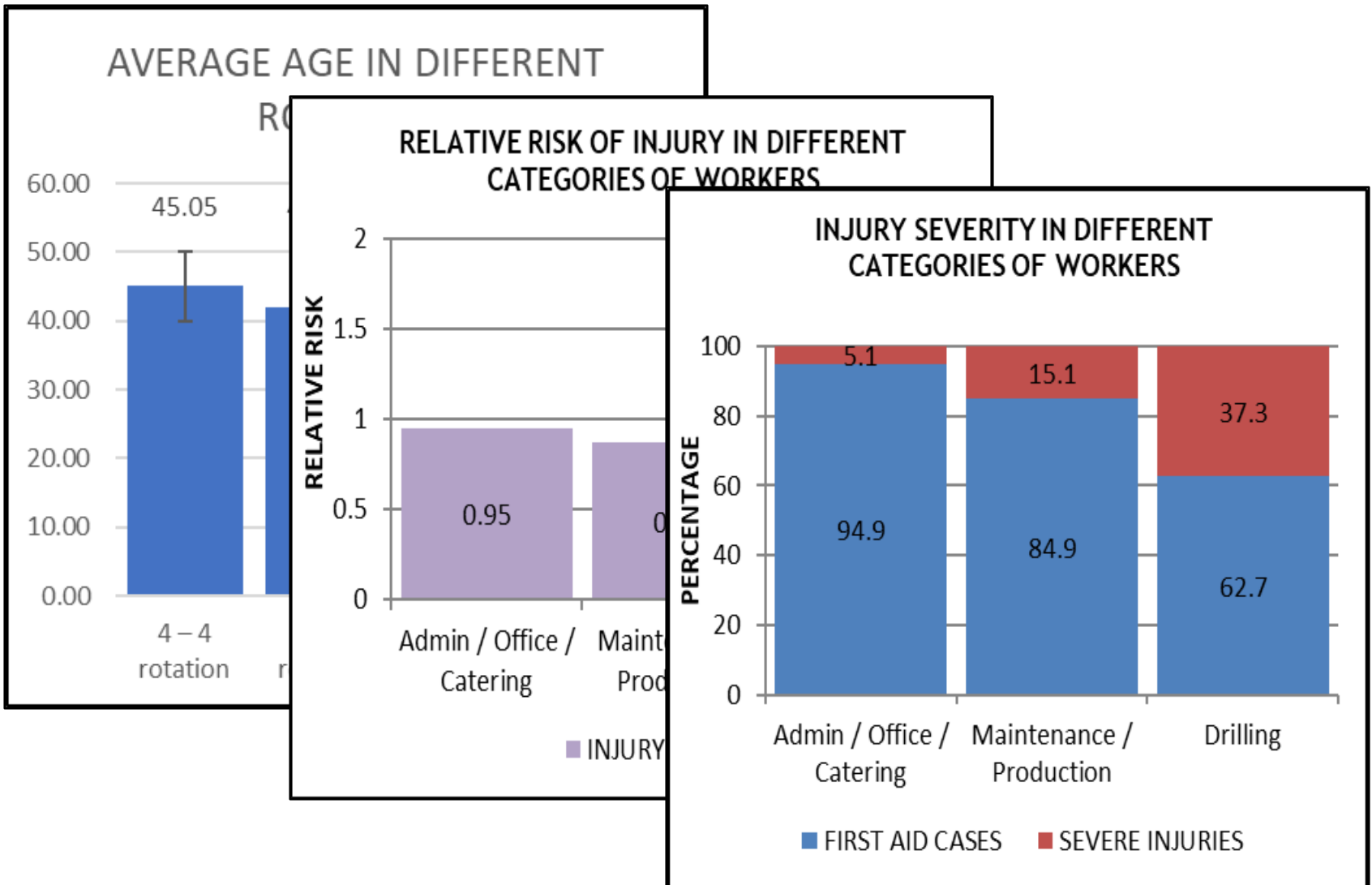
6 year data, 4 distinct rotation schedules

<b>LENGTH OF ROTATION (WORK – REST; WEEKS)</b>	<b>POPUL. %</b>	<b>INJURIES</b>
<b>4 – 4</b>	<b>39.2</b>	<b>132</b>
<b>8 – 4</b>	<b>26.7</b>	<b>68</b>
<b>16 – 4</b>	<b>23.3</b>	<b>82</b>
<b>24 – 4</b>	<b>09.7</b>	<b>25</b>
<b>OTHERS</b>	<b>01.0</b>	<b>4</b>
<b>TOTAL</b>		<b>311</b>

