

## AUTHORS

L. MARCHETTO<sup>1</sup>,  
 F. VIEIRA<sup>2,3</sup>,  
 A. FLOH<sup>2,4,5</sup>,  
 K. REISE<sup>5</sup>,  
 M. NONOYAMA<sup>6,7</sup>,  
 A. GOODWIN<sup>8</sup>,  
 I. TELIAS<sup>2,3</sup>,  
 L. BROCHARD<sup>2,3</sup>,  
 L. RODRIGUEZ GUERINEAU<sup>2,4,5</sup>

<sup>1</sup> Department of Paediatric Critical Care, SickKids, Toronto, Canada  
<sup>2</sup> Interdepartmental Division of Critical Care, University of Toronto, Toronto, Canada  
<sup>3</sup> Keenan Centre for Biomedical Research, Li Ka Shing Knowledge Institute, St. Michael's Hospital, Toronto, Canada  
<sup>4</sup> Cardiac Critical Care Unit, Department of Paediatric Critical Care, SickKids, Toronto, Canada  
<sup>5</sup> Department of Paediatrics, University of Toronto, Toronto, Canada  
<sup>6</sup> Department of Respiratory Therapy, SickKids, Toronto, Canada  
<sup>7</sup> Faculty of Health Sciences, Ontario Tech University, Oshawa Ontario  
<sup>8</sup> School of Biomedical Engineering, University of Sydney, Sydney, New South Wales, Australia

## CONTACT INFORMATION

Luca Marchetto  
 Research Fellow  
 Department of Critical Care,  
 Hospital for Sick Children  
 luca.marchetto@sickkids.ca

## INTRODUCTION

- Mechanical ventilation (MV) is a life-saving support but associated with time-sensitive morbidities.<sup>1</sup>
- Determination of extubation-readiness is imperfect, with reported failure rate of 4–19% in children and associated with worse outcomes;<sup>2</sup>
- Spontaneous Breathing Trials (SBTs) are the standard-of-care to guide timing of extubation and have been shown to decrease duration of MV and ventilator-associated complications;<sup>3</sup>
- There is variability in how to conduct (PS/CPAP vs CPAP) and interpret SBT in children;<sup>4</sup>
- Assessment of SBT outcome (pass/fail) is particularly challenging in the pediatric population (newborns to teenagers), due to the maturational changes of the respiratory system with **age-specific normal ranges of respiratory variables**;
- Understanding **the physiological changes and behavior** of adult-validated indexes in children with negative SBT outcome **may better identify patients at risk for SBT failure**

## RATIONALE & OBJECTIVES

### Physiological Rationale

- Exploring how respiratory variables, such as  $P_{0.1}$  (e.g., the drop in pressure in the first 100 msec of an inspiratory effort in a closed circuit, validated as a measurement of respiratory drive and linked with weaning failure in adults)<sup>5</sup>, and rapid shallow breathing index (RSBI)<sup>2</sup> perform in different age groups and during the SBT could provide more information on the weaning process and how children respond to respiratory muscle loading.

### Objectives

- To investigate the extent and timing of changes in physiological variables throughout the SBT;
- To identify which of these variables, and to what extent their variations are associated with different SBT outcomes;
- To examine the behavior of  $P_{0.1}$  and RSBI during the SBT.

