Fernando SM, Tran A, Cheng W, Rochwerg B, Taljaard M, Vaillancourt C, Rowan KM, Harrison DA, Nolan JP, Kyeremanteng K, McIsaac DI, Guyatt GH, Perry JJ. Pre- and Intra-Arrest Factors Associated with Survival Following Adult In-Hospital Cardiac Arrest – A Systematic Review and Meta-Analysis

ELECTRONIC APPENDIX

Supplemental Figure 1: Electronic Search Strategies.

Databases Searched:

- EMBASE Classic + Embase
- PubMed/Medline
- Scopus
- Web of Science
- Cochrane Central Register of Controlled Trials (CENTRAL)

EMBASE Classic + EMBASE 1947 to Week 6 2019
Date of Search: February 4, 2019

	Search Strategy	Results
1	cardiac arrest.mp.	48710
2	cardiac arrest.tw.	45943
3	predict*.ti.	406857
4	model*.ti.	641230
5	utility.ti.	41033
6	scor*.ti.	80730
7	validat*.ti.	94766
8	risk*.ti.	601828
9	prognos*.ti.	187311
10	associat*.ti.	906282
11	factor*.ti.	782852
12	3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11	3252259
13	1 or 2	48710
14	**12 and 13**	**8740**

PubMed/MEDLINE 1946 to Week 6 2019
Date of Search: February 4, 2019

	Search Strategy	Results
1	cardiac arrest.mp.	31296
2	cardiac arrest.tw.	29876
3	predict*.ti.	285873
4	model*.ti.	531484
5	utility.ti.	28233
6	scor*.ti.	54190
7	validat*.ti.	66976
8	risk*.ti.	439025
9	prognos*.ti.	139705
10	associat*.ti.	746962
11	factor*.ti.	667491
12	3 or 4 or 5 or 6 or 7 or 8 or 9 or 10 or 11	2606543
13	1 or 2	31296
14	**12 and 13**	**4925**

Supplemental Table 1: Standardized Data Extraction Sheet

Data to be Extracted	Notes to Reviewer
Basic Study Information	
Study Title	
Journal/Conference	
Conference Abstract vs. Full-text	
Year of Publication	
Language	If published in language other than English - Exclude
Author	List first author only
Correspondence Email	
Study Design	
Prospective vs. Retrospective	
Number of Sites	
Country/Countries of Study	
Eligibility Assessment	
Does the study include only adult patients (i.e. ≥ 16 years of age)?	If "No" – Exclude
Does the study only include patients with in-hospital cardiac arrest (IHCA)?	If "No" – Exclude
Does the study include patients from any of the following: A) Emergency Department; B) Intensive Care Unit; C) Hospital Wards	If "No" – Exclude
Does the study provide original data related to pre-arrest and intra-arrest variables of interest?	If "No" – Exclude
Does the study provide short-term mortality outcome data (i.e. in-hospital, or 30-day)?	If "No" – Exclude
Does the study include cases of out-of-hospital cardiac arrest?	If "Yes" – Exclude
Does the study only include patients receiving a particular post-arrest investigation (e.g. computed tomography) or treatment (e.g. therapeutic hypothermia, extracorporeal life support)?	If "Yes" – Exclude
Is the data presented in the study completely included in another report?	If "Yes" – Exclude, include only study with the largest number of patients
Are the unadjusted or adjusted odds ratios stated, or can they be derived?	If "No" – Contact Corresponding Author, if no response after three attempts, then exclude
Prognostic Factors	
In what setting were prognostic factors calculated?	e.g. Emergency Department, ICU

Outcome	
How was mortality defined (i.e. timing of outcome)?	i.e. in-hospital or 30-day
Study Population	
From which setting were patients recruited?	e.g. Emergency Department, Hospital Wards, ICU
Was population was included?	
Were elderly patients included?	
Were patients with a 'Do Not Resuscitate' (or similar) order included?	
Were pregnant patients included?	
Were patients with any other co-morbidity included/excluded?	
Odds Ratio Index Factor 1	
Pre-/Intra-arrest factor evaluated	e.g. age, sex, witnessed, shockable
Total number of patients	
Total number of Mortality+ Patients	
Total number of Mortality- patients	
Total number of Factor+ patients	
Total number of Factor- patients	
Unadjusted Odds Ratio	
Adjusted Odds Ratio	
Confounders included in model adjustment	
Odds Ratio Index Factor 2	
Pre-/Intra-arrest factor evaluated	e.g. age, sex, witnessed, shockable
Total number of patients	
Total number of Mortality+ Patients	
Total number of Mortality- patients	
Total number of Factor+ patients	
Total number of Factor- patients	
Unadjusted Odds Ratio	
Adjusted Odds Ratio	
Confounders included in model adjustment	
Author Contact	
Contact author?	If more information needed, indicate here to contact author

