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The Outcome of Aeromedical Transfer of Women in Preterm Labour in Western Australia

Natalie Akl

BMedSc (Hons) research project 2010

Preterm Birth

- A myriad of short and long term complications
- The single largest cause of the world's annual 4 million neonatal deaths
- IOM report estimated the cost of PTB in the US in 2005 at **\$26.2 billion**
- Pathogenesis of preterm labour is not well understood and there is a lack of effective preventative measures.

Inborn vs. Outborn

- ▶ Evidence suggests neonatal mortality is lower in hospitals with higher level NICUs and higher volume, especially among VLBW infants
- ▶ Benefit from birth in tertiary centre inversely related to gestational age
- ▶ Outborn status associated with increased risk of death and IVH





In-Utero vs. Postnatal Transfer

- ▶ Reduced ventilator time, reduced oxygen received, shorter mean NICU stay
- ▶ Lower mortality rates and lower severe morbidity:
 - ▶ Respiratory distress syndrome
 - ▶ Bronchopulmonary dysplasia
 - ▶ Intraventricular haemorrhage
 - ▶ Patent ductus arteriosus
- ▶ Increased incidence of IVH, RDS, PDA and nosocomial infections associated with transfer of VLBW infants

Management of preterm birth outside tertiary centres in WA

- ▶ Vast distances
- ▶ Transfer often by air
 - ▶ The decision to transfer must balance the risk of in-flight delivery with the risk of delivery in a less than optimal facility



RFDS in the literature

- ▶ A preliminary analysis evaluated the outcome of the routine use of beta-sympathomimetic tocolysis for aeromedical evacuation of women in preterm labour in WA: (Tsokos 1988)
 - ▶ 99 consecutive maternal aerial transfers for preterm labour in 1983 and 1984
 - ▶ No in-flight deliveries
 - ▶ 1 case of pulmonary oedema and 2 cases of maternal hyperglycaemia



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Aim

Describe the outcome of aeromedical transfer of women in preterm labour in WA

Specific objectives:

- Determine the success of this practice in terms of delayed time to delivery
- Describe complications of this practice, in particular relating to the use of salbutamol
- Determine the effectiveness of fetal fibronectin testing in this setting
- Generate hypotheses for future investigation in the area of prevention of preterm birth