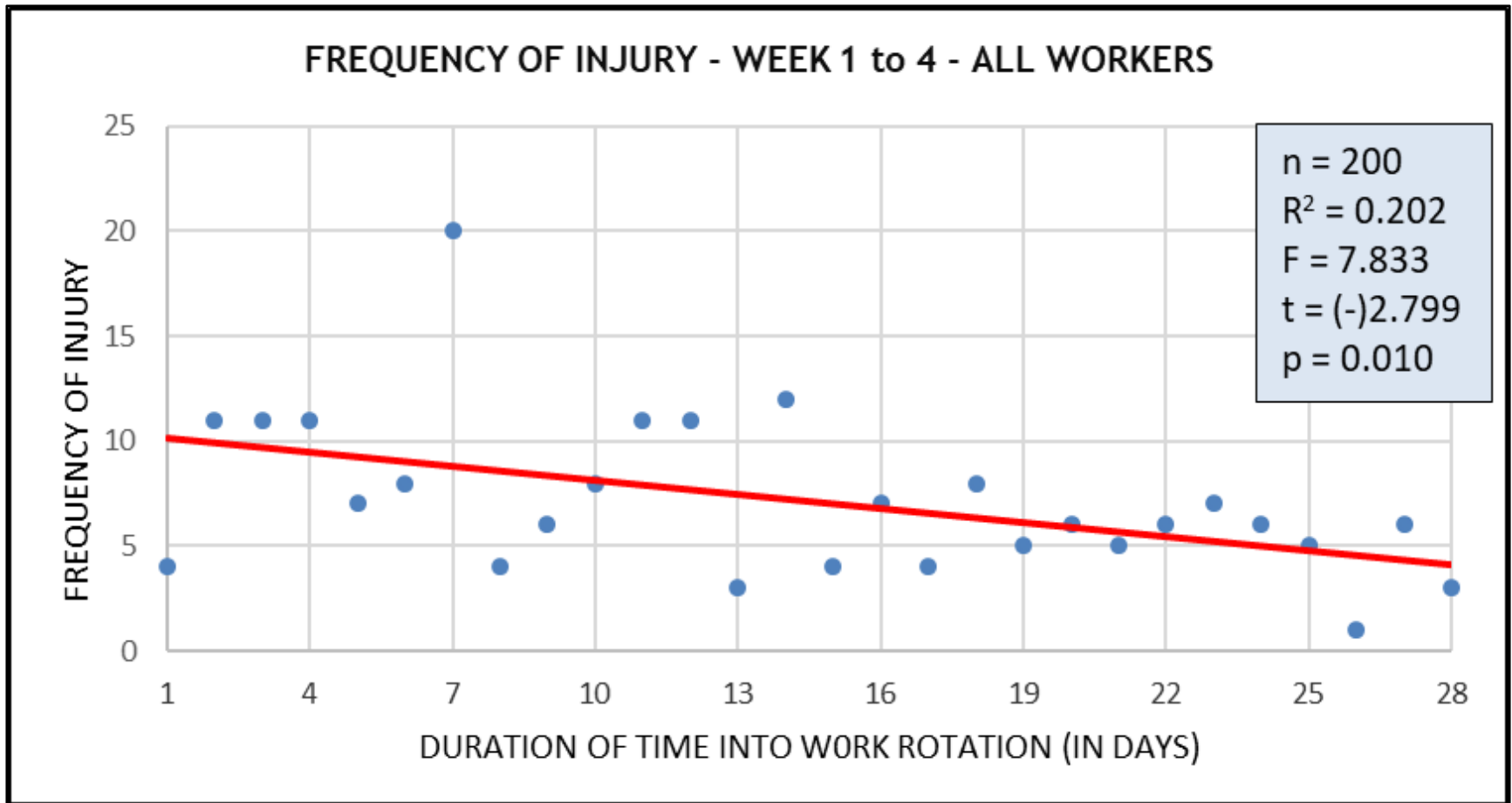
First Aid Cases 82%; no fatality

No clustering, mass or multiple injuries

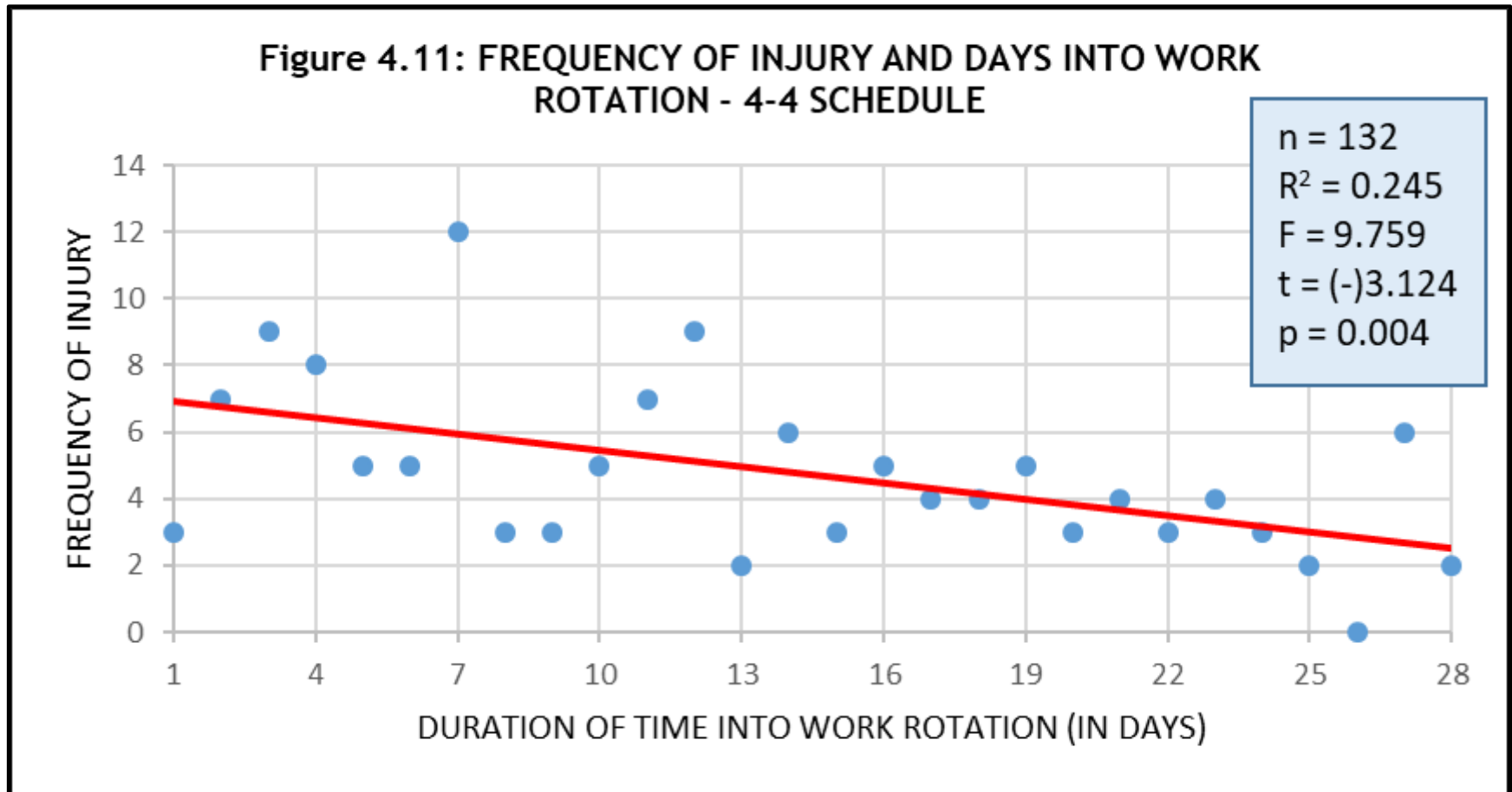
# SIGNIFICANT BASELINE DATA



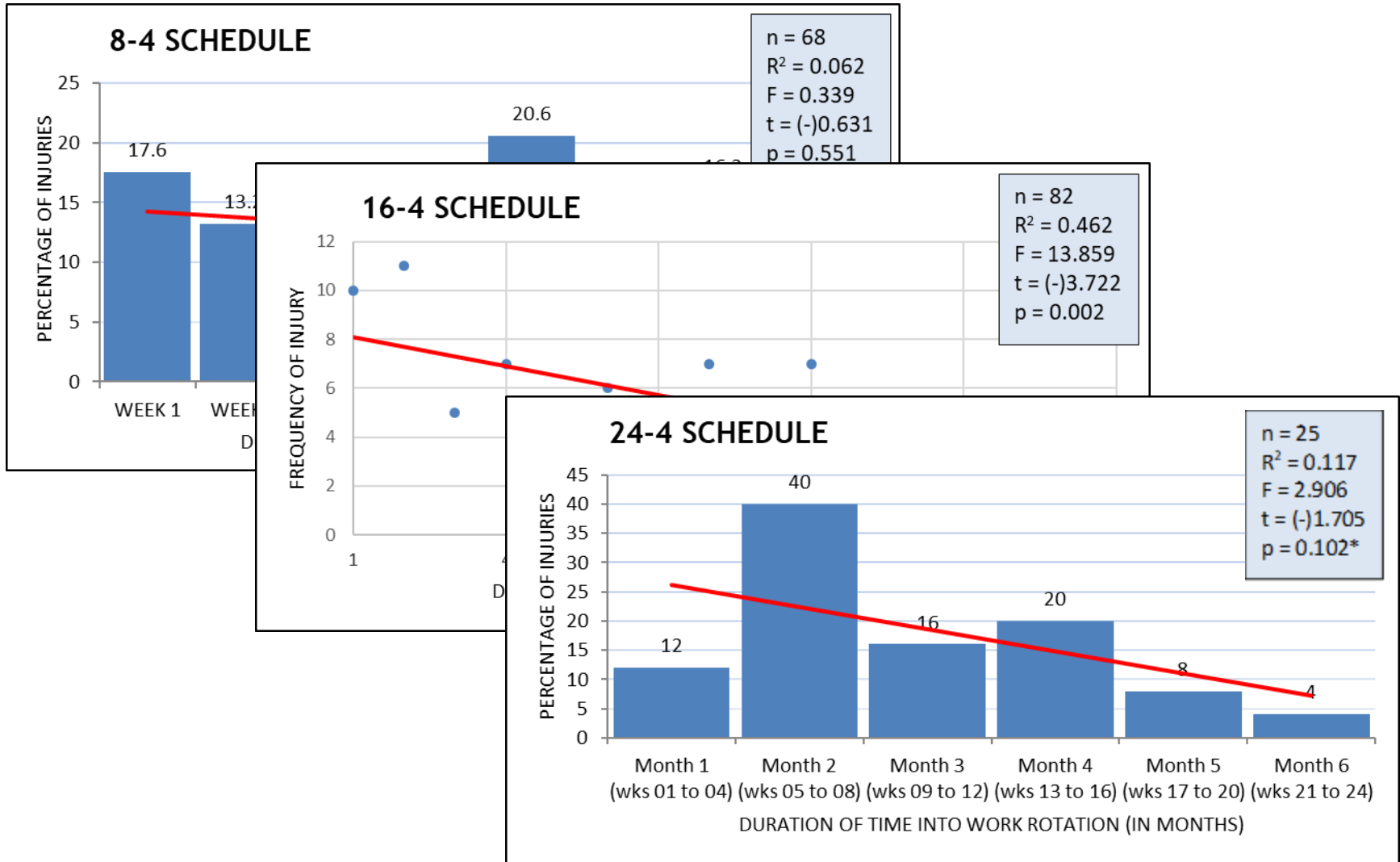
# STUDY RESULTS – ALL WORKERS



# STUDY RESULTS – 4-4 SCHEDULE

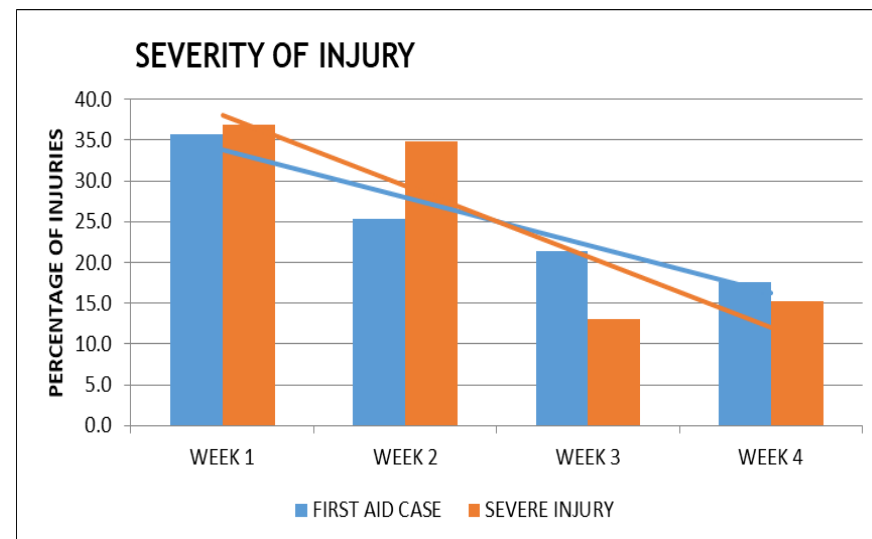
