Supplementary File 1

MEDLINE (Pubmed) search strategy

1. Blood Gas Monitoring, Transcutaneous [MeSH]
2. (TOSCA ADJ5 TCM) OR (Sentec ADJ5 V-Sign) OR (Transend ADJ5 SensorMedics) OR (FasTrac ADJ5 Critikon)
3. 1 OR 2
4. Preoperative OR pre-operative OR peri-operative OR perioperative OR intra-operative OR intraoperative OR post-operative OR postoperative OR anesthesia OR anaesthesia OR anesthesiology OR anaesthesiology
5. Surgery OR surgical OR operation OR operative OR operating
6. Critical care OR intensive care OR ICU OR Emergency department
7. Respiratory Failure (exp)
8. 4 OR 5 OR 6 OR 7
9. Accuracy OR precision OR reliability OR validity OR validation OR standard deviation
10. Bias OR mean difference OR limit of agreement OR Bland Altman
11. 9 OR 10
12. (exp "diagnostic errors"/ OR exp "sensitivity and specificity"/ OR (accura* OR reliabilit* OR target* OR utilit* OR discriminat* OR differentiat*)
13. 11 OR 12
14. 3 AND 8 AND 13
15. 14 AND NOT (animals [mh] NOT humans [mh])

EMBASE search strategy

1. transcutaneous carbon dioxide monitoring

2. (TOSCA ADJ5 TCM) OR (Sentec ADJ5 V-Sign) OR (Transend ADJ5 SensorMedics) OR (FasTrac ADJ5 Critikon)
3. 1 OR 2
4. Preoperative OR pre-operative OR peri-operative OR perioperative OR intra-operative OR intraoperative OR post-operative OR postoperative OR anesthesia OR anaesthesia OR anesthesiology OR anaesthesiology
5. Surgery OR surgical OR operation OR operative OR operating
6. Critical care OR intensive care OR ICU OR Emergency department
7. Hypercapnia OR hypercapnea OR hypercarbia OR Respiratory Failure (exp)
8. 4 OR 5 OR 6 OR 7
9. Accuracy OR precision OR reliability OR validity OR validation OR standard deviation
10. Bias OR mean difference OR limit of agreement OR Bland Altman
11. 9 OR 10
12. ('diagnostic accuracy'/de OR 'diagnostic test accuracy study'/de OR 'diagnostic error'/exp OR 'diagnostic value'/de OR 'sensitivity and specificity'/de OR 'predictive value'/de OR (accura* OR reliabilit* OR target* OR utilit* OR discriminat* OR differentiat*)
13. 11 OR 12
14. 3 AND 8 AND 13
15. 14 AND NOT (animals [mh] NOT humans [mh])

Specific formulas from (1) used to calculate population limits of agreement (i.e. limits of agreement with outer 95% confidence intervals)

Step 1: We adjusted repeated measurements, which were not properly adjusted in individual studies using the formula:

$$Sj^{2*} = Sj^2 /[(N_j - 1)/(N_j - C_j)],$$

where Sj^2 is the within-study variance in differences between $PaCO_2$ and $TcCO_2$, N_j is the total number of measurements taken and C_j is the number of measurements per individuals.

Step 2:

We calculated pooled limits of agreement:

$$\delta +/- 2\sqrt{(\sigma^2 + \tau^2)},$$

where δ is the average bias across studies (mean difference between $PaCO_2$ and $TcCO_2$), σ^2 is the average *adjusted* within-study variation in differences (the average of the Sj^{2*} from the previous formula) between $PaCO_2$ and $TcCO_2$, and τ^2 is the variation in bias across studies. The parameters δ and σ^2 were estimated using weighted least squares (with approximately inverse variance weights) and their standard errors were estimated using robust variance estimation (RVE). We used RVE instead of model-based standard errors since most studies included multiple measurements from each individual and the exact correlation between these measurements was unknown. The method-of-moments estimator (2) was used for the τ^2 parameter.

Step 3:

We calculated outer 95% confidence intervals for pooled limits of agreement using the formulas:

$$CI\text{-}LOA_{L\ or\ U} = LOA_{L\ or\ U} \pm t(m\text{-}1,\ 0.25) * \sqrt{(Var(LOA))},$$

where t(m-1, .025) is the critical value for the t-distribution with m-1 degrees of freedom. We estimated Var(LOA) from a formula included in (1) that is a combination of the sampling variances of the estimates of the mean bias, the mean precision, and the between study variation in bias.

