

# The Effect of Patient Warming during Cesarean Delivery on Maternal and Neonatal Outcomes: A Meta-analysis

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# Disclosures

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# Introduction



- Normothermia recommended for surgery under general and regional anaesthesia<sup>1</sup>
- No recommendations regarding warming for caesarean delivery
- Aim: determine efficacy of active warming on maternal and neonatal outcomes following elective caesarean delivery

# Methods for Meta-analysis



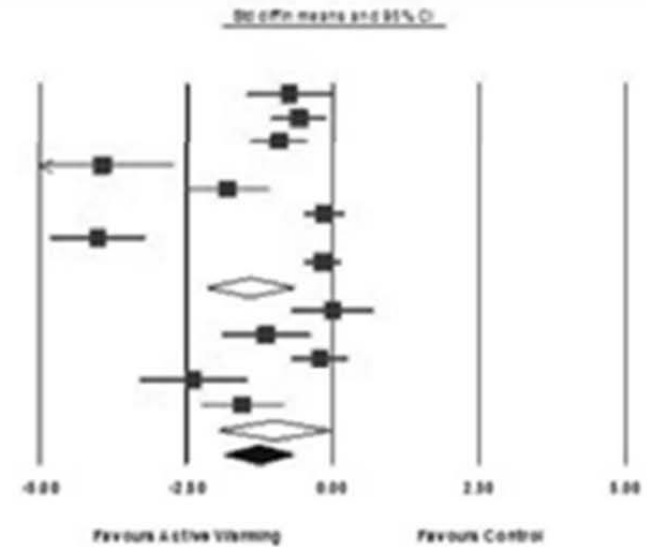
- Literature search
  - RCTs utilising forced air warming or warmed fluid
- Primary outcome:
  - maximum temperature change
- Secondary outcomes:
  - maternal (temperature at the end of surgery, shivering, thermal comfort, hypothermia)
  - neonatal (temperature, umbilical cord pH and Apgar scores)
- SMD/MD/RR and 95% CI calculated using random effects modelling (CMA, version 2, 2005)

# Results

- 13 studies included
- 789 patients (416 warmed and 373 controls) were analysed for the primary outcome

# Forest Plot - Temperature Change

Group by Subgroup within study	Study name	Warming method	Standard error	Statistics for each study				Sample size		SMD (95% CI)	
				Variance	Lower SMD	Upper SMD	Z-value	p-value	Warming		Control
Fluid	Chung	Fluid	0.376	0.143	-1.490	-0.010	-1.955	0.04711	15	15	
Fluid	Goyal	Fluid	0.255	0.065	-1.087	-0.086	-2.297	0.02159	32	32	
Fluid	Woolough	Fluid	0.206	0.066	-1.421	-0.417	-2.227	0.03022	50	28	
Fluid	Yokoyama	Fluid	0.624	0.390	-5.146	-2.699	-6.283	0.00000	15	15	
Fluid	Chan	Fluid	0.376	0.141	-2.842	-1.070	-4.809	0.00000	21	19	
Fluid	Jorgensen	Fluid	0.158	0.026	-0.511	0.228	-0.752	0.45227	57	56	
Fluid	Smith	Fluid	0.423	0.179	-4.830	-3.170	-9.448	0.00000	38	32	
Fluid	Park	Fluid	0.164	0.027	-0.491	0.132	-1.033	0.30161	73	76	
Fluid			0.381	0.148	-2.178	-0.682	-3.751	0.00018			
Forced Air	Bulk	Forced Air	0.265	0.133	-0.716	0.716	0.000	1.00000	15	15	
Forced Air	Chung	Forced Air	0.293	0.155	-1.902	-0.361	-2.877	0.00402	15	15	
Forced Air	Falls	Forced Air	0.255	0.065	-0.721	0.278	-0.870	0.38451	32	30	
Forced Air	Hahn 2002	Forced Air	0.477	0.227	-3.309	-1.440	-4.950	0.00000	15	15	
Forced Air	Hahn 2014	Forced Air	0.260	0.130	-2.243	-0.831	-4.267	0.00002	19	21	
Forced Air			0.485	0.236	-1.974	-0.071	-2.107	0.03614			
Overall			0.200	0.090	-1.861	-0.687	-4.251	0.00002			