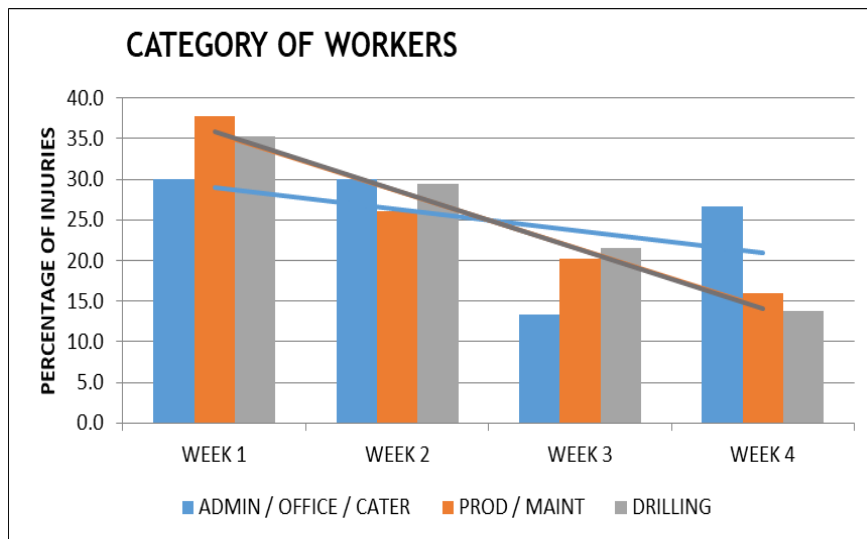
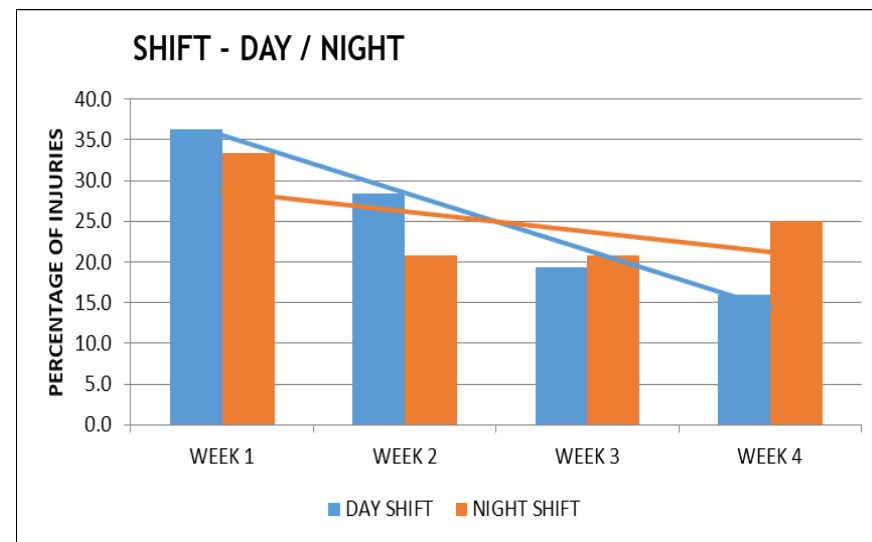
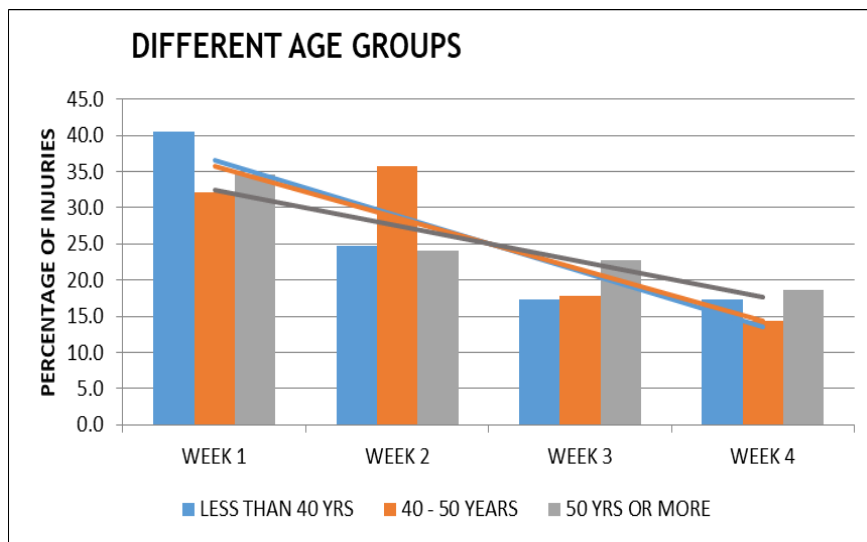


# STUDY RESULTS – OTHER SCHEDULES





# POSSIBLE CONFOUNDERS



# CONCLUSIONS

- In the first 4 weeks of work rotation there is a significant negative correlation between the incidence of injury and duration of time into the rotation.
- The negative correlation largely persists in all the rotations though not significant in all.
- The negative correlation holds true for both first aid cases and more serious injuries, for all age groups, for the various categories of work offshore, and for both day and night shift.

