

PRAGMATIC META-ANALYSIS OF PROPORTIONAL ASSIST VENTILATION+ VERSUS PRESSURE SUPPORT VENTILATION AND ITS IMPACT ON COST EFFECTIVENESS

R. Saunders¹, J. Davis¹, K.J. Bosma^{2,3}

1. Coreva Scientific, Königswinter, Germany; 2. Department of Medicine, University of Western Ontario, London, Canada; 3. London Health Sciences Centre, London, Ontario, Canada

Background

- Clinical studies of mechanical ventilation (MV) are often small with large uncertainty in outcomes [1,2]
- Meta-analysis provides a method to combine data into a single estimate of efficacy
- A meta-analysis of proportional assist ventilation+ (PAV+) versus pressure support ventilation (PSV) was recently undertaken but did not report on outcomes relevant to our cost-effectiveness model [3]
- A pragmatic meta-analysis was undertaken to provide estimates of efficacy and explore how data sources used impact on outcomes.

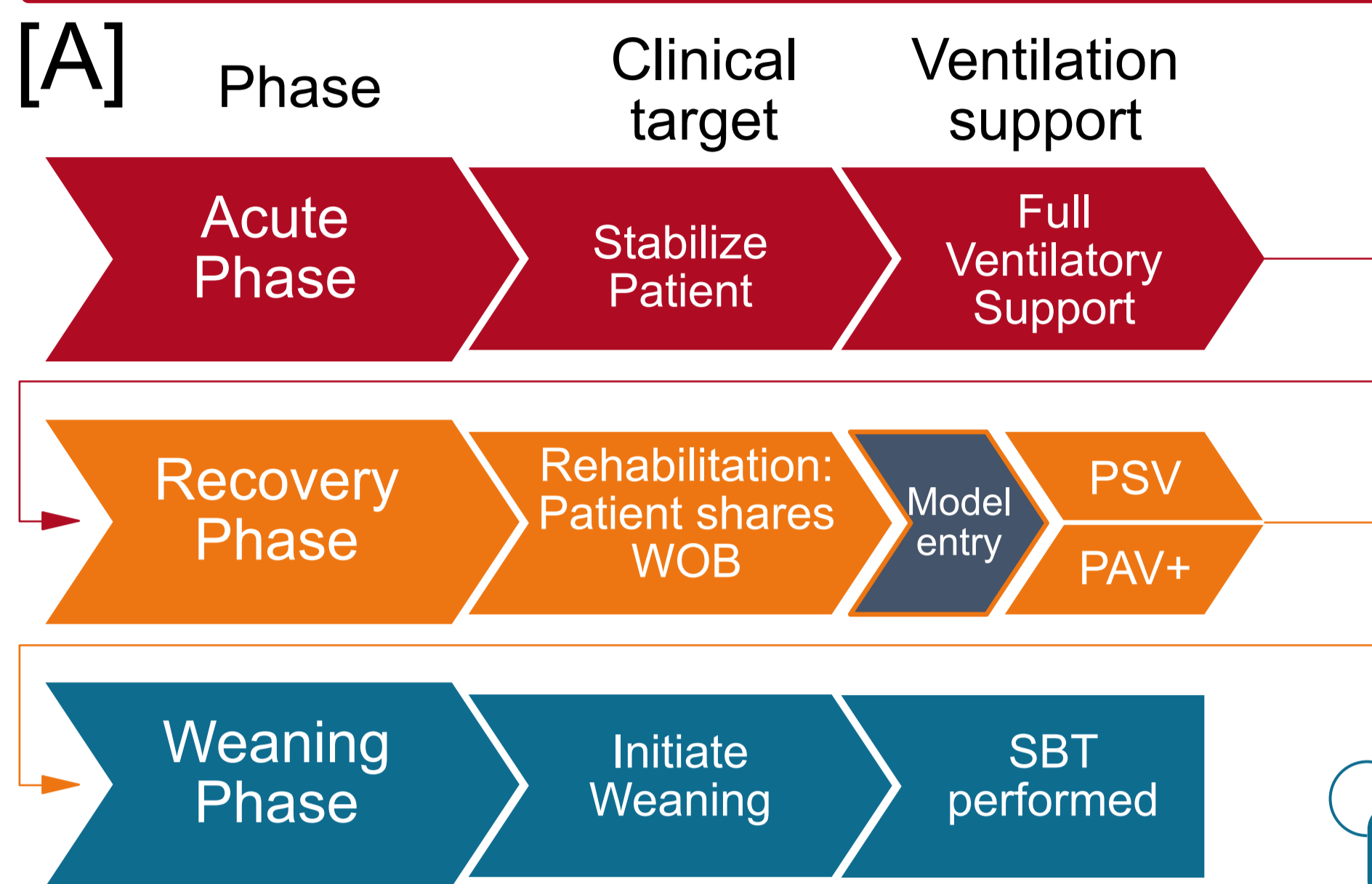


Fig.1 [A] Clinical pathway of mechanical ventilation

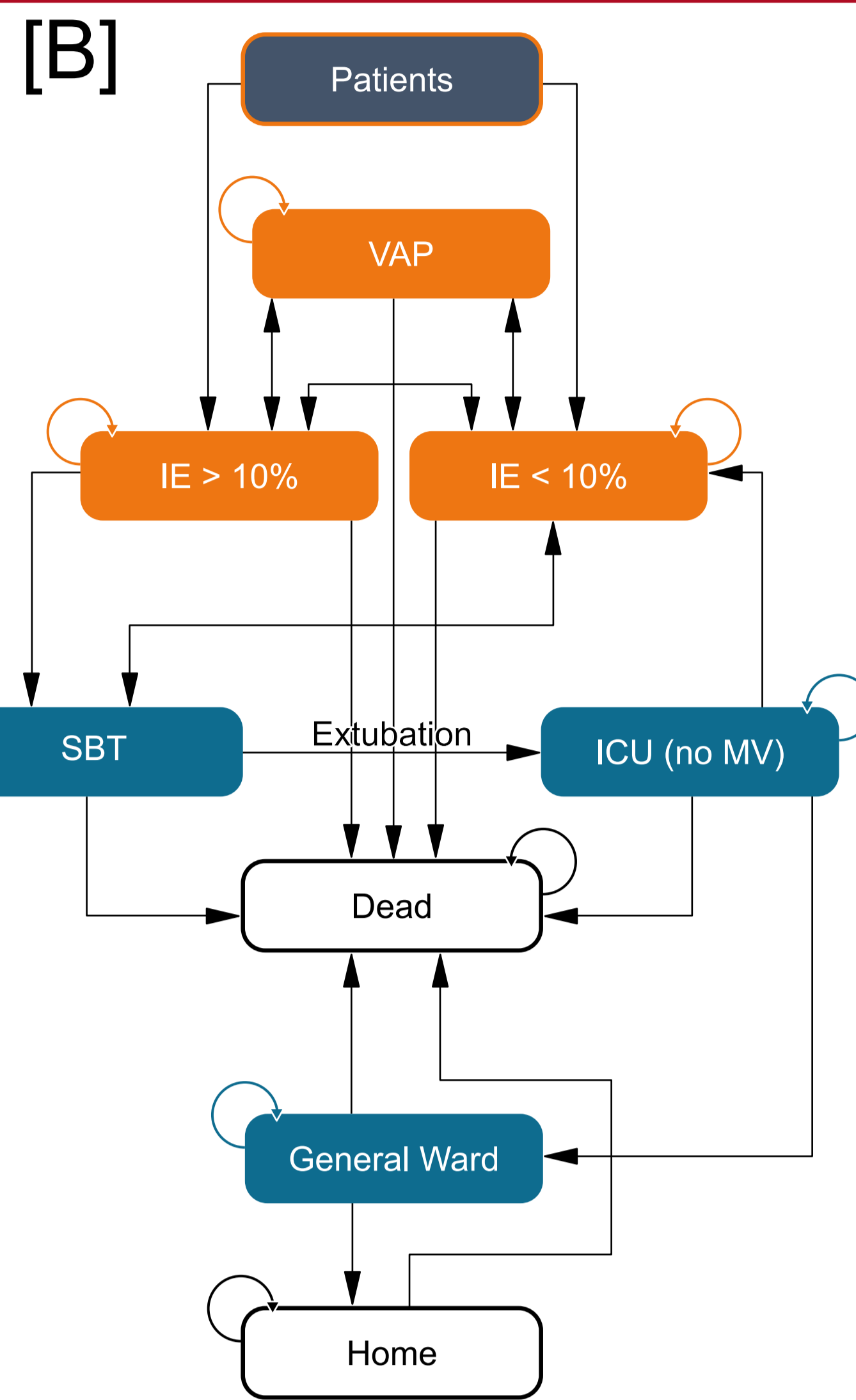


Fig.1 [B] Flow of the Markov model, simulating clinical practise in Canada.

VAP: Ventilator-associated Pneumonia, IE: Ineffective efforts, PSV: pressure support ventilation, PAV+: proportional assist ventilation+, ICU: Intensive care unit, MV: Mechanical ventilation, SBT: Spontaneous breathing trial, WOB: work of breathing