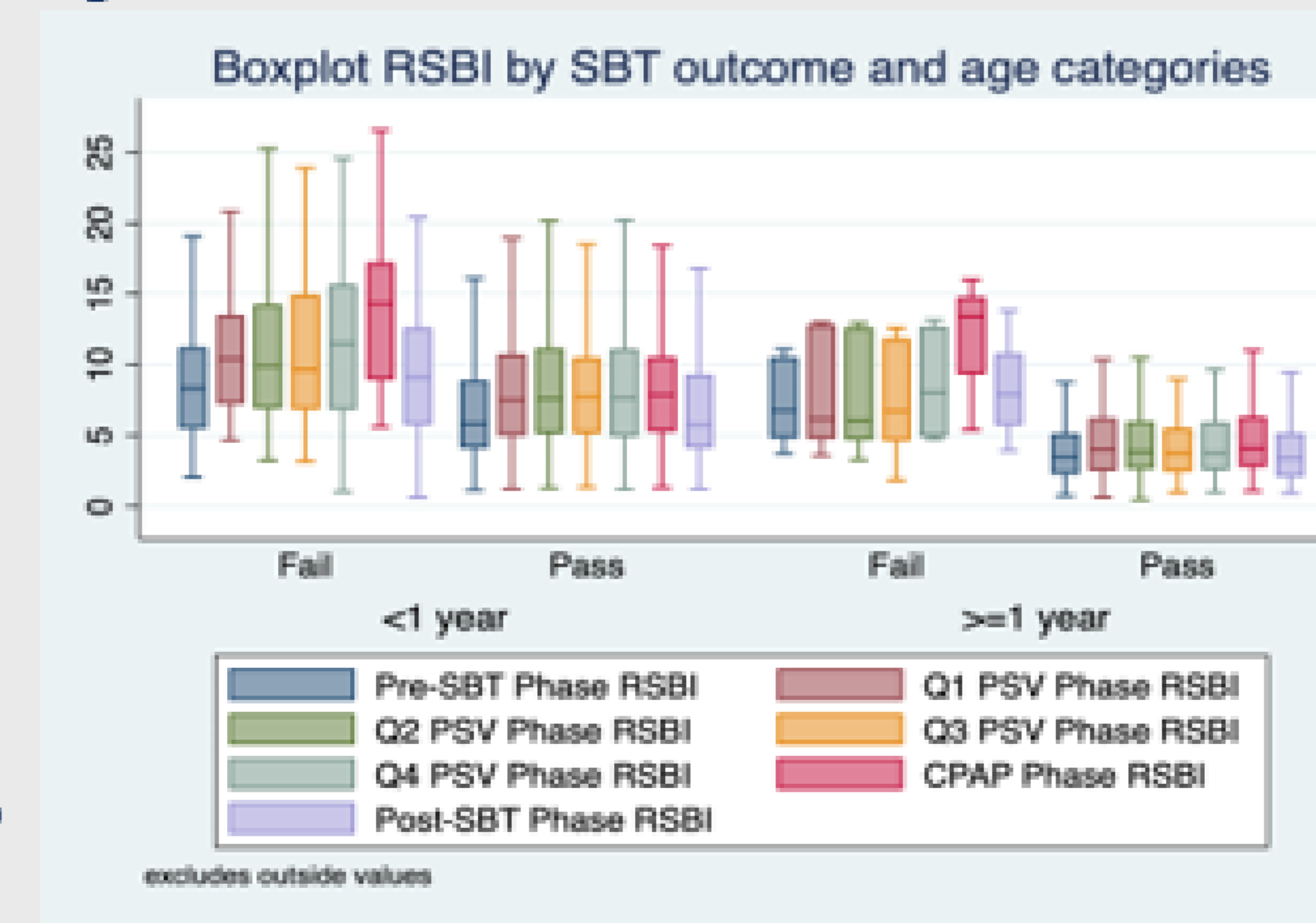
## METHOD

**Design:** retrospective study conducted in the Critical Care Unit at SickKids, November 2020 - March 2022.  
**Inclusion criteria:** mechanically ventilated children (<18 years) who underwent an SBT.  
**Exclusion criteria:** compassionate extubation, absence of *physiological data* and *SBT outcome* data.  
**Procedures:** patients who underwent an SBT were identified using a query on T3 (Etiometry™).  
**SickKids SBT protocol:** PSV stage (5 cmH<sub>2</sub>O above PEEP:~30 m) + CPAP phase (0 cmH<sub>2</sub>O above PEEP:~5 m)  
**Data extraction:** demographic information, physiological variables (respiratory rate [RR], volume [V<sub>T</sub>], heart rate (HR), blood pressure (BP), end-tidal CO<sub>2</sub> [etCO<sub>2</sub>], etc.), indexes ( $P_{0.1}$ , RSBI), and SBT outcome.  
**Analysis:** the median values for each variable were calculated during 7 different time-periods (pre-SBT phase; SBT-PSV 1st [1Q], 2nd [2Q], 3rd [3Q] and 4th quartile [4Q] phase; SBT-CPAP and post-SBT phase). Continuous variables were presented as median and interquartile range (IQR), categorical as data value and percentages. Wilcoxon and chi-squared tests were used to test the difference between groups for continuous and discrete variables, respectively.