# PROBABLE CAUSES

## Physical factors

long hours, shift work, night duty, sleep related problems, fatigue and psychological stress.

## Individual safety behavior

influencing injury incidence, its severity and pattern.

## Organizational safety culture

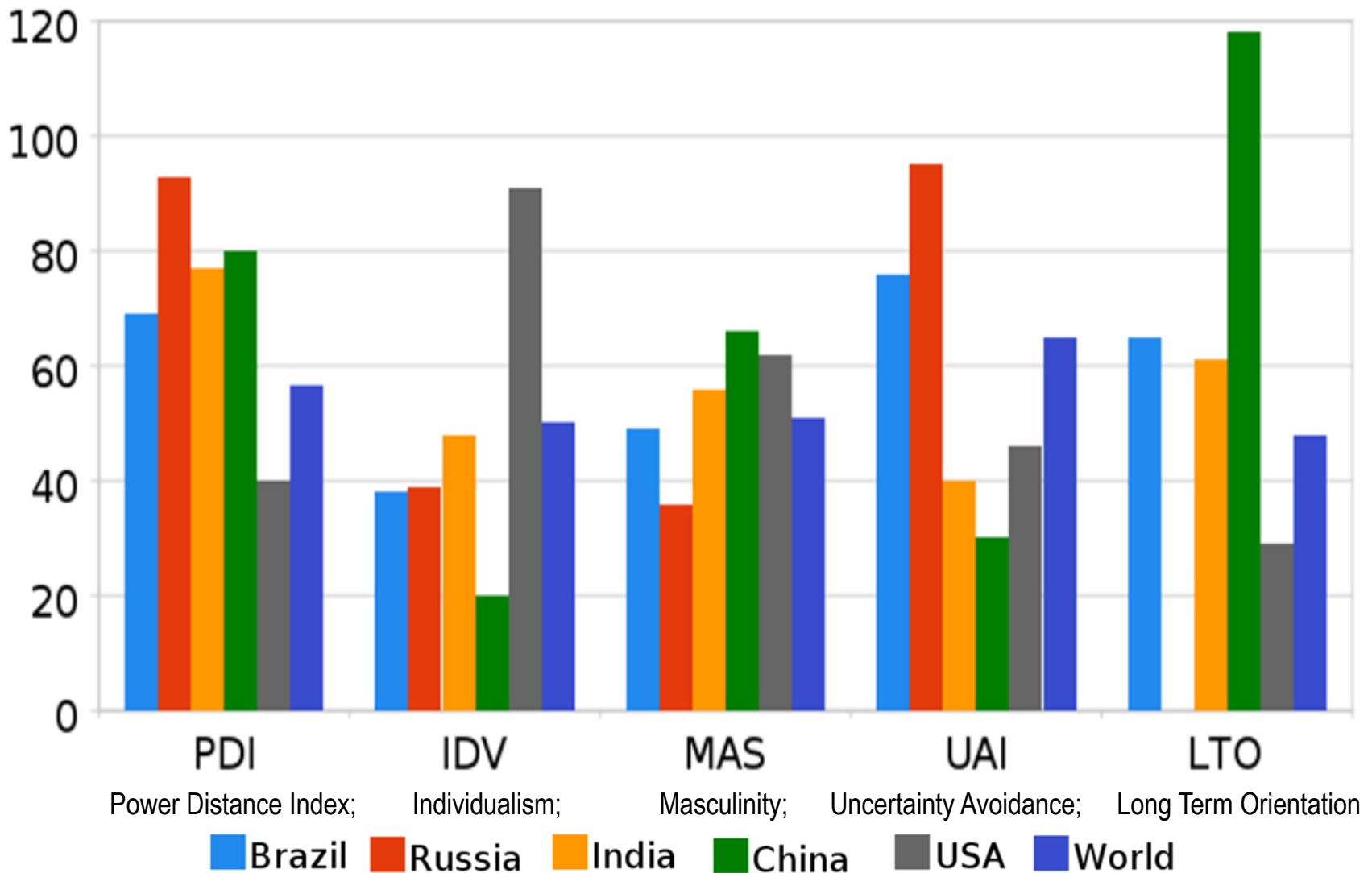
Versus

**National Culture** of risk taking and safety

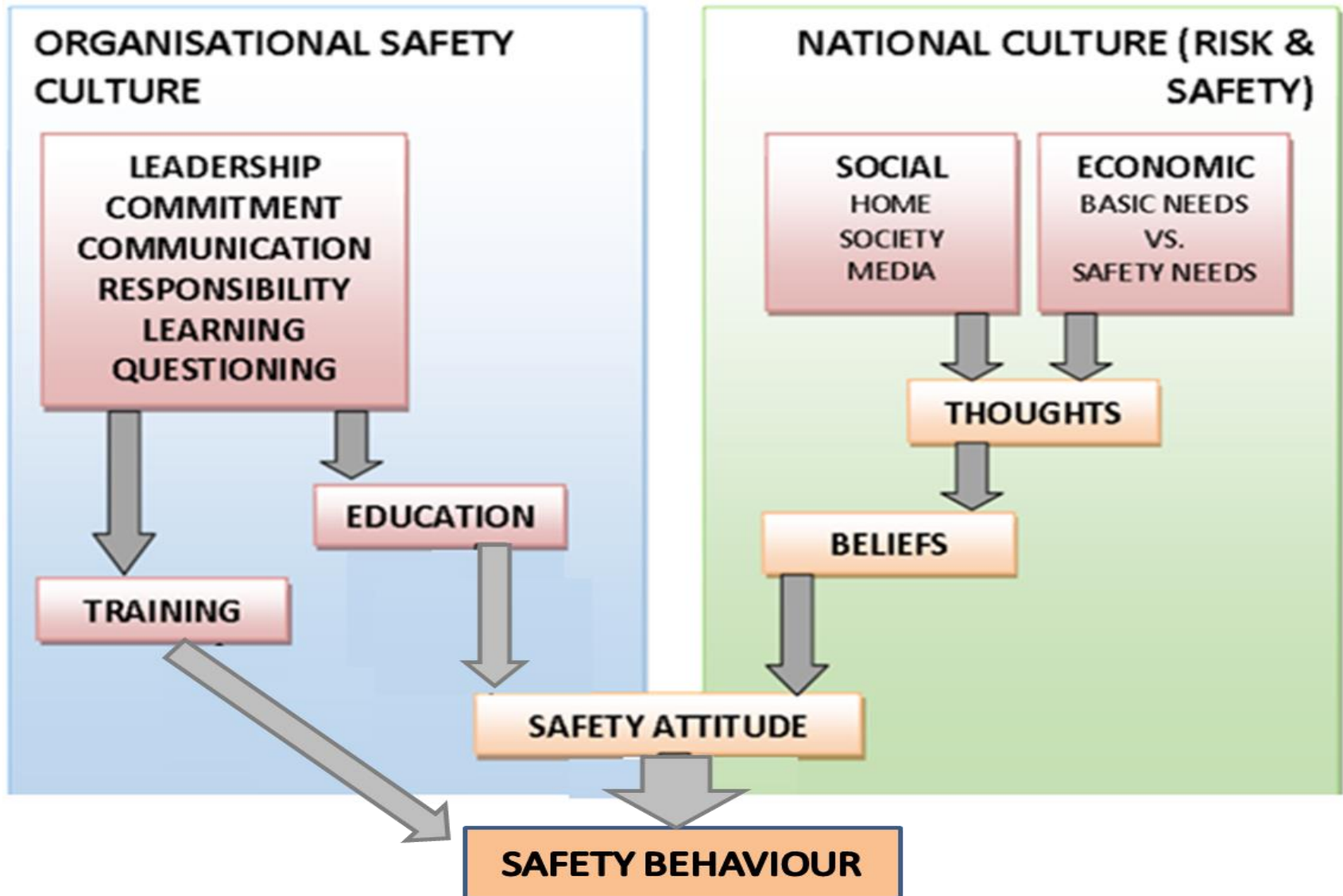


**MOST  
LIKELY**

# NATIONAL CULTURE - DIFFERENCES



# DETERMINANTS OF SAFETY BEHAVIOUR



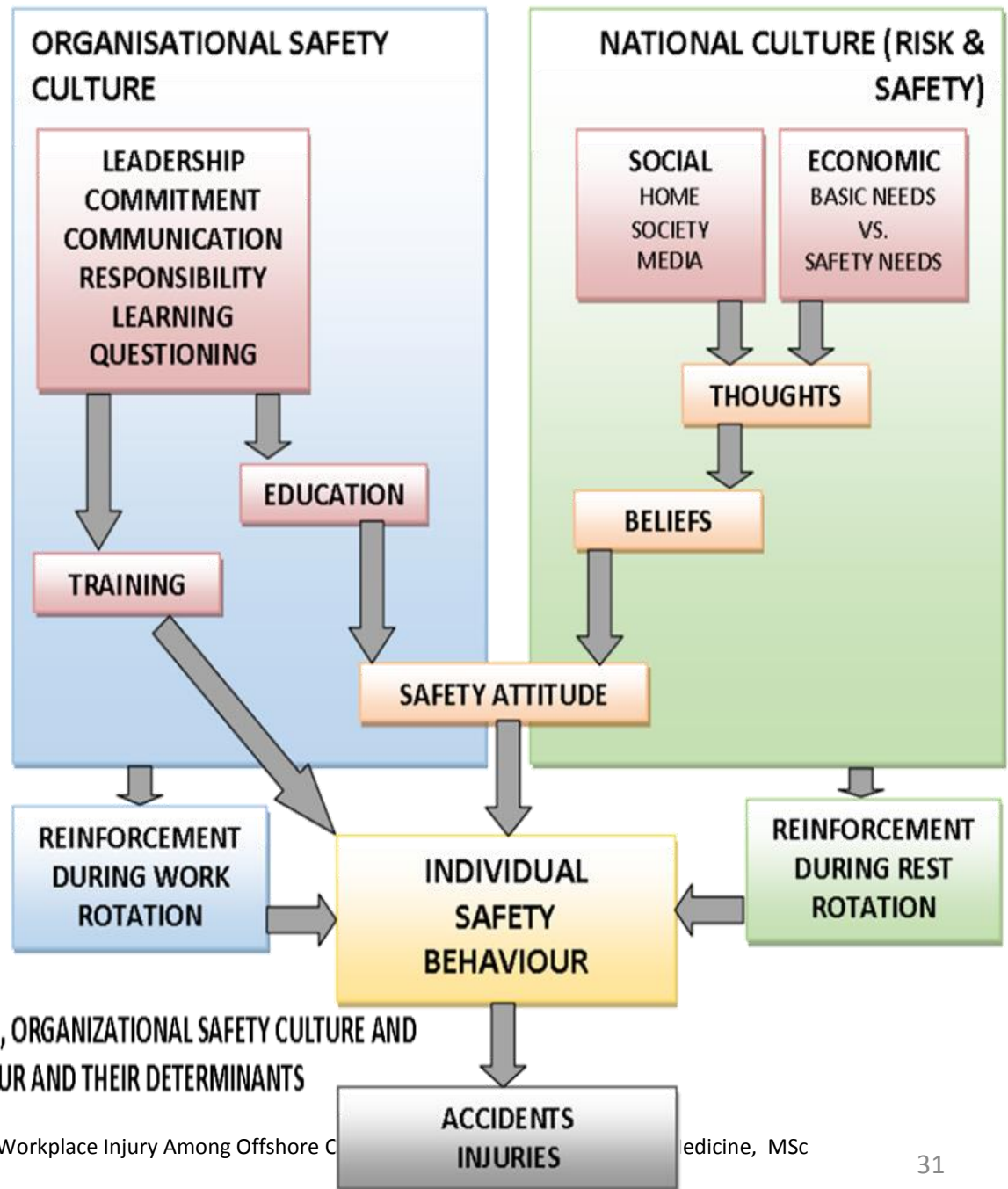
# SAFETY BEHAVIOUR AND ACCIDENTS

WHO 2006	INDIA	UK
Road fatalities / 100,000 popul.	19.5	3.5