(I<sup>2</sup>=92%)

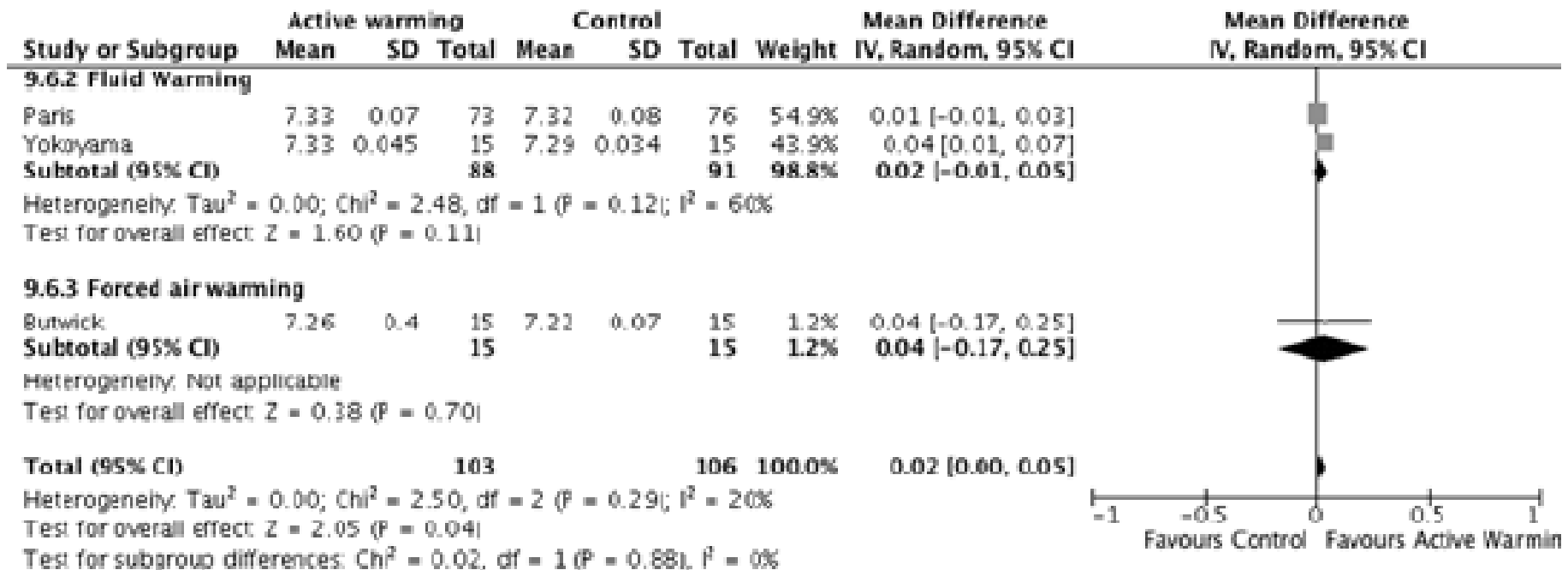
Warming was associated with reduced temperature change  
 SMD -1.27°C [- 1.86, -0.69]; p=0.00002

# Results - Maternal Outcomes

- Warming was associated with:
  - higher temperatures at end of surgery  
MD 0.43 °C [0.27, 0.59];  $p < 0.00001$
  - less shivering  
RR 0.58 [0.43, 0.79];  $p = 0.0004$ ; NNT = 7
  - improved thermal comfort  
MD 0.98 [0.24, 1.72];  $p = 0.01$
  - lower incidence of hypothermia  
RR 0.66 [0.50, 0.87];  $p = 0.003$ ; NNT = 5