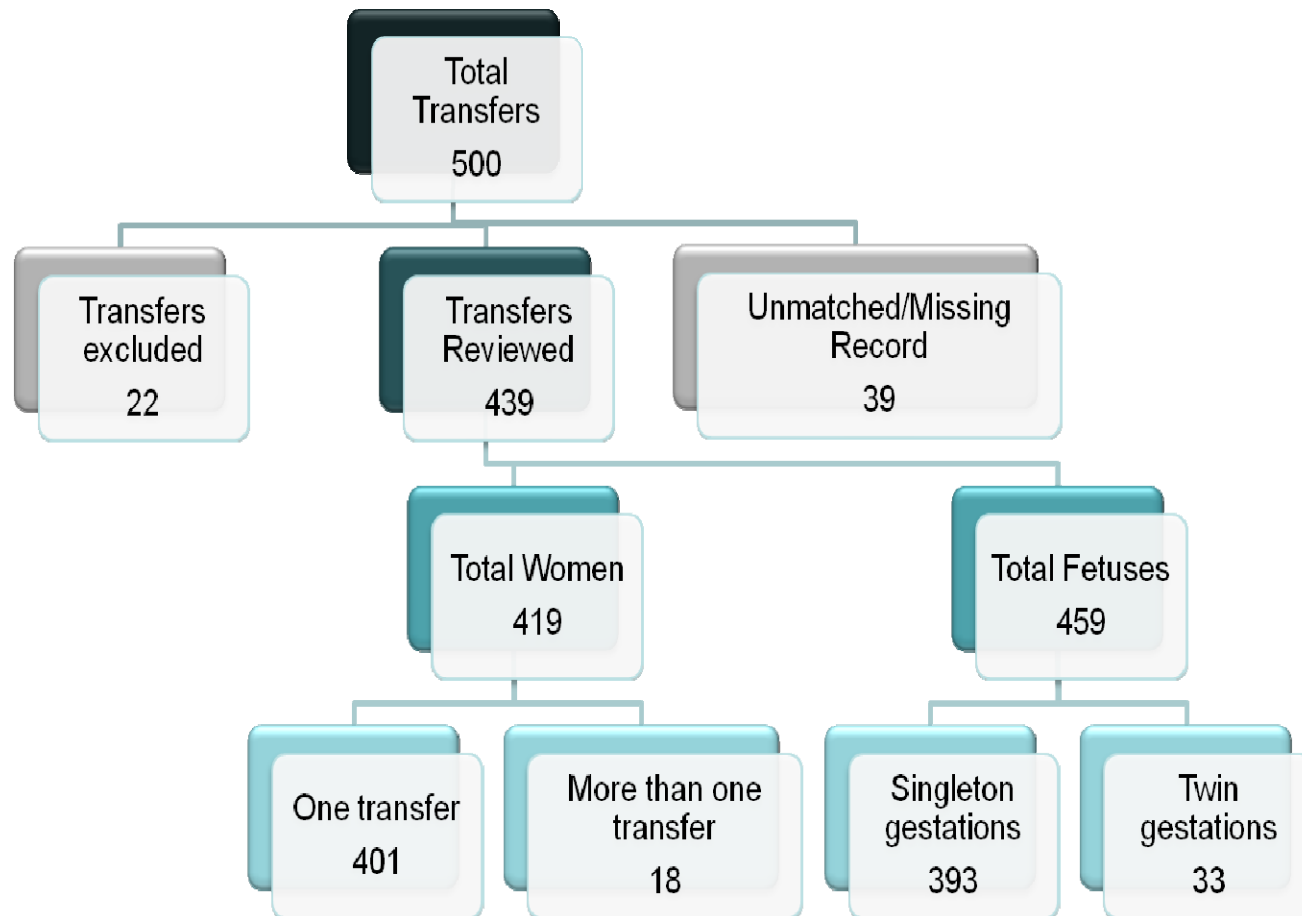
Study Design

- ▶ A retrospective observational study :
 - ▶ 500 consecutive RFDS transfers of women in preterm labour to KEMH, over a period ending December 31 2009.
- ▶ Limitations:
 - ▶ Sampling bias: does the selectivity of managing doctors ensure women at the greatest risk of imminent delivery are not transferred?

Methods

- ▶ Cases identified from RFDS medical database
 - ▶ Included women in established or threatened preterm labour, with or without rupture of membranes.
- ▶ Medical records retrieved from KEMH
 - ▶ Maternal demographics, obstetric history, assessment, neonatal outcomes.
- ▶ Flight data from RFDS aviation database
- ▶ Statistical analysis in collaboration with WIRF biostatistics team
 - ▶ Summary statistics - frequency distributions for categorical data, medians and IQR for continuous data
 - ▶ Categorical outcomes – chi-squared test
 - ▶ Kaplan-Meier survival estimates and log-rank tests were used to assess potential factors influencing time to delivery.