Fatal work injuries / 100,000 popul.	98.3	0.7

WHO 2006	Fatal work injury / 100,000 popul.
UK	0.7
IRELAND	2.2
FRANCE	3.0
GERMANY	2.5
AUSTRALIA	2.1
CANADA	2.2
USA	5.3
RUSSIA	11.9
KAZAKISTAN	10.6
BAHRAIN	8.0
JORDAN	13.0
SRI LANKA	2.8
INDIA	98.3

# LIKELY CAUSE

Dissonance between a national culture, poor in safety, experienced in the 4 weeks of rest rotation in the home country and the demands of a robust organizational safety culture required to maintain safety offshore.



# LIMITATIONS

- Small study. Small number of injuries. In some subset analysis, the numbers were not adequate to compute significance.
- Single operator. Single location.
- No analysis of causation.

Further studies into the timing of injuries offshore in relation to days into work rotation and its causal relation with individual safety behavior and organizational safety culture are warranted.



# WHAT IS THE NEW WITH THIS STUDY

This study presents a **paradigm shift** and a **fundamental change** in the basic concept that determines and limits the length of offshore rotation in many parts of the world.



**Longer rotations (4 weeks or more) are safely possible**

# IMPLICATIONS - SAFETY

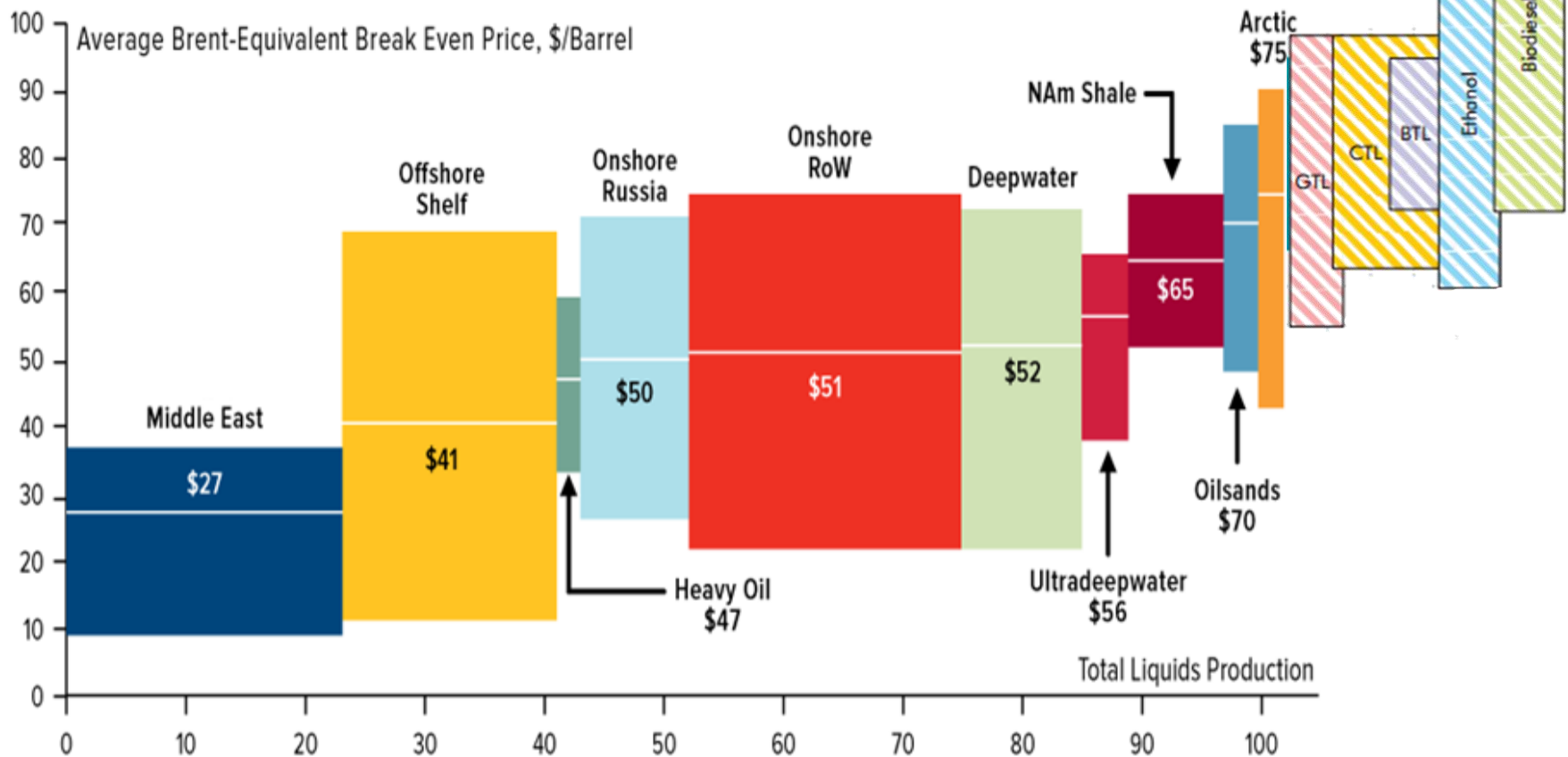
Steps to increase safety and decrease accidents offshore :