# Results - Neonatal Outcomes

- Umbilical artery pH was higher in the warmed group  
MD 0.02 [0, 0.05]; p=0.04





# Limitations

- Heterogeneity among studies for primary outcome:
  - anaesthesia technique / drugs / doses
  - fluid / Forced air
  - ambient temperatures
  - temperature measurement techniques and sites
- Blinding almost impossible in these studies

# Conclusion

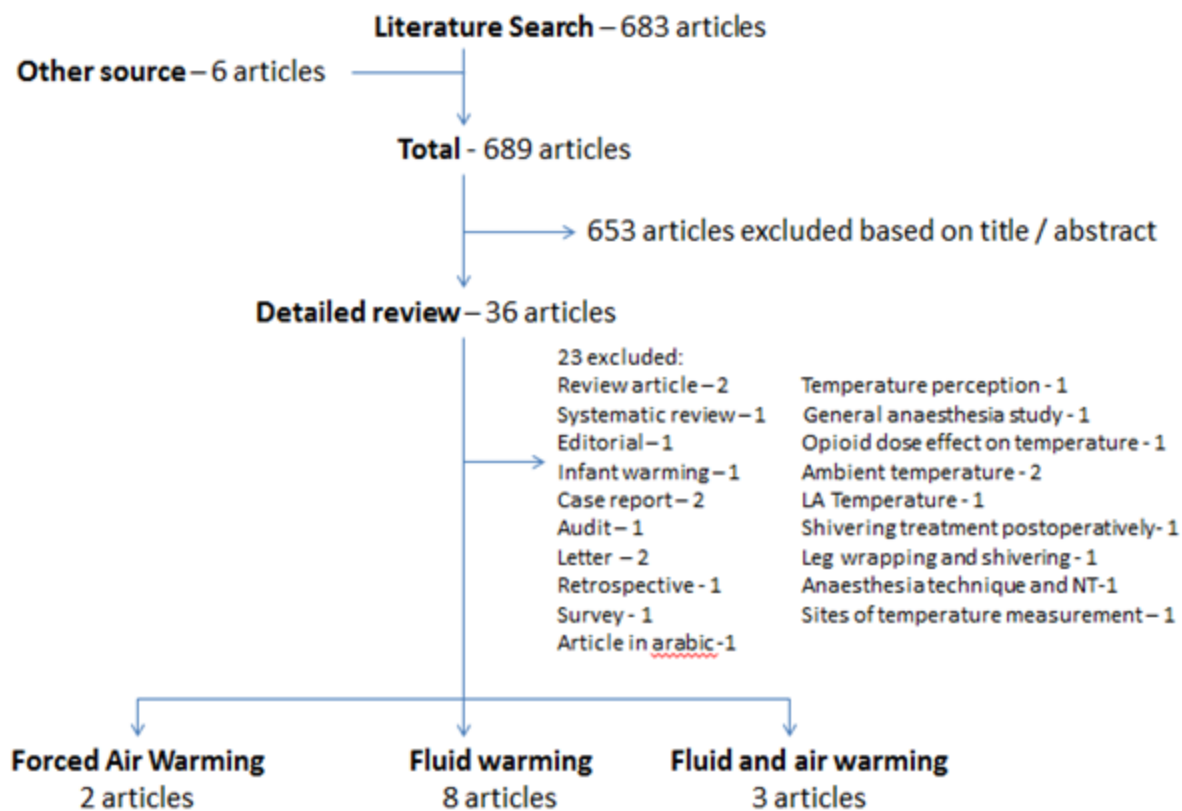
- Active warming for elective caesarean delivery prevents:
  - perioperative temperature reduction
  - hypothermia
  - shivering
- 16% of UK obstetric anaesthesia units warm women during caesarean delivery<sup>2</sup>
- Forced air warming or warmed fluid should be utilised for elective caesarean delivery