Supplemental Table 2: CHARMS-PF Checklist Detailed Characteristics of the 23 Included Cohorts (Adapted from Riley *et al*., *BMJ*, 2019).
Abbreviations: CPR = Cardiopulmonary Resuscitation; ED = Emergency Department; ICU = Intensive Care Unit; IHCA = In-Hospital Cardiac Arrest OHCA = Out-of-Hospital Cardiac Arrest; OR = Operating Room

Author (Year)	Journal	Type of Study	Sites	Country	Years	Sample Size	Survived to Hospital Discharge	% Survival	Inclusion Criteria	Exclusion Criteria
Al-Dury (2017)	*Am J Emerg Med*	Retrospective Cohort Study	66	Sweden	2006-2015	14933	4181	28.0	Patients 18 years or older, suffering IHCA, receiving CPR	
Ballew (1994)	*Arch Intern Med*	Retrospective Cohort Study	1	USA	1990-1991	313	50	16.0	> or = 18, ICD diagnosis of cardiac arrest OR completion of cardiac arrest form, received CPR	<18, OHCA, arrest in non-ward location (ED, OR, recovery room, or cardiac cath lab)
Bialecki (1995)	*Chest*	Retrospective Cohort Study	1	USA	1989-1991	242	40	16.5	Adult patients with attempt at CPR following cardiac arrest in-hospital	
Brady (2011)	*Resuscitation*	Prospective Cohort Study		USA	2000-2008	74213	13224	17.8	Adult patients experiencing cardiac arrest in-hospital	
Brindley (2002)	*CMAJ*	Retrospective Cohort Study	3	Canada	1997-1999	247	28	11.3	> or = 18, received CPR	Admitted to ICU, non-ward location (ED, OR), incomplete record

Chan (2013)	*Am J Emerg Med*	Retrospective Cohort Study	2	Hong Kong	2008	431	23	5.3	Adult patients with in-hospital resuscitation following cardiac arrest	
Chen (2016)	*J Chin Med Assoc*	Retrospective Cohort Study	1	Taiwan	2012	382	45	11.8	Adult patients with in-hospital resuscitation following cardiac arrest	OHCA, 'Do Not Resuscitate' order
Cleverley (2013)	*Resuscitation*	Retrospective Cohort Study	6	Canada	2002-2006	668	66	9.9	> or = 18. receiving CPR	Catheterization laboratory, CCU, ICU, OR arrests
Danciu (2004)	*Resuscitation*	Retrospective Cohort Study	1	USA	2000-2002	219	33	15.1	Adult patients with attempt at CPR following cardiac arrest in-hospital	
de Vos (1999)	*Arch Intern Med*	Retrospective Cohort Study	1	Netherlands	1988-1994	553	120	21.7	Adult patients with attempt at CPR following cardiac arrest in-hospital	OHCA, 2nd IHCA during same hospitalization
Doig (2000)	*Clin Invest Med*	Prospective Cohort Study	1	Canada	1992-1994	239	51	21.3	Adult patients with attempt at CPR following cardiac arrest in-hospital	
Dumot (2001)	*Arch Intern Med*	Retrospective Cohort Study	1	USA	1994-1995	445	104	23.4	≥18 years, receiving CPR for IHCA	<18 years, ‘Do Not Resuscitate’ order

Hessulf (2018)	*Int J Cardiol*	Retrospective Cohort Study	66	Sweden	2006-2015	17747	5058	28.5	Patients 18 years or older, suffering IHCA, receiving CPR	
Larkin (2010)	*Resuscitation*	Prospective Cohort Study	366	USA	2000-2004	49130	7812	15.9	Adult patients experiencing cardiac arrest in-hospital	
Li (2018)	*Am J Emerg Med*	Retrospective Cohort Study	3	China	2012-2016	320	68	21.3	Adult patients with acute coronary syndrome, complicated by cardiac arrest	OHCA, 'Do Not Resuscitate' order
Marwick (1991)	*Resuscitation*	Prospective Cohort Study	1	Australia	1984-1987	710	193	27.2	Patients attended to by Cardiac Arrest Team	Respiratory arrests
Meaney (2010)	*Crit Care Med*	Prospective Cohort Study	411	USA	1999-2005	51919	9125	17.6	Adult patients experiencing cardiac arrest in-hospital	
Ohlsson (2014)	*Resuscitation*	Prospective Cohort Study	1	Sweden	2007-2010	287	58	20.2	Prospectively enrolled following cardiac arrest	Pediatric cases, ‘Do Not Resuscitate’ order, missing data
Peberdy (2008)	*JAMA*	Prospective Cohort Study	507	USA	2000-2007	86748	15743	18.1	Adult patients experiencing cardiac arrest in-hospital	
Shao (2016)	*Resuscitation*	Prospective Cohort Study	12	China	2014	2712	247	9.1	≥ 14 years, pulseless, receiving CPR	