Study characteristics

Study	n	Participants and setting	$PaC0_2$ Mean (SD) or Median (IQR)	Technology	Location of sensor	Device temperature
Aarrestad 2016 (3)	65	Patients with chronic respiratory failure on long term non-invasive ventilation.	Mean 45.75 mmHg (SD 6.75)	TOSCA500 Sensor 92	Ear lobe	43°C
Baulig 2007 (4)	18	Adults after elective cardiac surgery.	Median 5.43 kPa, range 3.61-7.41 kPa	Sentec Vsign	Ear lobe	not reported
Baulig 2015 (5)	50	Patients undergoing elective, unilateral shoulder surgery.	Not reported	Sentec Vsign 2	Ear lobe	not reported
Bendjelid 2005 (6)	55	Adult ICU	Not reported	TOSCA	Ear lobe	42°C
Berkenbosch 2001 (7)	25	Older children receiving mechanical ventilation	Not reported	TOSCA TCM3	Not reported	43.5°C
Berkenbosch 2002 (8)	14	Infants and children receiving high-frequency oscillatory ventilation	Not reported	TOSCA TCM3	Not reported	43.5°C
Berlowitz 2011 (9)	6	ICU patients with arterial line	Not reported	TOSCA TCM3	Chest	43°C
Bernet 2008 (10)	20	NICU	Median 5.8kPa, range 6.4-10.6	TOSCA	Ear lobe	not reported
Bernet-Buettiker 2005 (11)	30	NICU	Median 42.3 mmHg, range 24.1-56.9	TOSCA	Ear lobe	42°C
Bobbia 2015 (12)	90	Acute respiratory failure in ED	Median 46.2 mmHg; IQR 37.6, 66.8	TOSCA TCM4	Ear lobe	44°C
Bolliger 2007 (13)	112	Adults undergoing major surgery then transferred to ICU	Not reported	Sentec and TOSCA500 Sensor 92	Ear lobe	42°C
Carter 2001 (14)	46	NICU after cardiac surgery	Range 23-52 mmHg	Fastrac	Upper abdomen, chest or upper thigh	43°C
Chakravarthy 2010 (15)	32	Post cardiac surgery in ICU	Not reported	TCM4	Upper chest	43°C

Chhajed 2010 (16)	270	Respiratory laboratory	Median 4.7 kPa, IQR 0.8	Sentec V-Sign	Ear lobe	42°C
Chhajed 2012 (17)	40	Adult ICU	Median 4.84 kPa, range 4.3-6.04	Sentec V-Sign	Ear lobe	42°C
Cox 2006 (18)	15	Thoracic surgery with one lung ventilation	Not reported	Sentec V-Sign	Ear lobe	42°C
Cuvelier 2005 (19)	12	Long-term home ventilation, mask or tracheotomy-mediated	Range 37-58	TCM3	Chest	44°C
Delerme 2012 (20)	48	Acute respiratory failure in ED	42 mmHg(16), range 18-108	TOSCA500 Sensor 92	Ear lobe	42°C
DeOliveira Jr 2010 (21)	40	Females undergoing gynaecological surgery with sedation (not mechanically ventilated)	Not reported	TOSCA500 Sensor 92	Ear lobe	42°C
Dion 2015 (22)	25	Laparoscopic-assisted bariatric surgery in severely obese patients	Not reported	Sentec Vsign2	Palmar surface of the forearm or the infraclaviculararea.	42°C
Domingo 2006 (23)	130	Patients referred for respiratory function tests	42.2 mmHg (7.2)	Sentec Vsign	Ear lobe	42°C
Dullenkopf 2003 (24)	60	Paediatric surgery	4.66 (0.48), range 3.8-7.3	TOSCA	Ear lobe	42°C
Ekkerkamp 2015 (25)	100	Patients with respiratory disease and healthy controls	42 (6.9) mmHg	TCM4	Chest	44°C
Fanelli 2008 (26)	13	Post-anaesthesia recovery	39.2 mmHg (IQR - 37.6,40.7), range 26-52 mmHg	Sentec Vsign	Not reported	42°C
Ferníçndez de Miguel 2010 (27)	12	PICU	51 mmHg (13)	Sentec	Not reported	not reported
Fuke 2009 (28)	9	Healthy volunteers	Not reported	TOSCA	Ear lobe	42°C
Gancel 2011 (29)	21	Acute respiratory failure in ED	51.6 mmHg (16.7), range 22.8-84.3 mmHg	TOSCA500 Sensor 92	Ear lobe	42°C