# Questions

# Subgroup Analysis

- Fluid warming (n=8; 300 patients per group)
  - Reduced maximum temperature change
  - Reduced shivering
  - Reduced hypothermia
- Forced air warming (n=5; 100 patients per group)
  - Maximum temperature change not different
  - Shivering and hypothermia not different
- Fluid warming and FAW not directly compared
- Heterogeneity not affected by:
  - Warming technique
  - Anaesthetic technique

Figure 1 – Literature search outlining included and excluded studies



NT = neonatal temperature; LA = local anaesthetic

Figure 3: Risk of bias figure for primary outcome of maximum temperature change

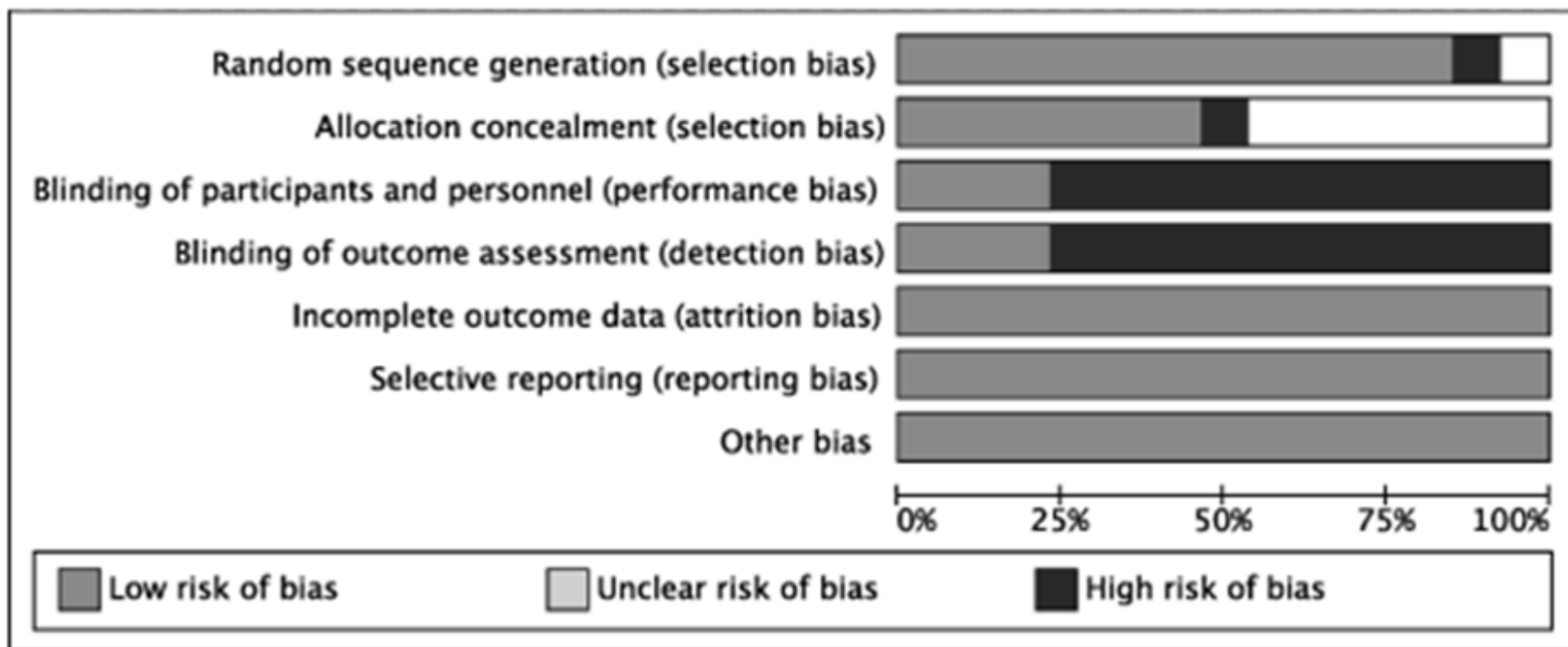
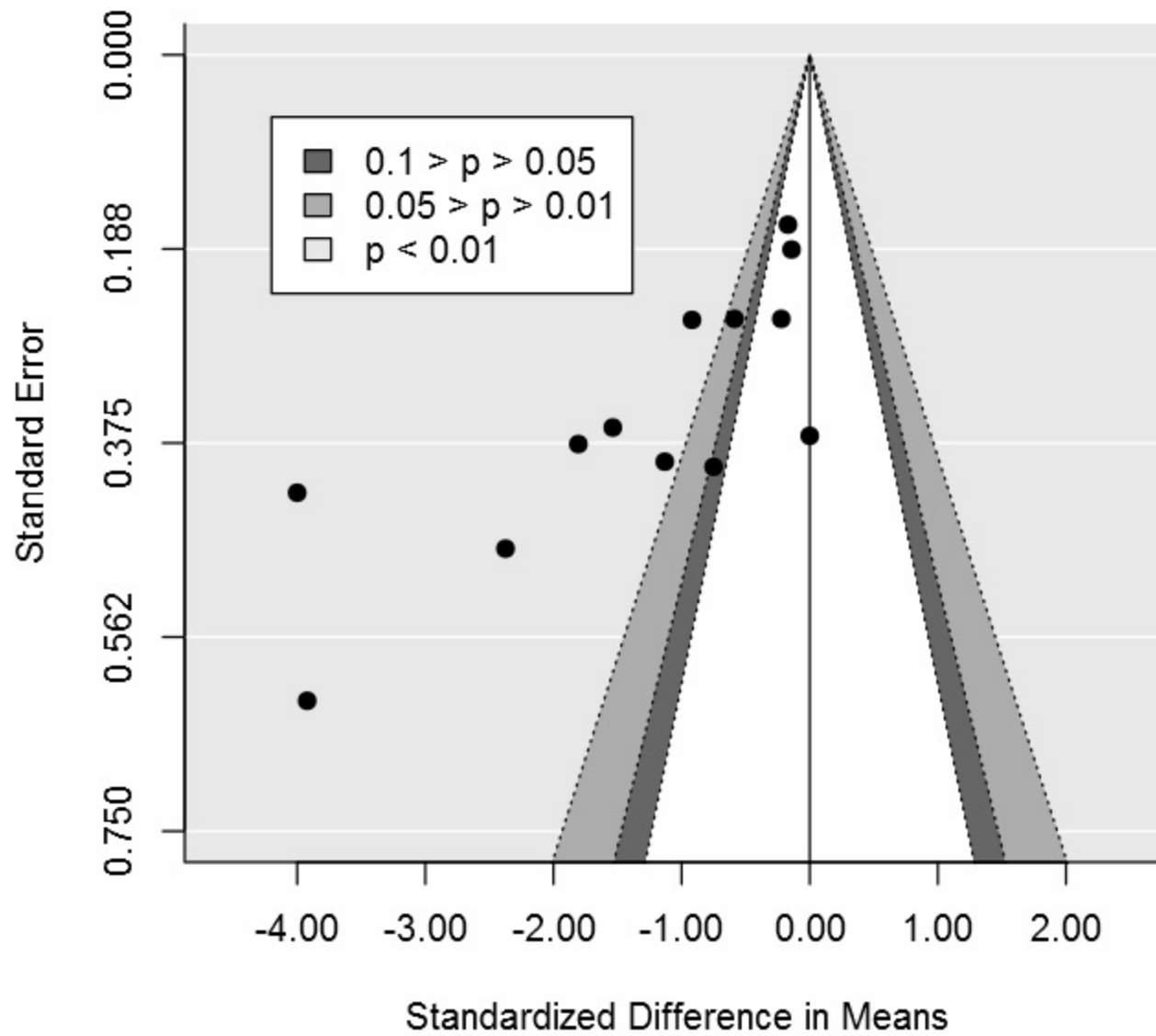
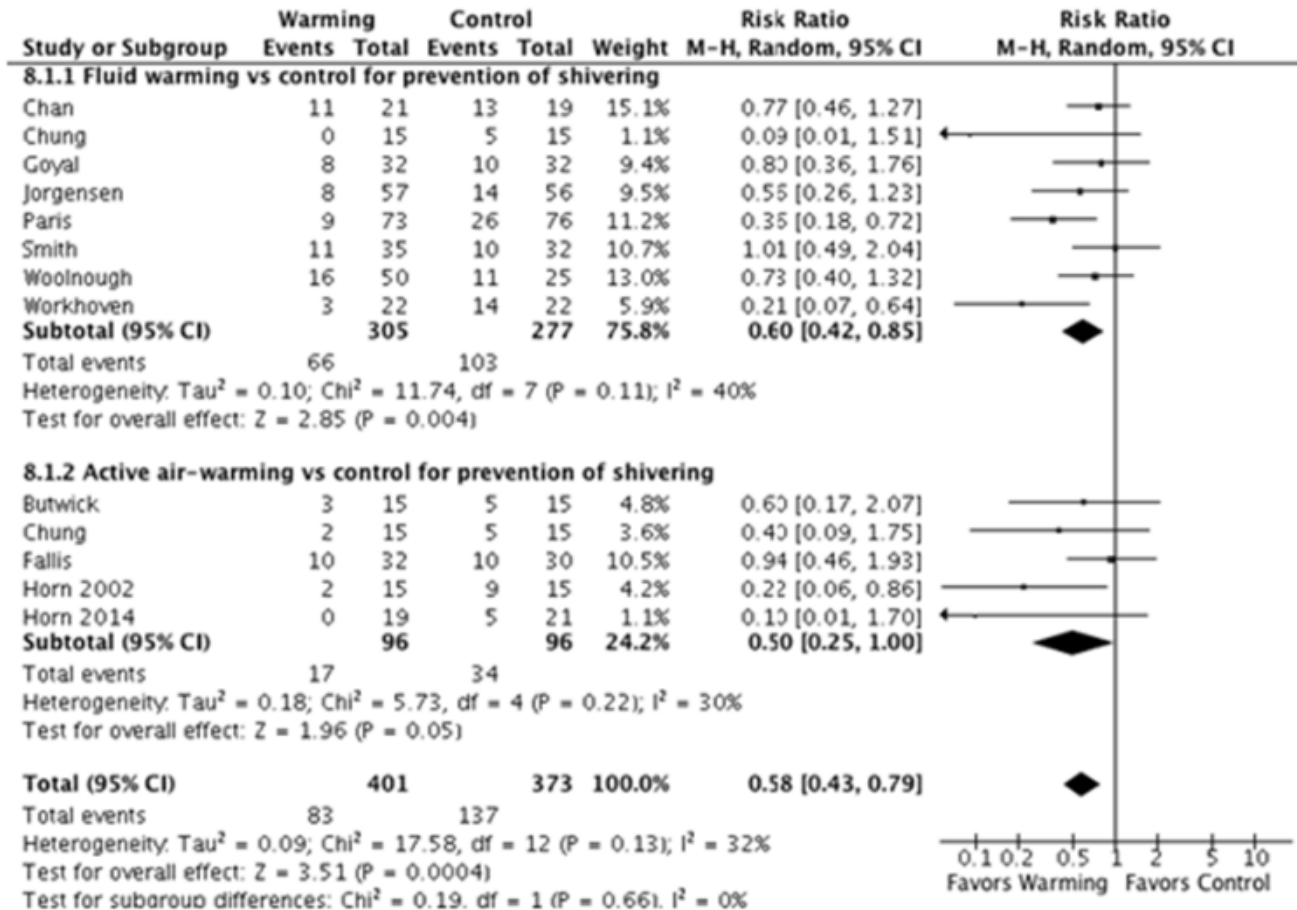


Figure 4: Contour-enhanced funnel plot for primary outcome of maximum temperature change



# Forest plot: Shivering





# Forest plot: Hypothermia