Skrifvars (2007)	*Resuscitation*	Prospective Cohort Study	5	Finland	1994-2003	1578	463	29.3	Patients attended to by Cardiac Arrest Team
Zoch (2000)	*Arch Intern Med*	Retrospective Cohort Study	2	USA	1983-1991	948	305	32.2	Patients attended to by Cardiac Arrest Team
UK NCAA (2019)		Prospective Cohort Study	185	United Kingdom	2013-2018	90276	37328	41.4	Patients attended to by Cardiac Arrest Team

Supplemental Table 3 – CHARMS-PF Checklist of Key Items in 23 Included Studies (Adapted from Moons *et al*., *PLoS Med*, 2014).

Source of data:	**N (%)**
Case Control	0 (0.0)
Observational Cohort	17 (73.9)
Randomized Trial	0 (0.0)
Registry Data	6 (26.1)
Participants:	
Indicated participant eligibility and recruitment method	23 (100.0)
Provided participant description	23 (100.0)
Provided study dates	23 (100.0)
Outcomes to be predicted:	
Definition and method for measurement of outcomes	23 (100.0)
Was the same outcome definition used in all participants?	23 (100.0)
Were the outcomes assessed without knowledge of the candidate prognostic factors?	10 (43.5)
Provided time of outcome occurrence or summary of duration of follow-up	23 (100.0)
Prognostic factors (index and comparator prognostic factors):	
Indicated number and type of prognostic factors	23 (100.0)
Provided definition and method for measurement of prognostic factors	23 (100.0
Timing of prognostic factor measurement (e.g. prior to IHCA, during IHCA, etc.)	23 (100.0)
Were prognostic factors assessed blinded for outcome?	10 (43.5)
Specified handling of prognostic factors in analysis (e.g. continuous, categorized)	23 (100.0)
Sample size:	
Was a sample size calculation conducted and, if so, how?	3 (13.0)
Indicated number of participants and number of outcomes or events	23 (100.0)
Number of outcomes considered in relation to the number of prognostic factors	23 (100.0)
Missing data:	
Reported number of participants with any missing value	17 (73.9)
Reported number of participants with missing data for each prognostic factor	17 (73.9)
Provided details of attrition	11 (47.8)
Reported handling of missing data	15 (65.2)
Analysis:	
Indicated modeling method utilized	23 (100.0)
Reported method for selection of factors for inclusion in multivariable model	23 (100.0)
Reported method of handling each continuous prognostic factor	16 (69.6)
Results:	
Reported unadjusted and adjusted prognostic effect estimates	23 (100.0)
Provided the set of adjustment factors used	23 (100.0)
Interpretation and discussion:	
Provided interpretation of presented results	23 (100.0)
Compared results with other studies, including strengths and limitations	23 (100.0)

Supplemental Table 4: Pre-Arrest Factors Evaluated in the 23 Included Cohorts.
Abbreviations: ACS = Acute Coronary Syndrome; CHF = Congestive Heart Failure; CKD = Chronic Kidney Disease; COPD = Chronic Obstructive Pulmonary Disease

Study	Age ≥ 60	Age ≥ 70	Sex	Malignancy	CHF	CKD	COPD	Diabetes	ACS	Sepsis
Al Dury (2017)			x							
Ballew (1994)										
Bialecki (1995)										
Brady (2011)										
Brindley (2002)			x							
Chan (2013)										
Chen (2016)			x							
Cleverly (2013)										
Danciu (2004)						x				
de Vos (1999)		x				x				
Doig (2000)										
Dumot (2001)										
Hessulf (2018)				x	x	x	x		x	
Larkin (2010)				x		x			x	x
Li (2018)		x								
Marwick (1991)	x		x							
Meaney (2010)										
Ohlsson (2014)				x						
Peberdy (2008)										
Shao (2016)	x		x							
Skrifvars (2007)			x	x		x		x		
Zoch (2000)										
UK NCAA (2019)	x		x							

Supplemental Table 5: Intra-Arrest Factors Evaluated in the 23 Included Cohorts.
Abbreviations: ACS = Acute Coronary Syndrome; CHF = Congestive Heart Failure; CKD = Chronic Kidney Disease; COPD = Chronic Obstructive Pulmonary Disease

