

# A public-private collaboration to objectively measure the value of capnography monitoring

Rhodri Saunders<sup>1</sup>, Rafael Torrejon Torres<sup>1</sup> and Federica Janeke<sup>2</sup>  
 1. Coreva Scientific, Königswinter, Germany; 2. Medtronic Italia S.p.a, Milano, Italy

## Background

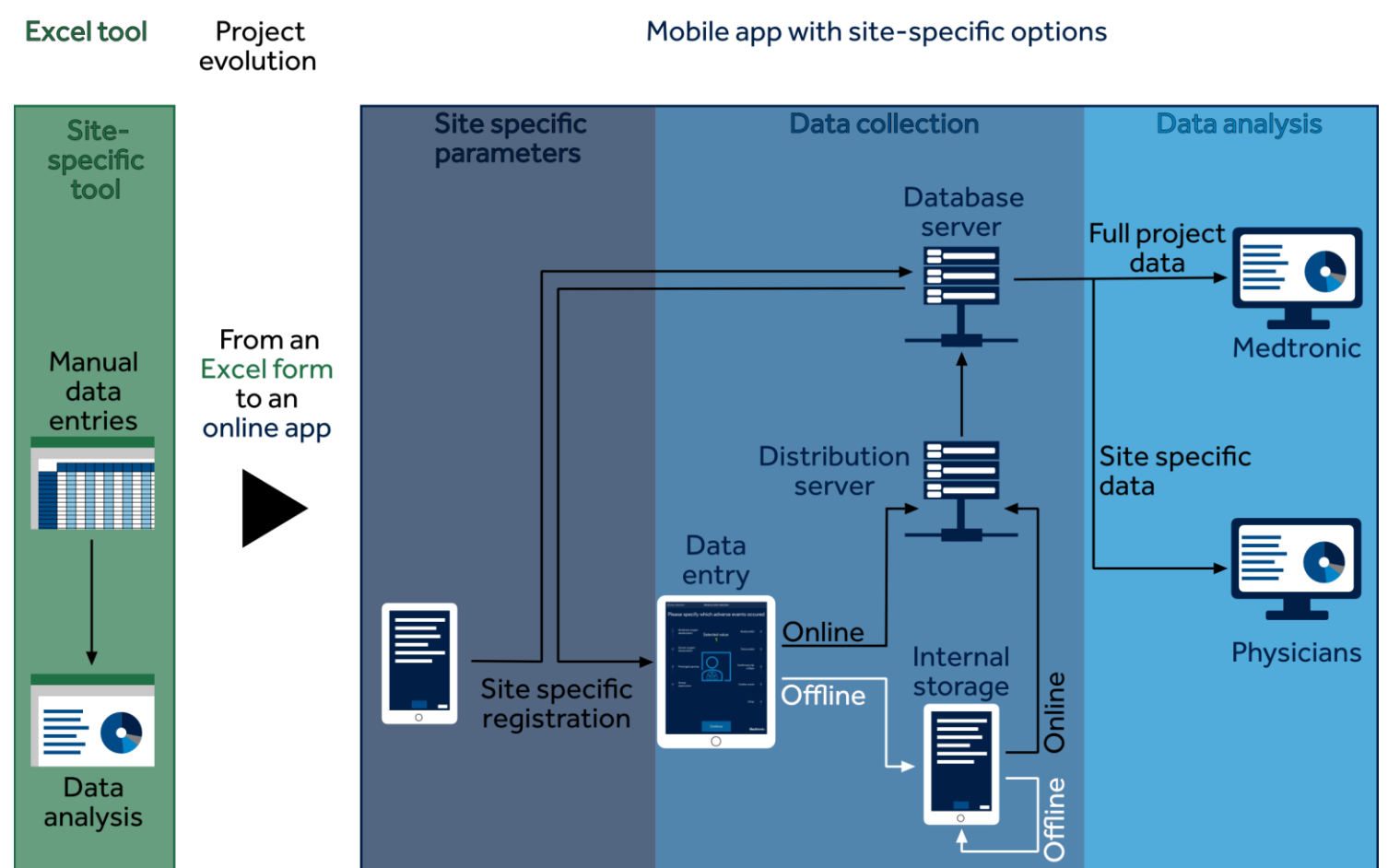
- Respiratory compromise is a known patient safety concern during sedation<sup>1</sup>, but early detection is possible<sup>2</sup> and may minimize patient harm
- Waveform capnography is one such method of early detection and although included in guidelines<sup>3</sup> is not always used during procedural sedation
- Via objective measurement of outcomes data, value-based healthcare allows interventions to be introduced at low financial risk to hospitals
- Quality improvement initiatives (QII) provide an excellent opportunity to trial new medical technologies and begin a value-based healthcare project