Study Population



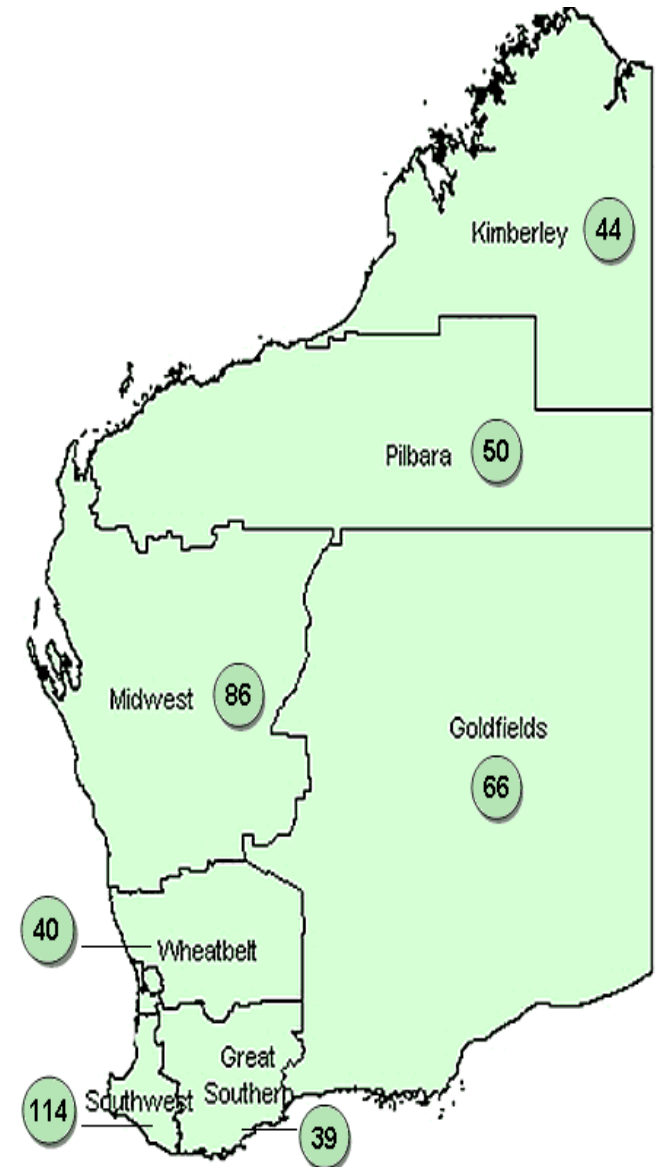
Baseline Characteristics

Maternal	Neonatal
Median age: 26.4 years	Median gestational age at birth: 34 weeks
Median gestation: 32 weeks	87% preterm
28.5% ATSI	10 stillbirths, 6 neonatal deaths
34.5% smoked during pregnancy	Median arterial cord blood: 7.30
52% had a complication in current pregnancy	42% required NICU admission

Transfer Characteristics

- Median total flight time: **76 minutes**
- Median flight distance: **393 km**
- 23% of transfers >1000km
- The median maximum ambient altitude for all transfers legs was **20,000 feet**, the median maximum cabin altitude was **6,500 feet**.
- Minimum oxygen saturation recorded was **92%**

No deliveries occurred in-flight.