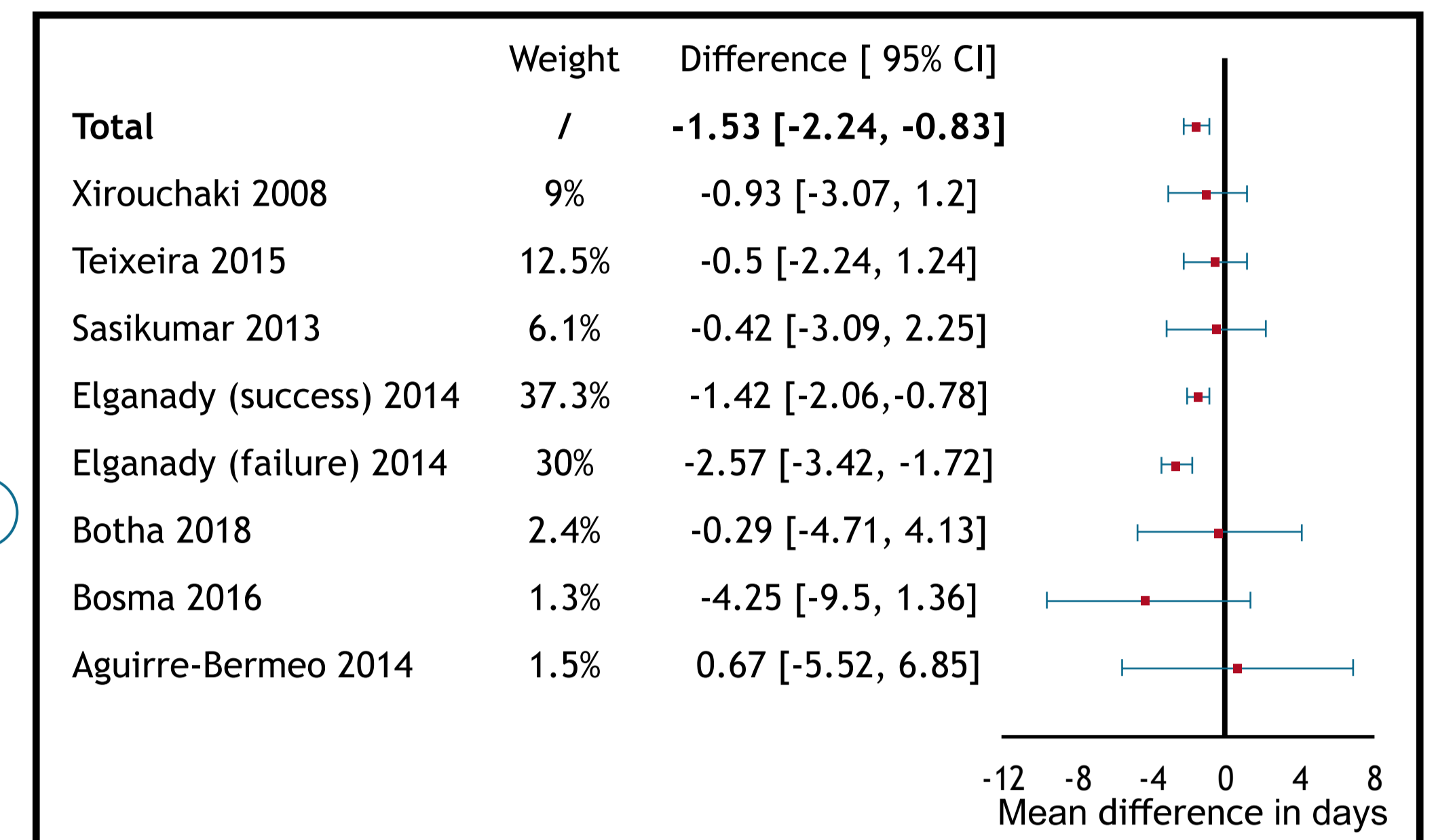


Fig.2 Forest plot of time from randomization to extubation or death.

Methods

- A Markov-model of patient care from MV in the intensive care unit (ICU) through to discharge home or death was developed for the Canadian setting (Fig. 1)
- Structured searches identified studies of PAV+ versus PSV that were then subject to meta-analysis
- Outcomes of interest were:
 - MV/ICU/hospital time
 - ICU/hospital mortality
- The model was populated with efficacy inputs from either Canadian trials or meta-analysis estimates
- Outcome parameters:
 - 20 years time horizon
 - Costs in 2017 CAD
 - Quality-adjusted life years (QALYs) using EQ-5D
- A sensitivity analyses (n=2,000) was performed, using a willingness-to-pay (WTP) threshold of CAD 50,000 per QALY gained

Results

- Seven studies comparing PAV+ with PSV were identified (Fig. 2)
- A total of 271 PAV+ patients and 253 PSV patients
- Meta-analysis included at least 4 studies for each outcome
- Heterogeneity was low ($I^2 \leq 24\%$) and PAV+ was associated with a significant reduction in time on MV (Fig. 2), in the ICU, and in hospital
- Using Canadian data the Cost of care and quality of life results were:
 - PSV: CAD 141,003 and 6.07 QALYs gained
 - PAV+: CAD 129,333 and 6.29 QALYs gained
 - This makes PAV+ dominant.
- With meta-analysis data, PAV+ cost CAD 147,276 and accrued 6.98 QALYs over 20 years
- Therefore PAV+ was cost effective at CAD 21,100 per QALY gained
- The sensitivity analysis revealed that in the Canadian scenario 80% of simulations were under the WTP threshold, compared with 100% when using meta-analysis (Fig. 3)

References

- Bosma KJ, Read BA, Bahrgard Nikoo MJ, Jones PM, Priestap FA, Lewis JF. A Pilot Randomized Trial Comparing Weaning From Mechanical Ventilation on Pressure Support Versus Proportional Assist Ventilation. Crit Care Med. 2016;44(2):1-11.
- Botha J, Green C, Carney I, Haji K, Gupta S, Tiruvoipati R. Proportional assist ventilation versus pressure support ventilation in weaning ventilation: a pilot randomised controlled trial. Crit Care Resusc. 2018;20(1):33-40.
- Tirupakuzhi Vijayaraghavan BK, Hamed S, Jain A, et al. Evidence Supporting Clinical Use of Proportional Assist Ventilation: A Systematic Review and Meta-Analysis of Clinical Trials. J Intensive Care Med. January 2018:885066618769021.