Griffin 2003 (30)	30	General anaesthesia in severely obese adults	Not reported	TCM3	Forearm	45°C
Hazenberg 2011 (31)	15	Chronic respiratory failure	Not reported	TOSCA	Ear lobe	42°C
Henao-Brasseur 2016 (32)	37	Adult ICU	Not reported	Sentec	Not reported	not reported
Herrejon 2006 (33)	30	Chronic respiratory failure	Median 42.6 mmHg, range 31.5-75.4 mmHg	Sentec Vsign	Ear lobe	42°C
Heuss 2004 (34)	33	Adults undergoing colonoscopy	Not reported	Sentec Vsign	Ear lobe	42°C
Hinkelbein 2008 (35)	34	Adult ICU	43.2 mmHg (8.8), range 24.9-72.4 mmHg	TCM4	Chest	42°C
Hirabayashi 2009 (36)	39	Adult ICU and post-anaesthesia recovery	range 30-45	TCM3	Upper arm	44°C
Hirata 2014 (37)	48	NICU	Not reported	TCM4	Abdomen, chest, back and thigh	38-42°C
Janssens 2005 (38)	40	Chronic respiratory failure	42 mmHg (11), range 20-71 mmHg	TCM3	Chest	43°C
Janssens 2001 (39)	28	Chronic respiratory failure	49 mmHg (8.6), range 32-66 mmHg	TCM3	Chest	43°C
Johnson 2008 (40)	38	Adult ICU	Not reported	Sentec Vsign	Ear lobe	42°C
Kelly 2011 (41)	46	Acute respiratory failure in ED	median 60 mmHg (IQR 46-70), range 33-91 mmHg	TCM4	Chest	not reported
Kim 2014 (42)	53	Acute respiratory failure in ED	Normotenstive: 55.5 mmHg (24.1); hypotensive: 44.5 mmHg (18.4)	Sentec Vsign	Ear lobe	42°C

Lermuzeaux 2016 (43)	25	Acute respiratory failure in ED	44 mmHg (12.7)	Sentec Vsign	Ear lobe	42°C
Liu 2014 (44)	21	Anesthesia of obese patients undergoing laparoscopic bariatric surgery	Not reported	TCM4	Chest	44°C
Maniscalco 2008 (45)	35	Obese patients undergoing respiratory function tests	Not reported	TOSCA	Ear lobe	42°C
McBride 2002 (46)	30	neurosurgical procedures in adults	range 26 to 62 mmHg	TOSCA	Not reported	44°C
McVicar 2009 (47)	51	Acute respiratory failure in ED	Median 5.5 kPa, range 2.27-9.43 kPa	TOSCA	Ear lobe	42°C
Mukhopadhyay 2016 (48)	52	NICU	Not reported	Sentec	Not reported	not reported
Nicolini 2011 (49)	80	Acute respiratory failure in ED	mean 56.97 mmHg (9.87), range 42-89 mmHg	TOSCA	Ear lobe	not reported
Nishiyama 2006 (50)	15	Adults undergoing surgery with general anaesthesia	Not reported	TCM4	Chest, upper arm, forearm	43°C
Nishiyama 2011 (51)	10	Adults undergoing surgery with general anaesthesia	Not reported	TCM4 and Sentec	Chest, ear lobe	43°C and 42°C
Oshibuchi 2003 (52)	26	Thoracic surgery with one lung ventilation	41 mmHg (4)	TCM3	Upper arm	42°C
Parker 2007 (53)	48	Chronic respiratory failure	range 4 - 10.9 kPa	TOSCA	Ear lobe	42°C
Perrin 2011 (54)	24	Acute respiratory failure in ED	median 36.5 mmHg, range 19-64 mmHg	TOSCA500	Ear lobe	not reported
Peschanski 2016 (55)	64	Acute respiratory failure in ED	49 mmHg (16) range 22-103 mmHg	TCM4	Chest or forearm	44°C
Piquilloud 2013 (56)	20	Acute respiratory failure in ED	range 43-80 mmHg	Sentec	Ear lobe	not reported
Rodriguez 2006 (57)	50	Adult ICU	Not reported	Sentec	Ear lobe	42°C