1. Safety refresher at the beginning on each rotation?
2. Different refresher for workers coming from different national cultures?



# IMPLICATIONS - COSTS

Oil and Gas is here to stay for many years as, irrespective of cost of producing oil, as the cost of alternatives is still very high.

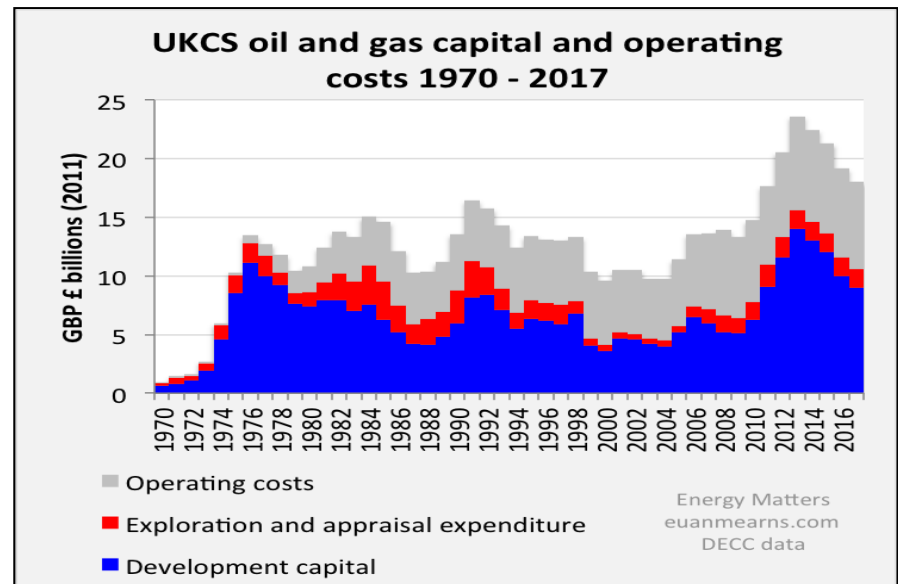
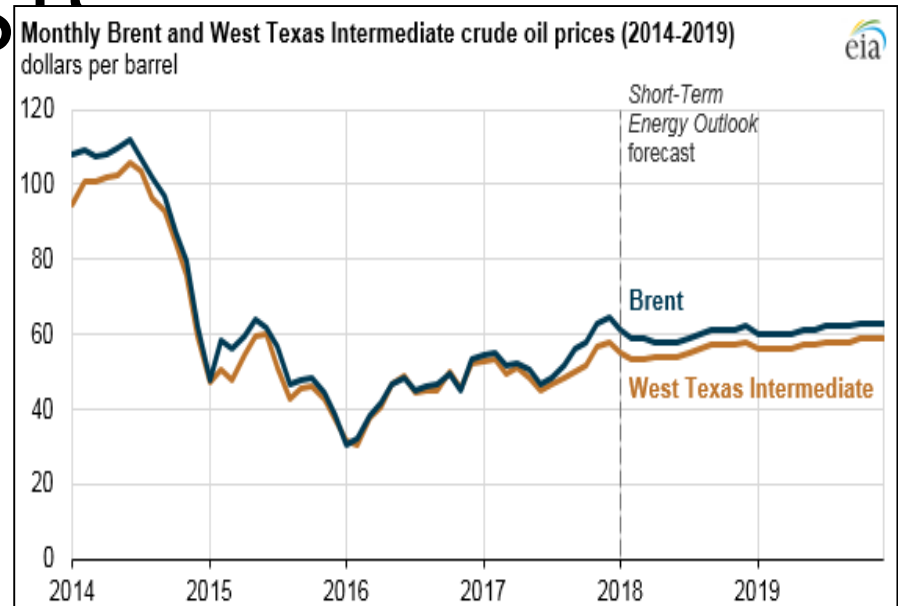


Source: Rystad Energy, Morgan Stanley, U.S. Global Investors

# IMPLICATIONS - COSTS

Oil prices are unlikely to increase over the next few years, hence necessary to cut down on operating costs to make offshore operations economically viable.

Decreasing manpower logistic cost is one of the ways of doing it!





**THANK YOU**