Study	Witnessed	Monitored	Daytime	VT	VF	Asystole	PEA	Shockable	Intubation	Duration
Al Dury (2017)										
Ballew (1994)				x		x				
Bialecki (1995)						x			x	x
Brady (2011)	x	x								
Brindley (2002)			x							
Chan (2013)		x						x		
Chen (2016)								x		
Cleverly (2013)	x	x		x	x	x	x			
Danciu (2004)								x		
de Vos (1999)								x		
Doig (2000)								x		
Dumot (2001)									x	
Hessulf (2018)	x	x	x					x	x	
Larkin (2010)	x	x		x	x				x	
Li (2018)								x		
Marwick (1991)					x				x	
Meaney (2010)		x						x		
Ohlsson (2014)		x						x		
Peberdy (2008)		x	x							
Shao (2016)								x		
Skrifvars (2007)	x		x					x		
Zoch (2000)		x								
UK NCAA (2019)			x	x	x	x	x	x		x

Supplemental Table 6: Prognostic Factors Included in Adjustment for Mortality in the 23 Included Cohorts. Abbreviations: CPR = Cardiopulmonary resuscitation; STEMI = ST-Elevation Myocardial Infarction

Study – Author (Year)	Prognostic Factors Included in Adjusted Analyses
Al Dury (2017)	age; sex; initial rhythm, etiology of arrest; comorbidities
Ballew (1994)	age; sex; initial rhythm; etiology of arrest
Bialecki (1995)	age; sex; initial rhythm; etiology of arrest; location of arrest; event duration; intubation; laboratory values
Brady (2011)	age; sex; initial rhythm; etiology of arrest; ethnicity; time of day; weekend; illness category; location; comorbidities; pharmacological interventions; time to first shock; event duration; interval between admit and event; total number of arrests this visit
Brindley (2002)	age; sex; initial rhythm; etiology of arrest; location; witnessed arrest
Chan (2013)	age; sex; initial rhythm; etiology of arrest; location; witnessed arrest; time of day; intubation; pharmacological interventions
Chen (2016)	age; sex; initial rhythm; pharmacological interventions; event duration
Cleverly (2013)	age; sex; initial rhythm; time of day
Danciu (2004)	age; sex; initial rhythm; etiology of arrest; witnessed arrest; time of day; event duration
de Vos (1999)	age; sex; initial rhythm; comorbidities; functional status before admission
Doig (2000)	age; sex; initial rhythm; etiology of arrest; witnessed arrest; pharmacological interventions; time to defibrillation; functional status
Dumot (2001)	age; sex; initial rhythm, time of day; event duration; intubation; pharmacological interventions;
Hessulf (2018)	age; sex; initial rhythm; etiology of arrest; location; time of day; comorbidities; witnessed arrest; monitored
Larkin (2010)	age; sex; initial rhythm; comorbidities; location; intubation; pharmacological interventions; witnessed arrest; monitored; total number of arrests this visit
Li (2018)	age; sex; initial rhythm; location; event duration; smoker; prior percutaneous coronary intervention
Marwick (1991)	age; sex; initial rhythm; location; witnessed; pharmacological interventions; time to CPR; time to defibrillation
Meaney (2010)	age; sex; initial rhythm; location; witnessed; monitored; pharmacological interventions
Ohlsson (2014)	age; sex; initial rhythm; heart rate; STEMI
Peberdy (2008)	age; sex; initial rhythm; location; witnessed; monitored; pharmacological interventions; duration of event; delay in CPR; hospital size; use of epinephrine
Shao (2016)	age; sex; initial rhythm; location; delay in CPR
Skrifvars (2007)	age; sex; initial rhythm; etiology of arrest; witnessed; time of day; location; comorbidities;
Zoch (2000)	age; sex; initial rhythm; etiology of arrest; location; monitored
UK NCAA (2019)	age; sex; initial rhythm; time of day; location;

Supplemental Table 7: QUIPS Quality Assessment for Risk of Bias of the 23 Included Cohorts. Abbreviations: PF = Prognostic Factor; ROB = Risk of bias