Roediger 2011 (58)	20	Adult ICU	median 36.7 mmHg, range 27.3-54.7	Sentec Vsign	Ear lobe, forehead, cheek	42°C
Rosier 2014 (59)	25	Adult ICU	37 mmHg (6.2)	Sentec Vsign	Ear lobe	42°C
Ruiz 2016 (60)	81	Acute respiratory failure in ED	59.8 mmHg (11.9)	Sentec Vsign	Chest	42°C
Sandberg 2011 (61)	46	NICU	6.9 mmHg (95% CI=6.7-7.8)	TOSCA	Chest	43°C
Schafroth Török 2008 (62)	19	Chronic respiratory failure	47.8 mmHg (9)	Sentec	Ear lobe	42°C
Senn 2005 (63)	18	Adult ICU	range 22-59 mmHg	TOSCA	Ear lobe	42°C
Simon 2003 (64)	15	Rigid bronchoscopy during high-frequency jet ventilation	Not reported	Microgas	Abdomen	42°C
Stege 2009 (65)	12	Cardiopulmonary exercise testing	range 3.28 -7.75 kPa	TOSCA500 Sensor 92	Ear lobe	42°C
Storre 2007 (66)	10	Initiation of noninvasive ventilation	Baseline 67.2 mmHg (11.9)	Sentec Vsign	Ear lobe	42°C
Tingay 2005 (67)	21	NICU	Not reported	Microgas	Chest or abdomen	not reported
Tobias 2003 (68)	15	Thoracic surgery with one lung ventilation	Not reported	TCM3	Not reported	45°C
Tonelli 2015 (69)	29	Chronic respiratory failure	33 mmHg (5)	PeriFlux	Forearm	45°C
Tschupp 2003 (70)	20	PICU	range 30-46.5 mmHg	Sentec Vsign	Ear lobe	42°C
Urbano 2010 (71)	41	PICU	Median 44 mHg, range 28-85	Sentec, TOSCA 500, TCM3	Chest, abdomen or ear lobe	42°C, 43.5°C
vanOppen 2015 (72)	10	Adult ICU	Admission 75.53 mmHg	TCM4	Ear lobe	not reported
Vivien 2006 (73)	20	Apnea testing in brain-dead patients	Baseline 41.4 mmHg (6.3); end of apnoea test 98.3 mmHg (20)	Sentec Vsign	Ear lobe	42°C
Xue 2010 (74)	16	Adults undergoing prolonged laporascopic surgery	Baseline 40 mmHg (3.6), 30 minutes 47	Sentec Vsign	Ear lobe	42°C

			mmHg (3.5), 60 minutes 44.9 mmHg (5.2)			
Zhang 2015 (75)	18	Thoracic surgery with one lung ventilation	Baseline TLV 46.5 mmHg (6.9), 30 minutes OLV 52.2 mmHg (9.1), OLV60 52.2 mmHg (7), OLV90 52.4 mmHg (6.9), OLV120 52.2 mmHg (6.6)	TCM3	Upper arm	42°C

Legend: ICU=Intensive care unit; NICU=Neonatal intensive care unit; PICU=Pediatric intensive care unit; ED=Emergency department