## Methods

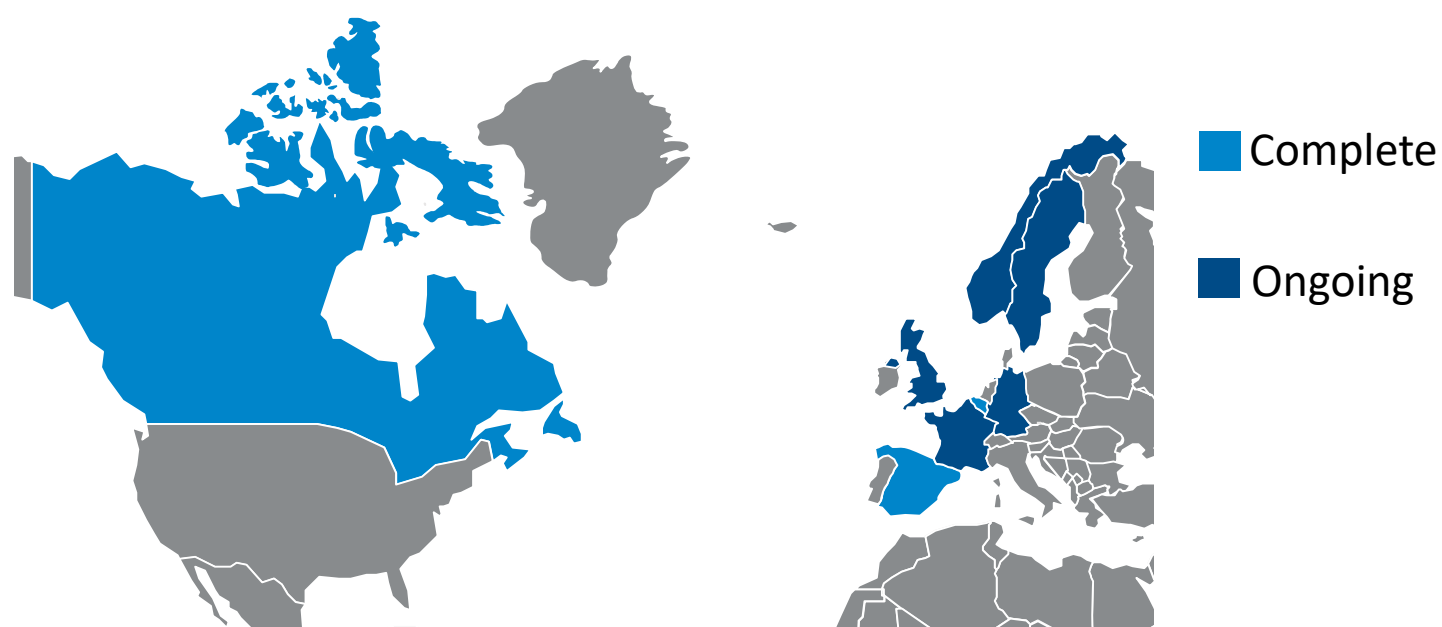
- As part of a hospital-led QII, capnography monitoring was introduced to the standard of care (SoC) for procedural sedation
- A de-novo, digital solution was developed to collect outcomes data and was adapted to meet the requirements of each hospital
- An initial Excel<sup>®</sup> data collection tool is being turned into an app (**Fig.1**)
- Common to all QIIs was the collection of SIVA-defined<sup>4</sup>, sedation-related adverse events and interventions, and patient risk classification
- 20% reduction in combined incidence of oxygen desaturation (mild and severe), tachycardia, and bradycardia (primary outcome) was targeted
- At each hospital, a baseline reading for current care was established
- After this, capnography was introduced and comprehensive training on the use of capnography and safe sedation was provided by Medtronic

### Ethics and data protection

- Each hospital received ethics approval, or a waiver was granted
- Privacy by design was implemented to prevent any patient being identified



**Fig.1** Workflow and evolution of data collection. All online data transfers are encrypted.



**Fig.2** Countries in which hospitals engaged in collaborative quality improvement initiatives (QII). *Light blue*: Successful completion of the QII (Belgium, Canada, Spain); *Dark blue*: Ongoing QII (England, France, Germany, Norway, Sweden)