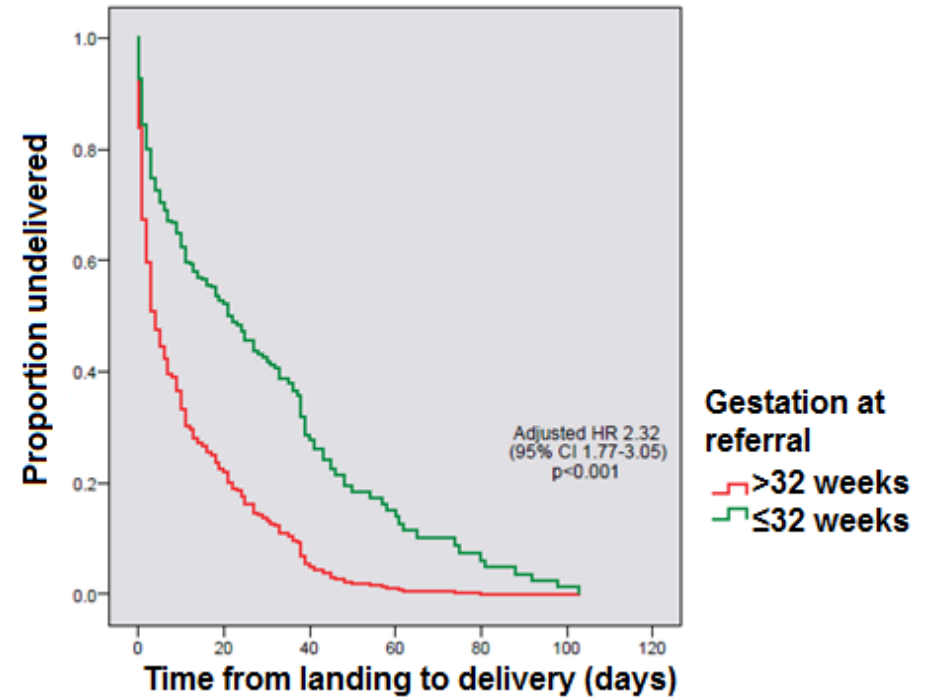
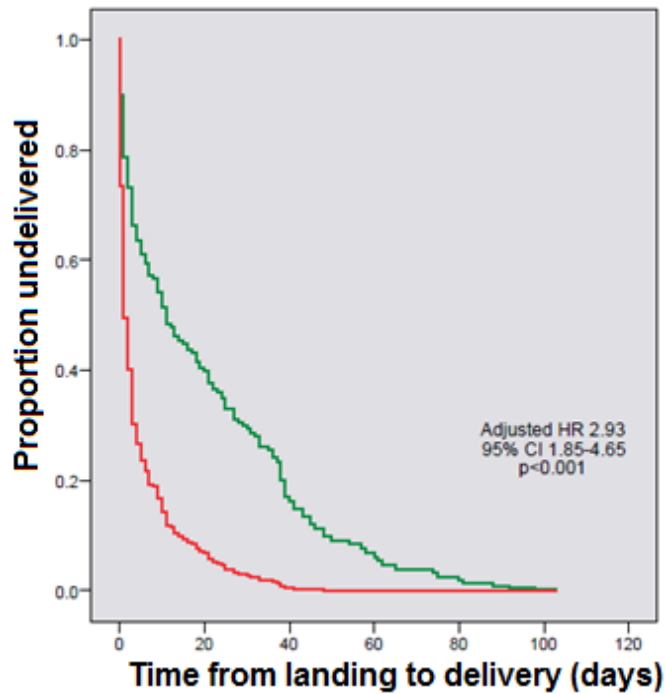
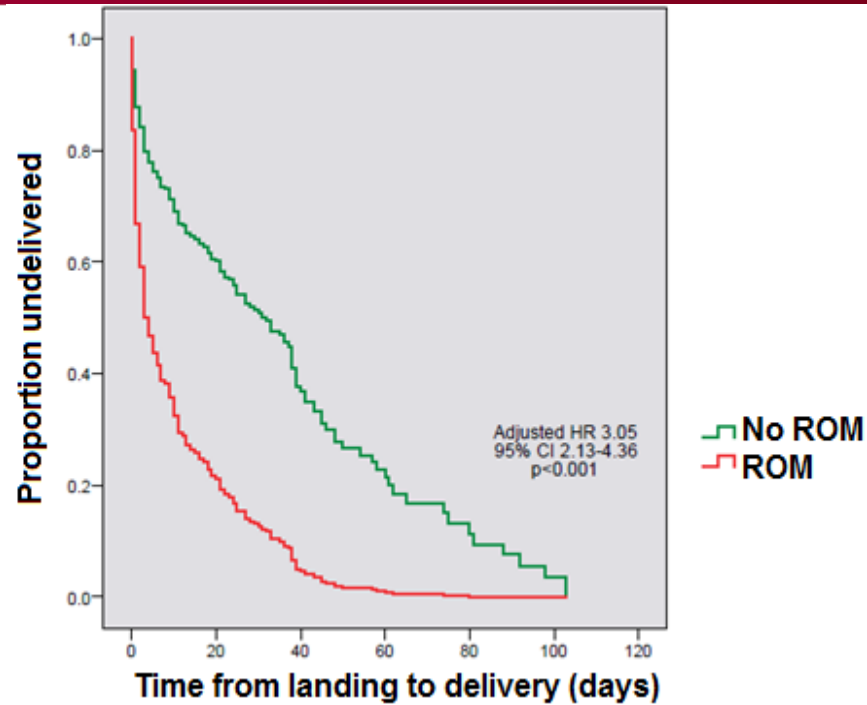