References for supplementary information

1. Tipton E, Shuster J. A framework for the meta-analysis of Bland–Altman studies based on a limits of agreement approach. Statistics in Medicine. 2017;36(23):3621-35.
2. DerSimonian R, Laird N. Meta-analysis in clinical trials. Controlled Clinical Trials. 1986;7(3):177-88.
3. Aarrestad S, Tollefsen E, Kleiven AL, Qvarfort M, Janssens J-P, Skjønsberg OH. Validity of transcutaneous PCO2 in monitoring chronic hypoventilation treated with non-invasive ventilation. Respiratory Medicine. 2016;112:112-8.
4. Baulig W, Schütt P, Roth HR, Hayoz J, Schmid ER. Clinical validation of a digital transcutaneous PCO2/SpO2 ear sensor in adult patients after cardiac surgery. Journal Of Clinical Monitoring And Computing. 2007;21(5):303-9.
5. Baulig W, Keselj M, Baulig B, Guzzella S, Borgeat A, Aguirre J. Transcutaneous continuous carbon dioxide tension monitoring reduced incidence, degree and duration of hypercapnia during combined regional anaesthesia and monitored anaesthesia care in shoulder surgery patients. Journal of Clinical Monitoring and Computing. 2015;29(4):499-507.
6. Bendjelid K, Schütz N, Stotz M, Gerard I, Suter PM, Romand J-A. Transcutaneous PCO2 monitoring in critically ill adults: clinical evaluation of a new sensor. Critical Care Medicine. 2005;33(10):2203-6.
7. Berkenbosch JW, Lam J, Burd RS, Tobias JD. Noninvasive monitoring of carbon dioxide during mechanical ventilation in older children: end-tidal versus transcutaneous techniques. Anesthesia And Analgesia. 2001;92(6):1427-31.
8. Berkenbosch JW, Tobias JD. Transcutaneous carbon dioxide monitoring during high-frequency oscillatory ventilation in infants and children. Critical Care Medicine. 2002;30(5):1024-7.
9. Berlowitz DJ, Spong J, O'Donoghue FJ, Pierce RJ, Brown DJ, Campbell DA, et al. Transcutaneous measurement of carbon dioxide tension during extended monitoring: evaluation of accuracy and stability, and an algorithm for correcting calibration drift. Respiratory Care. 2011;56(4):442-8.
10. Bernet V, Döll C, Cannizzaro V, Ersch J, Frey B, Weiss M. Longtime performance and reliability of two different PtcCO2 and SpO2 sensors in neonates. Paediatric Anaesthesia. 2008;18(9):872-7.
11. Bernet-Buettiker V, Ugarte MJ, Frey B, Hug MI, Baenziger O, Weiss M. Evaluation of a new combined transcutaneous measurement of PCO2/pulse oximetry oxygen saturation ear sensor in newborn patients. Pediatrics. 2005;115(1):e64-e8.
12. Bobbia X, Claret P-G, Palmier L, Robert M, Granpierre RG, Roger C, et al. Erratum: Concordance and limits between transcutaneous and arterial carbon dioxide pressure in emergency department patients with acute respiratory failure: a single-center, prospective, and observational study. Scandinavian Journal of Trauma, Resuscitation and Emergency Medicine. 2015;23(1):77.
13. Bolliger D, Steiner LA, Kasper J, Aziz OA, Filipovic M, Seeberger MD. The accuracy of non-invasive carbon dioxide monitoring: a clinical evaluation of two transcutaneous systems. Anaesthesia. 2007;62(4):394-9.
14. Carter BG, Wiwczaruk D, Hochmann M, Osborne A, Henning R. Performance of transcutaneous PCO2 and pulse oximetry monitors in newborns and infants after cardiac surgery. Anaesthesia And Intensive Care. 2001;29(3):260-5.
15. Chakravarthy M, Narayan S, Govindarajan R, Jawali V, Rajeev S. Weaning mechanical ventilation after off-pump coronary artery bypass graft procedures directed by noninvasive gas measurements. Journal Of Cardiothoracic And Vascular Anesthesia. 2010;24(3):451-5.
16. Chhajed PN, Miedinger D, Baty F, Bernasconi M, Heuss LT, Leuppi JD, et al. Comparison of combined oximetry and cutaneous capnography using a digital sensor with arterial blood gas analysis. Scandinavian Journal Of Clinical And Laboratory Investigation. 2010;70(1):60-4.