## Discussion

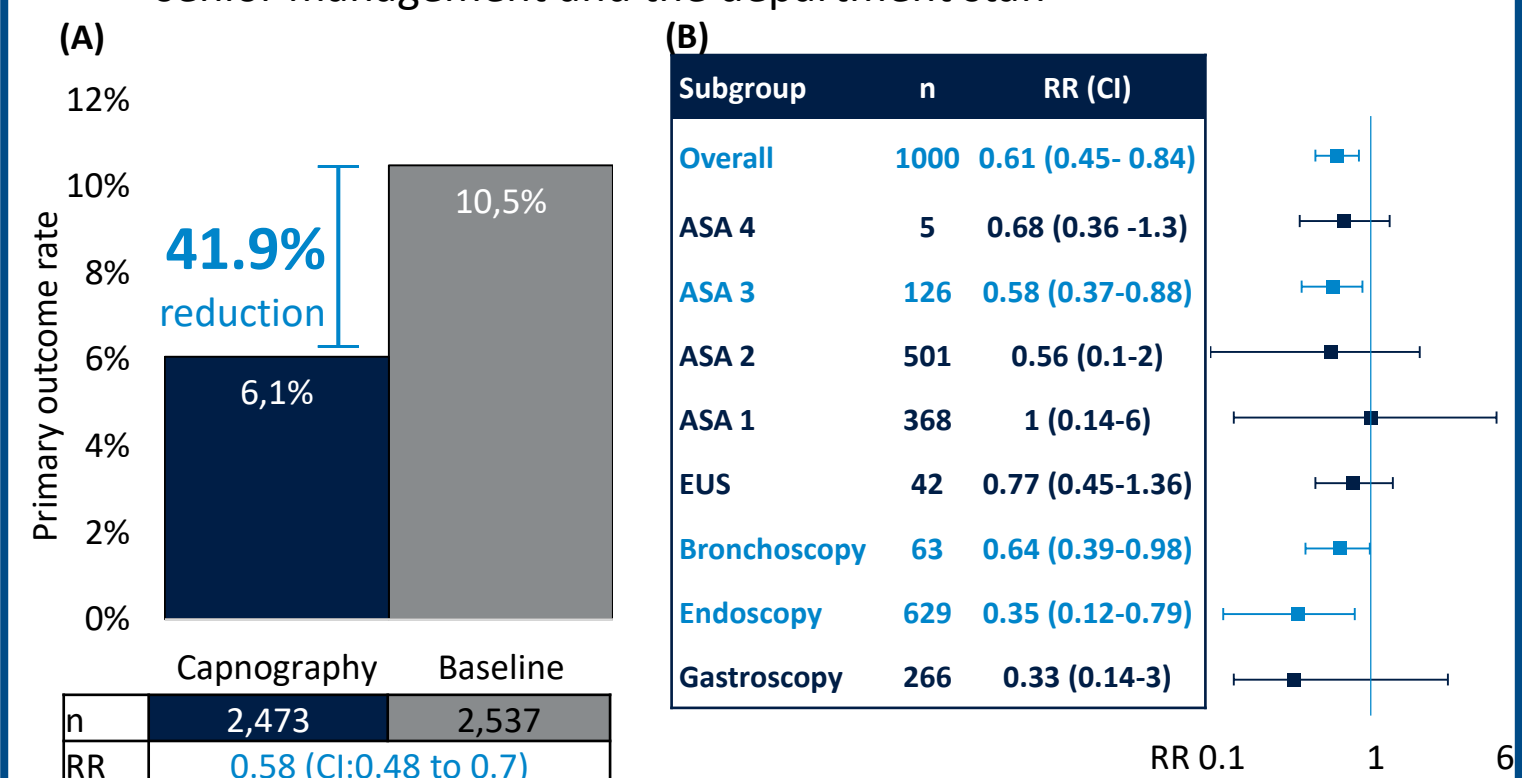
- Value-based healthcare implies payment for patient outcomes and QII results could drive pay-for-value contracting
- By improving safety and reducing rare but expensive inpatient admissions, initial indications are that capnography is cost effective
- The program focuses on outcomes not captured in medical records so objective data collection was required. This increased staff burden initially, testing of continued benefit may need to be optimized
- QII worked because sites had a commitment to guidelines, education, and process optimization – technology was one part of the solution
- We hope that this program can be a template applied in more hospitals and for more devices

## Conclusion

- Results of this value-based healthcare program are positive and the perceived value of capnography was high
- Capnography was a benefit in real-world procedural sedation
- The program demonstrated the importance of partnership in understanding each hospital's needs and finding solutions

## Results

- This private-public collaboration is currently complete or underway in 8 hospitals in Europe and North America (**Fig.2**)
- Of three completed sites, all surpassed the targeted 20% decrease
  - The primary outcome was reduced by 41.9% (RR, 0.58, CI: 0.48-0.7,  $p < 0.05$ , **Fig.3 A**)
  - Matching patients by procedure and risk classification gave a RR of 0.61 (CI:0.45-0.84,  $p < 0.05$ , **Fig.3 B**)
  - Capnography was associated with reduced need for escalations of care, including admission to the intensive care unit
- Adverse events reduced mainly after providers became familiar with and trusted capnography (learning curve effects)
  - Training was imperative and often >1 training was needed
- Tracking outcomes data added burden to departmental staff
  - Successful implementation required that the QII was supported by senior management and the department staff



**Fig. 3** (A) Primary outcome data from all completed sites (B) Matched analysis of subgroups. *Light blue*: Significant ( $p < 0.05$ ) differences. n: number of patients, RR: risk ratio, CI: confidence interval ASA: American society of anesthesiology, EUS: Endoscopic ultra sound

## References

- Saunders R, et al. BMJ Open 2017;7:e013402.
- Waugh JB, et al. J Clin Anesth. 2011 May;23(3):189–96.
- Hinkelbein J, et al. Eur J Anaesthesiol. 2018;35(1):6–24
- Mason KP, et al. Br J Anaesth. 2012;108(1):13–20.