Clinical factors and time to delivery



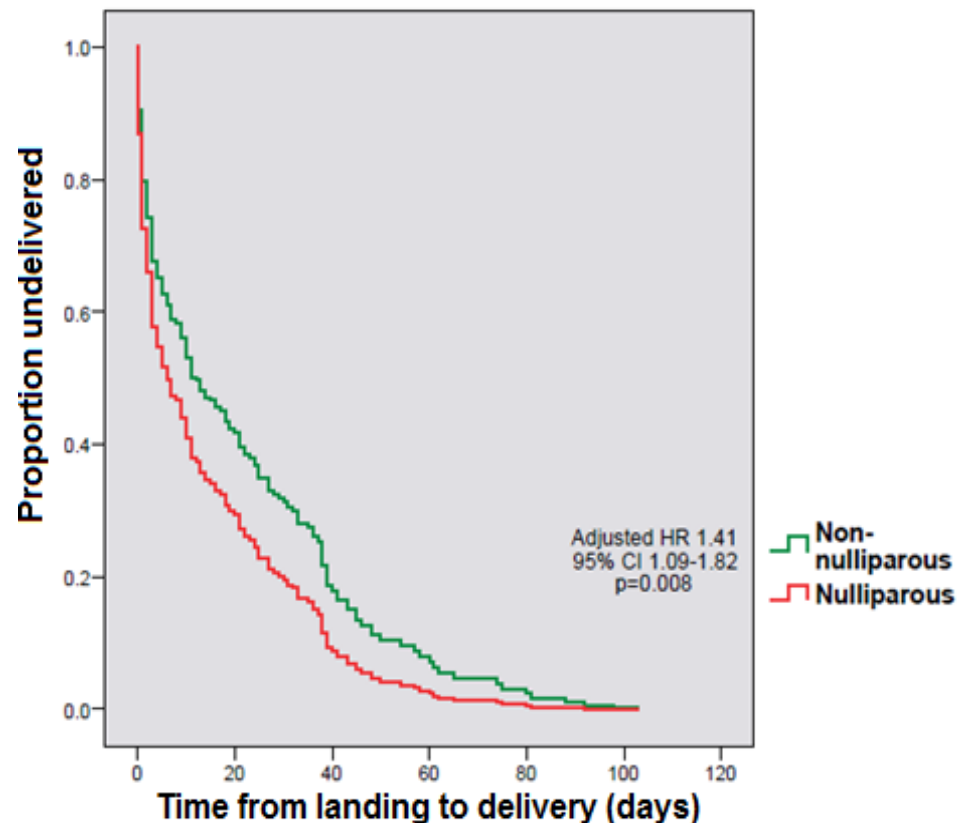
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Factor	Median (Q1-Q3) time to delivery (days)	Univariable analysis		
		HR	95% CI	p-value
Membranes				
intact	17 (2-38)	1.00		
ruptured	3 (1-11)	1.78	1.42-2.24	<0.001
Cervical dilatation				
< 4 cm	10 (2-32)	1.00		
≥ 4 cm	1 (1-2)	3.28	2.09-5.16	<0.001
Gestation				
≤ 32 weeks	14 (3-39)	1.00		
> 32 weeks	3 (1-16)	2.08	1.63-2.66	<0.001



Parity and time to delivery

- Rates of delivery were significantly increased in nulliparous women relative to non-nulliparous (ie. parous) women (**HR 1.39**, 95% CI 1.10 – 1.75, **p=0.005**)
- Median time to delivery: 3 days vs. 11 days