17. Chhajed PN, Chaudhari P, Tulasigeri C, Kate A, Kesarwani R, Miedinger D, et al. Infraclavicular sensor site: a new promising site for transcutaneous capnography. Scandinavian Journal Of Clinical And Laboratory Investigation. 2012;72(4):340-2.
18. Cox P, Tobias JD. Noninvasive monitoring of PaCO(2) during one-lung ventilation and minimal access surgery in adults: End-tidal versus transcutaneous techniques. Journal of Minimal Access Surgery. 2006;3(1):8-13.
19. Cuvelier A, Grigoriu B, Molano LC, Muir J-F. Limitations of transcutaneous carbon dioxide measurements for assessing long-term mechanical ventilation. Chest. 2005;127(5):1744-8.
20. Delerme S, Montout V, Goulet H, Arhan A, Le Saché F, Devilliers C, et al. Concordance between transcutaneous and arterial measurements of carbon dioxide in an ED. American Journal of Emergency Medicine. 2012;30(9):1872-6.
21. De Oliveira Jr GS, Ahmad S, Fitzgerald PC, McCarthy RJ. Detection of hypoventilation during deep sedation in patients undergoing ambulatory gynaecological hysteroscopy: A comparison between transcutaneous and nasal end-tidal carbon dioxide measurements. British Journal of Anaesthesia. 2010;104(6):774-8.
22. Dion JM, McKee C, Tobias JD, Herz D, Sohner P, Teich S, et al. Carbon dioxide monitoring during laparoscopic-assisted bariatric surgery in severely obese patients: transcutaneous versus end-tidal techniques. Journal Of Clinical Monitoring And Computing. 2015;29(1):183-6.
23. Domingo C, Canturri E, Luján M, Moreno A, Espuelas H, Marín A. Transcutaneous measurement of partial pressure of carbon dioxide and oxygen saturation: Validation of the SenTec monitor. Archivos de Bronconeumologia. 2006;42(5):246-51.
24. Dullenkopf A, Bernardo SD, Berger F, Fasnacht M, Gerber AC, Weiss M. Evaluation of a new combined SpO2/PtcCO2 sensor in anaesthetized paediatric patients. Paediatric Anaesthesia. 2003;13(9):777-84.
25. Ekkernkamp E, Welte L, Schmoor C, Huttmann SE, Dreher M, Windisch W, et al. Spot check analysis of gas exchange: invasive versus noninvasive methods. Respiration. 2015;89(4):294-303.
26. Fanelli G, Baciarello M, Squicciarini G, Malagutti G, Zasa M, Casati A. Transcutaneous carbon dioxide monitoring in spontaneously breathing, nonintubated patients in the early postoperative period. Minerva Anestesiologica. 2008;74(7-8):375-80.
27. Fernández de Miguel S, Gaboli M, González-Celador R, Gómez de Quero P, Murga Herrero V, Sánchez Granados JM, et al. Validation of the transcutaneous carbon dioxide tension measurements in critical paediatric patients. Anales de Pediatria. 2010;72(3):165-71.
28. Fuke S, Miyamoto K, Ohira H, Ohira M, Odajima N, Nishimura M. Evaluation of transcutaneous CO2 responses following acute changes in PaCO2 in healthy subjects. Respirology (Carlton, Vic.). 2009;14(3):436-42.
29. Gancel PE, Roupie E, Guittet L, Laplume S, Terzi N. Accuracy of a transcutaneous carbon dioxide pressure monitoring device in emergency room patients with acute respiratory failure. Intensive Care Medicine. 2011;37(2):348-51.
30. Griffin J, Terry BE, Burton RK, Ray TL, Landrum AL, Johnson JO, et al. Comparison of end-tidal and transcutaneous measures of carbon dioxide during general anaesthesia in severely obese adults. British Journal of Anaesthesia. 2003;91(4):498-501.
31. Hazenberg A, Zijlstra JG, Kerstjens HAM, Wijkstra PJ. Validation of a transcutaneous CO2 monitor in adult patients with chronic respiratory failure. Respiration. 2011;81(3):242-6.
32. Henao-Brasseur J, Bedel J, Mutlu G, Grimaldi D, Brasseur F, Laurent V, et al. Transcutaneous CO2 monitoring: a new tool to identify spontaneous breathing trial failure during weaning from mechanical ventilation. A pilot cohort study. Intensive Care Medicine. 2016;42(6):1078-9.