## RESULTS

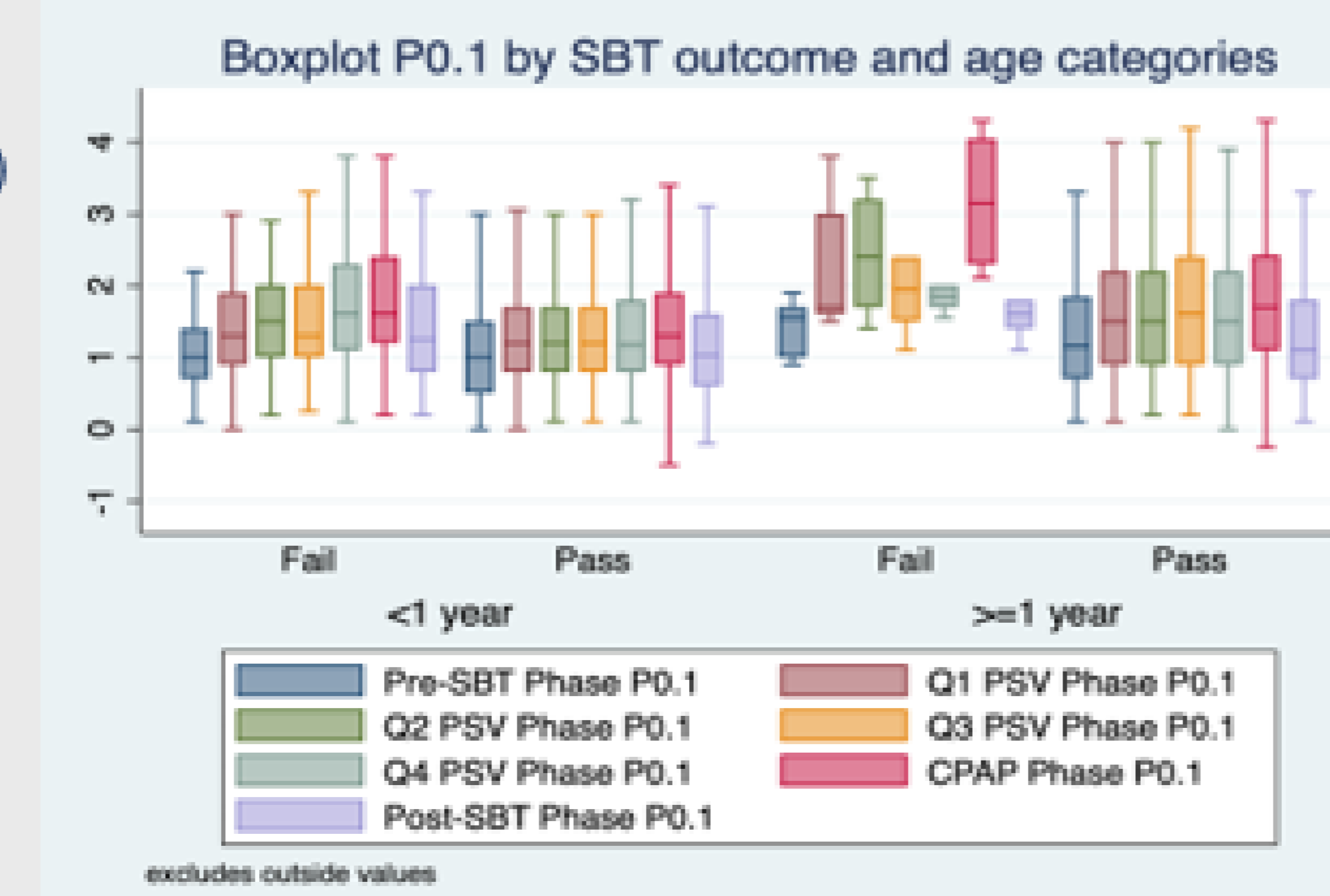
- 508 SBTs performed on 305 patients MV patients
- 49.2% females, median [IQR] age 4 [0-26] mo;
- 427 SBTs (84.1%) passed, 81 SBTs (15.9%) failed;
- 75 (92.6%) failures were among patients <1 year, 6 (7.4%) among patients ≥1 year;
- Among the SBT failures, 47 failed prior to the CPAP phase (58.0%), while 34 during the CPAP phase (42.0%);
- Failed SBTs were associated with significantly higher RR, lower VT/kg and higher RSBI (Figure 1) across all time-periods, including at baseline (pre-SBT);
- Failed SBTs had significantly higher  $P_{0.1}$  during the latter phases of PSV (Q2-3-4) for the overall sample (Figure 2);
- Patients ≥ 1 year had significantly higher  $P_{0.1}$  during the CPAP phase.