Transfer variables and delayed delivery

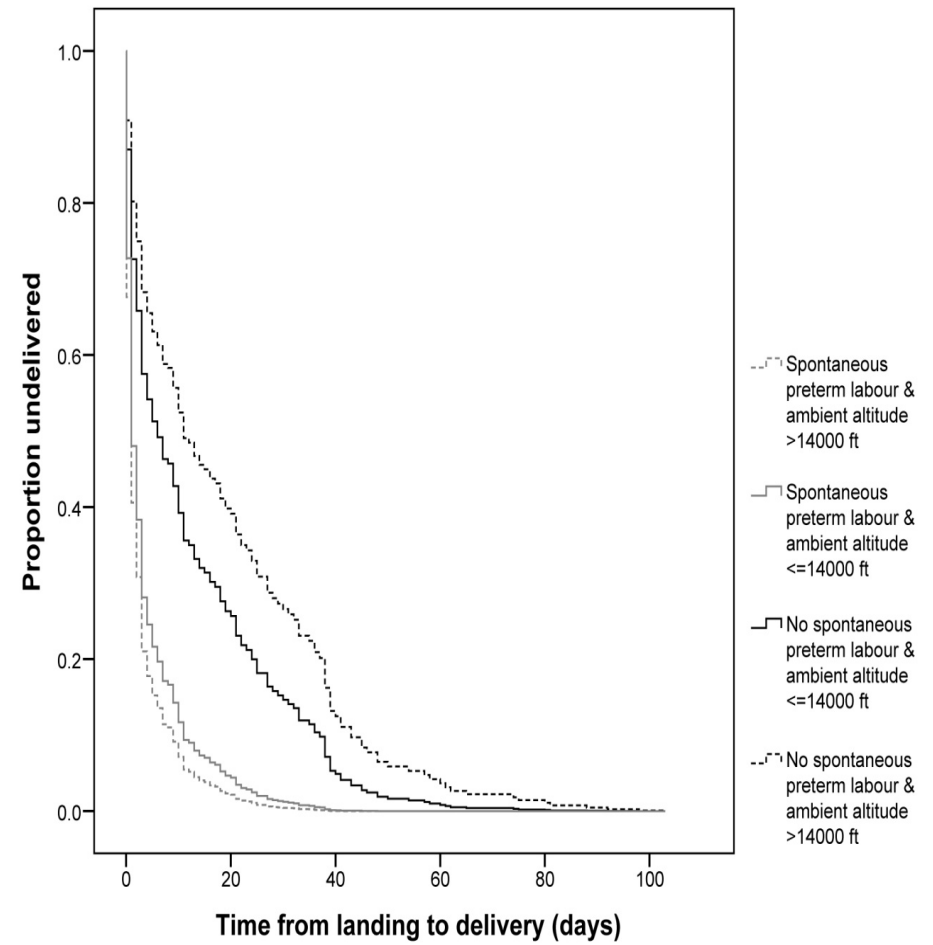
- Significant correlation between transport time and distance travelled ($r=0.988$, $p<0.001$).
- Distance also correlated with ambient altitude and cabin altitude

Factor	Median (Q1-Q3) time to delivery (days)	Univariable analysis		
		HR	95% CI	p-value
Ambient altitude				
< 14 000 ft	4 (1-22)	1.00		
> 14 000 ft	9 (2-35)	0.68	0.53-0.87	0.003
Cabin altitude				
Sea level	7 (1-24)	1.00		
> Sea level	7 (1-31)	0.76	0.58-0.99	0.158
Time				
\leq 1 hour	7 (1-25)	1.00		
> 1 hour	8 (2-32)	0.78	0.62-0.98	0.019
Distance				
\leq 1000 km	6 (1-24)	1.00		
> 1000 km	11 (1-38)	0.75	0.57-0.99	0.032

Adjusted effect of ambient altitude

Factor	HR	95% CI	p-value
no SPTL & \leq 14000	1.00		
no SPTL & $>$ 14000	0.69	0.50 - 0.94	0.020