Conclusion

- Efficacy data from individual trials as compared to meta-analysis substantially changed the numerical outcomes of the model
- However the interpretation remained the same: PAV+ is expected to be cost effective for mechanical ventilation in Canada



View PDF

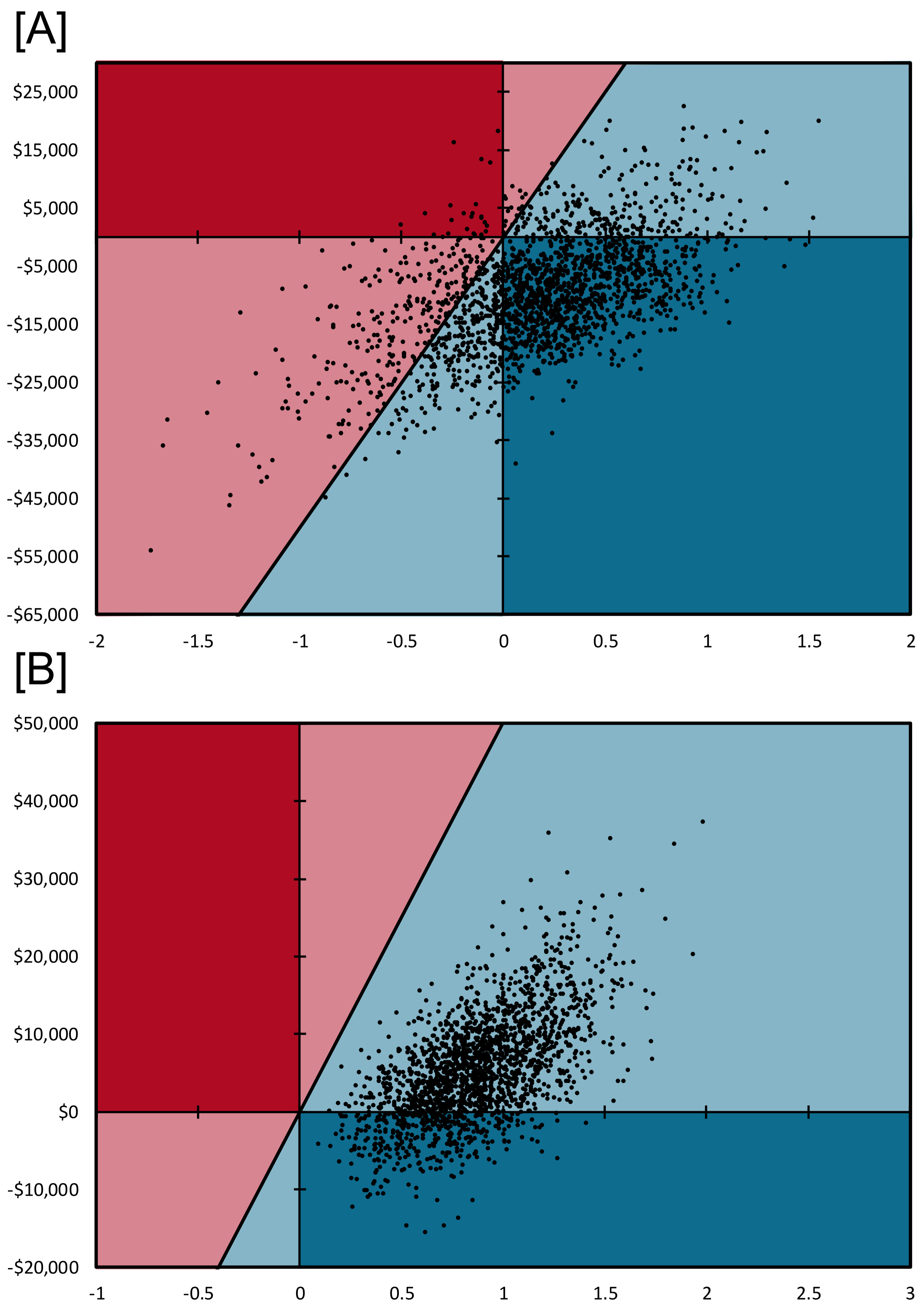


Fig.3 [A] Sensitivity analysis for data from a single study

[B] Sensitivity analysis for data from a meta analysis

The diagonal line represents the willingness to pay threshold of 50,000 per QALY gained in both graphs. Dark red: dominated; light red: not cost-effective; light blue: cost-effective; dark blue: dominant