33. Herrejón A, Inchaurraga I, Palop J, Ponce S, Peris R, Terrádez M, et al. Usefulness of transcutaneous carbon dioxide pressure monitoring to measure blood gases in adults hospitalized for respiratory disease. Archivos De Bronconeumología. 2006;42(5):225-9.
34. Heuss LT, Chhajed PN, Schnieper P, Hirt T, Beglinger C. Combined pulse oximetry/cutaneous carbon dioxide tension monitoring during colonoscopies: pilot study with a smart ear clip. Digestion. 2004;70(3):152-8.
35. Hinkelbein J, Floss F, Denz C, Krieter H. Accuracy and precision of three different methods to determine Pco2 (Paco2 vs. Petco2 vs. Ptcco2) during interhospital ground transport of critically ill and ventilated adults. Journal of Trauma - Injury, Infection and Critical Care. 2008;65(1):10-8.
36. Hirabayashi M, Fujiwara C, Ohtani N, Kagawa S, Kamide M. Transcutaneous PCO2 monitors are more accurate than end-tidal PCO2 monitors. Journal Of Anesthesia. 2009;23(2):198-202.
37. Hirata K, Nishihara M, Oshima Y, Hirano S, Kitajima H. Application of transcutaneous carbon dioxide tension monitoring with low electrode temperatures in premature infants in the early postnatal period. American Journal Of Perinatology. 2014;31(5):435-40.
38. Janssens JP, Laszlo A, Uldry C, Titelion V, Picaud C, Michel JP. Non-invasive (transcutaneous) monitoring of PCO2 (TcPCO 2) in older adults. Gerontology. 2005;51(3):174-8.
39. Janssens JP, Perrin E, Bennani I, De Muralt B, Titelion V, Picaud C. Is continuous transcutaneous monitoring of PCO2 (TcPCO2) over 8 h reliable in adults? Respiratory Medicine. 2001;95(5):331-5.
40. Johnson DC, Batool S, Dalbec R. Transcutaneous carbon dioxide pressure monitoring in a specialized weaning unit. Respiratory Care. 2008;53(8):1042-7.
41. Kelly AM, Klim S. Agreement between arterial and transcutaneous pCO2 measurement in patients undergoing non-invasive ventilation: A pilot study. EMA - Emergency Medicine Australasia. 2011;23:33.
42. Kim J-Y, Yoon Y-H, Lee S-W, Choi S-H, Cho Y-D, Park S-M. Accuracy of transcutaneous carbon dioxide monitoring in hypotensive patients. Emergency Medicine Journal: EMJ. 2014;31(4):323-6.
43. Lermuzeaux M, Meric H, Sauneuf B, Girard S, Normand H, Lofaso F, et al. Superiority of transcutaneous CO2 over end-tidal CO2 measurement for monitoring respiratory failure in nonintubated patients: A pilot study. Journal Of Critical Care. 2016;31(1):150-6.
44. Liu S, Sun J, Chen X, Yu Y, Liu X, Liu C. The application of transcutaneous CO2 pressure monitoring in the anesthesia of obese patients undergoing laparoscopic bariatric surgery. Plos One. 2014;9(4):e91563-e.
45. Maniscalco M, Zedda A, Faraone S, Carratù P, Sofia M. Evaluation of a transcutaneous carbon dioxide monitor in severe obesity. Intensive Care Medicine. 2008;34(7):1340-4.
46. McBride DS, Jr., Johnson JO, Tobias JD. Noninvasive carbon dioxide monitoring during neurosurgical procedures in adults: end-tidal versus transcutaneous techniques. Southern Medical Journal. 2002;95(8):870-4.
47. McVicar J, Eager R. Validation study of a transcutaneous carbon dioxide monitor in patients in the emergency department. Emergency Medicine Journal: EMJ. 2009;26(5):344-6.
48. Mukhopadhyay S, Maurer R, Puopolo KM. Neonatal Transcutaneous Carbon Dioxide Monitoring--Effect on Clinical Management and Outcomes. Respiratory Care. 2016;61(1):90-7.
49. Nicolini A, Ferrari MB. Evaluation of a transcutaneous carbon dioxide monitor in patients with acute respiratory failure. Annals of Thoracic Medicine. 2011;6(4):217-20.
50. Nishiyama T, Nakamura S, Yamashita K. Comparison of the transcutaneous oxygen and carbon dioxide tension in different electrode locations during general anaesthesia. European Journal Of Anaesthesiology. 2006;23(12):1049-54.