SPTL = spontaneous preterm labour, defined as regular contractions of at least 1 in 10 minutes associated with cervical changes



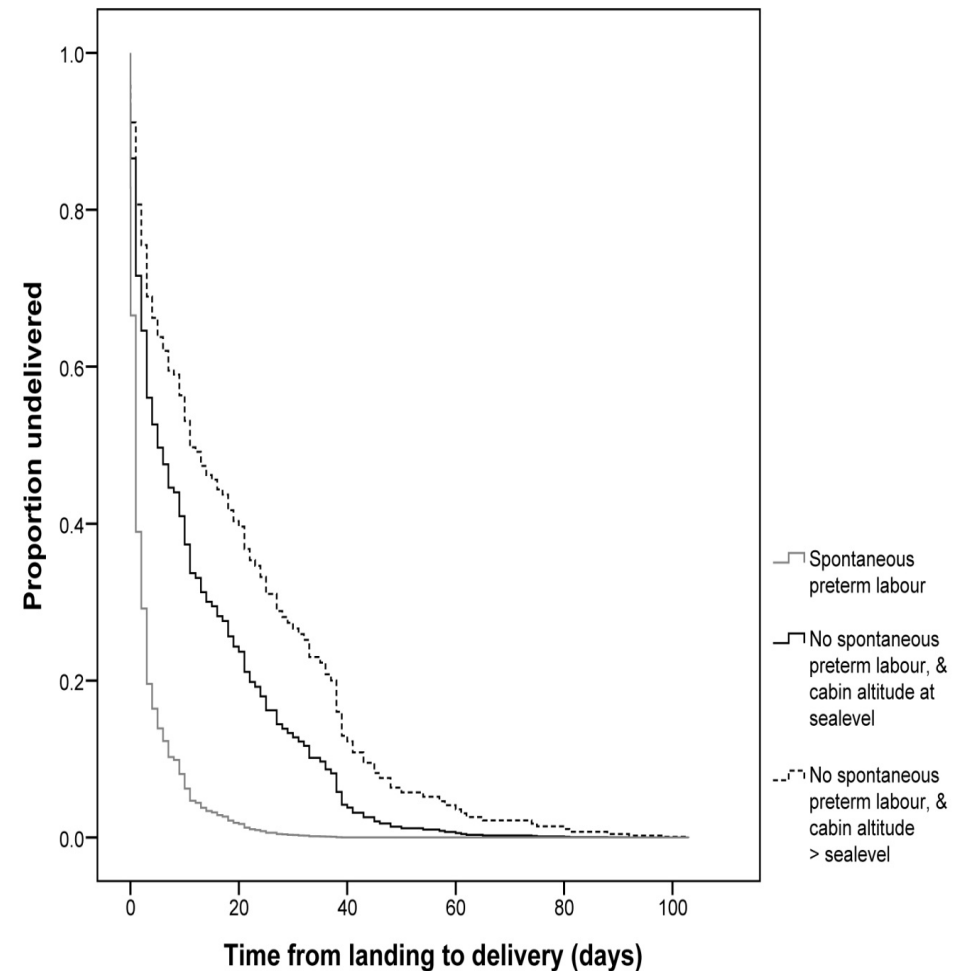
Adjusted effect of cabin altitude



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Factor	HR	95% CI	p-value
no SPTL & sea level	1.00		
no SPTL & > sea level	0.66	0.46 - 0.94	0.022

SPTL = spontaneous preterm labour, defined as regular contractions of at least 1 in 10 minutes associated with cervical changes



Conclusion

- This study has confirmed that aeromedical transfer of women presenting with preterm labour in WA is safe
 - Ambient altitudes greater than 14,000 feet and cabin altitude above sea level appear to **enhance** the effect of delaying delivery in women not in established preterm labour
- Identifying women who are at a lower risk of delivery to **prioritise transfers**
- The balance between the harms and benefits associated with the rates of **essential antenatal transfers** and rates of **neonatal transfer** that are appropriate or reasonable is unknown.

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Thank You