Figure 1



Age	<1 year	≥1 year
Phase	p (comparison between Fail and Pass)	p (comparison between Fail and Pass)
Pre-SBT median IQR	0.0002	0.0114
Q1 P 8V median IQR	<0.0001	0.0329
Q2 P 8V median IQR	0.0001	0.0400
Q3 P 8V median IQR	0.0001	0.0627
Q4 P 8V median IQR	<0.0001	0.0055
CPAP median IQR	<0.0001	0.0027
Post median IQR	<0.0001	0.0024

Figure 2



Age	<1 year	≥1 year
Phase	p (comparison between Fail and Pass)	p (comparison between Fail and Pass)
Pre-SBT median IQR	0.8459	0.4851
Q1 P 8V median IQR	0.0934	0.1746
Q2 P 8V median IQR	0.0102	0.0718
Q3 P 8V median IQR	0.0015	0.2600
Q4 P 8V median IQR	0.0002	0.1577
CPAP median IQR	0.0853	0.0245
Post median IQR	0.0033	0.0201

## CONCLUSION

- Patients who failed SBT had higher RR and RSBI at baseline and across all the stages of the SBT.
- Patients who failed SBT had higher  $P_{0.1}$  in the last three quartiles of the PSV stage and in the CPAP-stage for the subgroup of patients ≥ 1 year but were not clinically significant.
- $P_{0.1}$  measured by Servo ventilators did not add meaningful information during the weaning process in children.
- CPAP phase helped discriminate a large portion of SBT failures.

## ACKNOWLEDGEMENTS

To the Department of Critical Care of SickKids, for being "home" during two amazing fellowship years.