51. Nishiyama T, Kohno Y, Koishi K. Comparison of ear and chest probes in transcutaneous carbon dioxide pressure measurements during general anesthesia in adults. Journal Of Clinical Monitoring And Computing. 2011;25(5):323-8.
52. Oshibuchi M, Cho S, Hara T, Tomiyasu S, Makita T, Sumikawa K. A comparative evaluation of transcutaneous and end-tidal measurements of CO2 in thoracic anesthesia. Anesthesia And Analgesia. 2003;97(3):776-9.
53. Parker SM, Gibson GJ. Evaluation of a transcutaneous carbon dioxide monitor ("TOSCA") in adult patients in routine respiratory practice. Respiratory Medicine. 2007;101(2):261-4.
54. Perrin K, Wijesinghe M, Healy B, Wadsworth K, Bowditch R, Bibby S, et al. Randomised controlled trial of high concentration versus titrated oxygen therapy in severe exacerbations of asthma. Thorax. 2011:thx. 2010.155259.
55. Peschanski N, Garcia L, Delasalle E, Mzabi L, Rouff E, Dautheville S, et al. Can transcutaneous carbon dioxide pressure be a surrogate of blood gas samples for spontaneously breathing emergency patients? The ERNESTO experience. Emerg Med J. 2016;33(5):325-8.
56. Piquilloud L, Jolliet P, Revelly J. Thévoz, D., & P. . Relationship between transcutaneous CO2 measurement and PaCO2 during non invasive ventilation delivered in hypercapnic acute respiratory failure. Schweiz Med Forum 61. 2013;2013 SRC - GoogleScholar.
57. Rodriguez P, Lellouche F, Aboab J, Buisson CB, Brochard L. Transcutaneous arterial carbon dioxide pressure monitoring in critically ill adult patients. Intensive Care Medicine. 2006;32(2):309-12.
58. Roediger R, Beck-Schimmer B, Theusinger OM, Rusch D, Seifert B, Spahn DR, et al. The revised digital transcutaneous PCO2/SpO2 ear sensor is a reliable noninvasive monitoring tool in patients after cardiac surgery. Journal Of Cardiothoracic And Vascular Anesthesia. 2011;25(2):243-9.
59. Rosier S, Launey Y, Bleichner JP, Laviolle B, Jouve A, Malledant Y, et al. The accuracy of transcutaneous P<inf>CO2</inf> in subjects with severe brain injury: A comparison with End-Tidal P<inf>CO2</inf>. Respiratory Care. 2014;59(8):1242-7.
60. Ruiz Y, Farrero E, Córdoba A, González N, Dorca J, Prats E. Transcutaneous carbon dioxide monitoring in subjects with acute respiratory failure and severe hypercapnia. Respiratory Care. 2016;61(4):428-33.
61. Sandberg KL, Brynjarsson H, Hjalmarson O. Transcutaneous blood gas monitoring during neonatal intensive care. Acta Paediatrica (Oslo, Norway: 1992). 2011;100(5):676-9.
62. Schafroth Török S, Leuppi JD, Baty F, Tamm M, Chhajed PN. Combined oximetry-cutaneous capnography in patients assessed for long-term oxygen therapy. Chest. 2008;133(6):1421-5.
63. Senn O, Clarenbach CF, Kaplan V, Maggiorini M, Bloch KE. Monitoring carbon dioxide tension and arterial oxygen saturation by a single earlobe sensor in patients with critical illness or sleep apnea. Chest. 2005;128(3):1291-6.
64. Simon M, Gottschall R, Gugel M, Fritz H, Mohr S, Klein U. Comparison of transcutaneous and endtidal CO2-monitoring for rigid bronchoscopy during high-frequency jet ventilation. Acta Anaesthesiologica Scandinavica. 2003;47(7):861-7.
65. Stege G, van den Elshout FJJ, Heijdra YF, van de Ven MJT, Dekhuijzen PNR, Vos PJE. Accuracy of transcutaneous carbon dioxide tension measurements during cardiopulmonary exercise testing. Respiration; International Review Of Thoracic Diseases. 2009;78(2):147-53.
66. Storre JH, Steurer B, Kabitz H-J, Dreher M, Windisch W. Transcutaneous PCO2 monitoring during initiation of noninvasive ventilation. Chest. 2007;132(6):1810-6.
67. Tingay DG, Stewart MJ, Morley CJ. Monitoring of end tidal carbon dioxide and transcutaneous carbon dioxide during neonatal transport. Archives of Disease in Childhood: Fetal and Neonatal Edition. 2005;90(6):F523-F6.
68. Tobias JD. Noninvasive carbon dioxide monitoring during one-lung ventilation: End-tidal versus transcutaneous techniques. Journal Of Cardiothoracic And Vascular Anesthesia. 2003;17(3):306-8.

69. Tonelli AR, Alkukhun L, Cikach F, Ahmed M, Dweik RA**.** Are Transcutaneous Oxygen and Carbon Dioxide Determinations of Value in Pulmonary Arterial Hypertension? Microcirculation. 2015;22(4):249-56.
70. Tschupp A, Fanconi S**.** A combined ear sensor for pulse oximetry and carbon dioxide tension monitoring: Accuracy in critically III children. Anesthesia And Analgesia. 2003;96(1):82-4.
71. Urbano J, Cruzado V, López-Herce J, del Castillo J, Bellón JM, Carrillo A**.** Accuracy of three transcutaneous carbon dioxide monitors in critically ill children. Pediatric Pulmonology. 2010;45(5):481-6.
72. van Oppen JD, Daniel PS, Sovani MP**.** What is the potential role of transcutaneous carbon dioxide in guiding acute noninvasive ventilation? Respiratory Care. 2015;60(4):484-91.
73. Vivien B, Marmion F, Roche S, Devilliers C, Langeron O, Coriat P, et al. An evaluation of transcutaneous carbon dioxide partial pressure monitoring during apnea testing in brain-dead patients. Anesthesiology. 2006;104(4):701-7.
74. Xue Q, Wu X, Jin J, Yu B, Zheng M**.** Transcutaneous carbon dioxide monitoring accurately predicts arterial carbon dioxide partial pressure in patients undergoing prolonged laparoscopic surgery. Anesthesia And Analgesia. 2010;111(2):417-20.
75. Zhang H, Wang D-X**.** Noninvasive Measurement of Carbon Dioxide during One-Lung Ventilation with Low Tidal Volume for Two Hours: End-Tidal versus Transcutaneous Techniques. Plos One. 2015;10(10):e0138912-e.