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## REFERENCES

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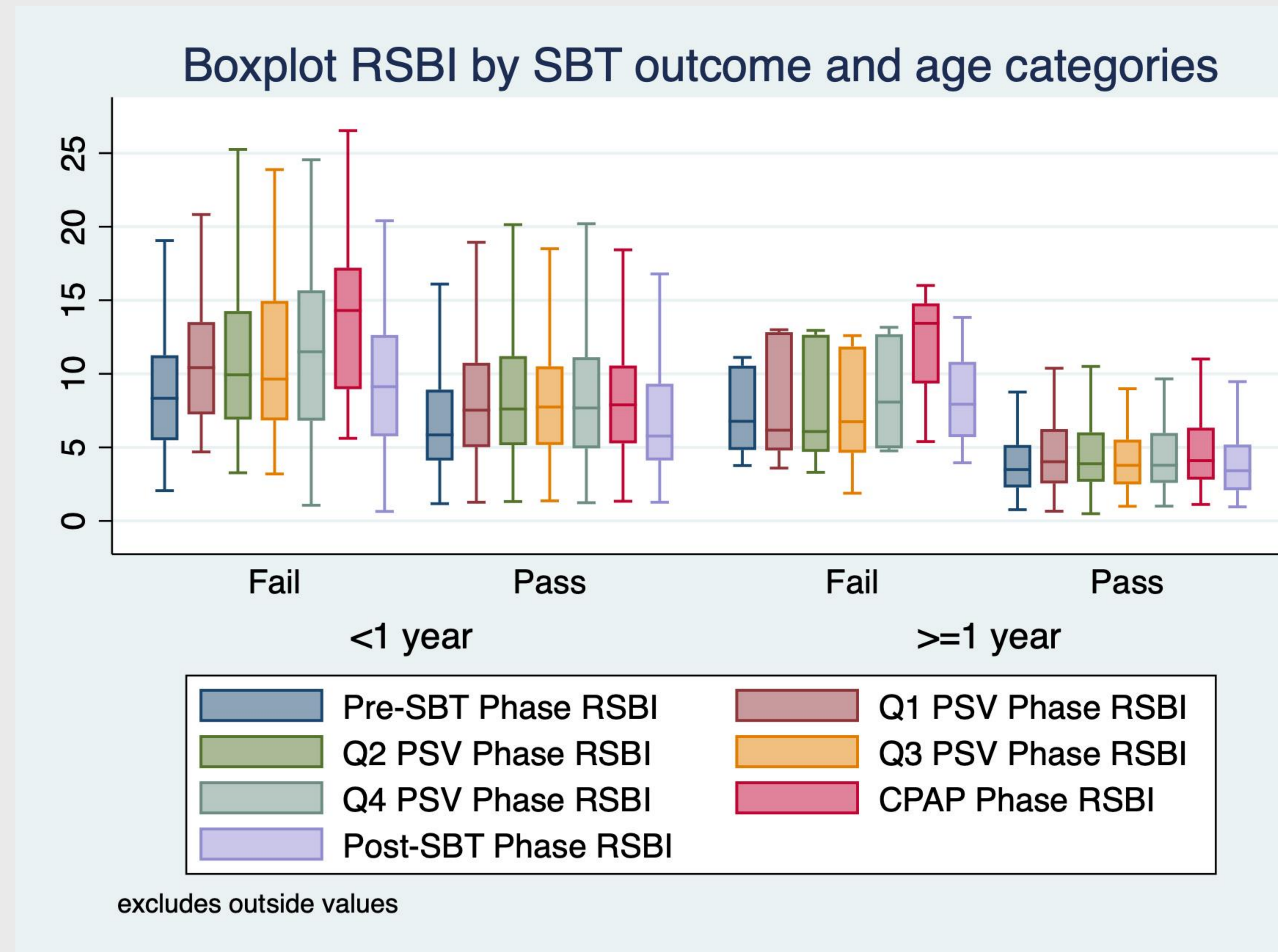
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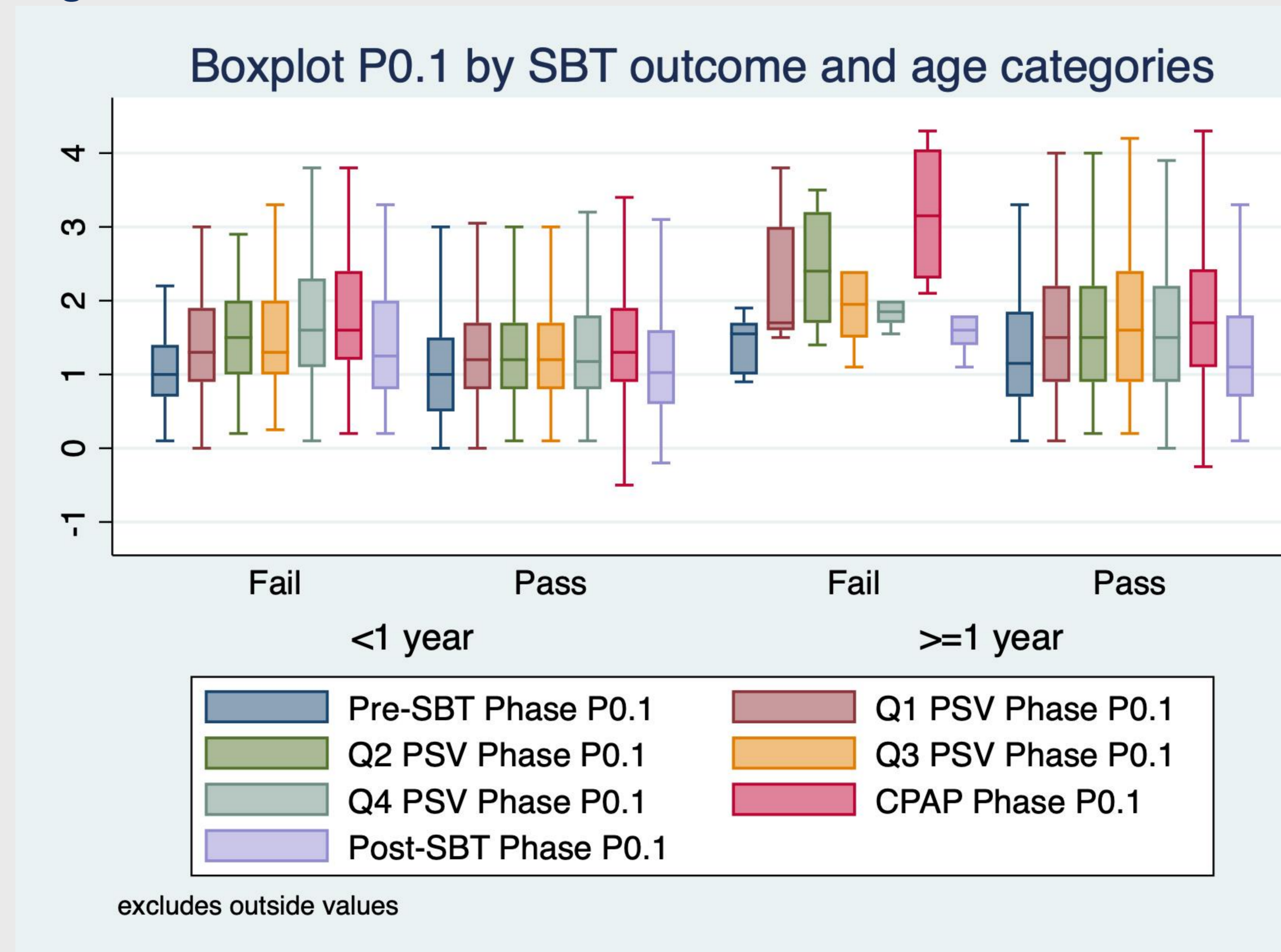
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