Study	Study Participation	Study Attrition	PF Measurement	Outcome Measurement	Adjustment	Statistical Reporting
Al Dury (2017)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Ballew (1994)	Low ROB	Moderate ROB	Low ROB	Low ROB	Low ROB	Moderate ROB
Bialecki (1995)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Brady (2011)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Brindley (2002)	Moderate ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Chan (2013)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Chen (2016)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Cleverly (2013)	Moderate ROB	Moderate ROB	Low ROB	Low ROB	Low ROB	Moderate ROB
Danciu (2004)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
de Vos (1999)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Doig (2000)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Dumot (2001)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Hessulf (2018)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Larkin (2010)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Li (2018)	Moderate ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Marwick (1991)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Meaney (2010)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Ohlsson (2014)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Peberdy (2008)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Shao (2016)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Skrifvars (2007)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
Zoch (2000)	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB
UK NCAA (2019)	Moderate ROB	Low ROB	Low ROB	Low ROB	Low ROB	Low ROB

<u>Supplemental Table 8:</u> GRADE Certainty of Prognostic Estimates – Pre-Arrest Factors (Adapted from Iorio *et al*., *BMJ*, 2015).

№ of studies	Certainty assessment						impact	Certainty	Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations			
Male sex									
7	observational studies	not serious [a]	not serious [b]	not serious	serious [c]	none	Pooled Odds Ratio = 0.84 (95% CI 0.73-0.95)	⊕⊕⊕◯ MODERATE	CRITICAL
Age									
5	observational studies	serious [d]	not serious [b]	not serious	serious [c]	none	Pooled Odds Ratio = 0.42 (95% CI 0.18-0.99)	⊕⊕◯◯ LOW	CRITICAL
History of Malignancy									
4	observational studies	not serious	not serious [b]	not serious	not serious	none	Pooled Odds Ratio = 0.57 (95% CI 0.45-0.71)	⊕⊕⊕⊕ HIGH	CRITICAL
History of Congestive Heart Failure									
1	observational studies	not serious	not serious	not serious	serious [e]	none	Pooled Odds Ratio = 0.62 (95% CI 0.56-0.68)	⊕⊕⊕◯ MODERATE	CRITICAL
History of Chronic Kidney Disease									
5	observational studies	not serious	not serious [b]	not serious	not serious	none	Pooled Odds Ratio = 0.56 (95% CI 0.40-0.78)	⊕⊕⊕⊕ HIGH	CRITICAL

№ of studies	Certainty assessment						impact	Certainty	Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations			
History of Chronic Obsrtuctive Pulmonary Disease									
1	observational studies	not serious	not serious	not serious	serious [e]	none	Pooled Odds Ratio = 0.65 (95% CI 0.58-0.72)	⨁⨁⨁◯ MODERATE	CRITICAL
History of Diabetes Mellitus									
1	observational studies	not serious	not serious	not serious	serious [e]	none	Pooled Odds Ratio = 0.53 (95% CI 0.34-0.83)	⨁⨁⨁◯ MODERATE	CRITICAL
Diagnosis of Acute Coronary Syndrome									
2	observational studies	not serious	serious [f]	not serious	serious [c]	none	Pooled Odds Ratio = 0.70 (95% CI 0.28-1.78)	⨁⨁◯◯ LOW	CRITICAL
Diagnosis of Sepsis									
1	observational studies	not serious	not serious	not serious	serious [e]	none	Pooled Odds Ratio = 0.80 (95% CI 0.70-0.91)	⨁⨁⨁◯ MODERATE	CRITICAL

Explanations

a. The majority of weight in pooled estimate (>65%) comes from low RoB studies, the one moderate RoB study is consistent with the others.
b. Despite a high I-squared there is high degree of overlap amongst point estimates and confidence intervals.
c. Wide confidence intervals do not rule out important prognostic factor or no impact of this factor.
d. Majority of pooled estimate weight comes from studies at moderate RoB.
e. Small amount of study data and studies reporting on this variable.
f. High Isquared with non-overlapping point estimates and discrepant findings amongst included studies.

Supplemental Table 9: GRADE Certainty of Prognostic Estimates – Intra-Arrest Factors (Adapted from Iorio *et al*., *BMJ*, 2015).

№ of studies	Certainty assessment						impact	Certainty	Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations			
Witnessed Arrest									
5	observational studies	not serious [a]	not serious [b]	not serious	not serious	none	Pooled Odds Ratio = 2.46 (95% CI 1.75-3.45)	⊕⊕⊕⊕ HIGH	CRITICAL
Monitored Patient									
9	observational studies	not serious [a]	not serious [b]	not serious	not serious	none	Pooled Odds Ratio = 1.84 (95% CI 1.44-2.36)	⊕⊕⊕⊕ HIGH	CRITICAL
Arrest during 'Daytime' Hours									
6	observational studies	not serious [a]	not serious [b]	not serious	not serious	none	Pooled Odds Ratio = 1.39 (95% CI 1.19-1.61)	⊕⊕⊕⊕ HIGH	CRITICAL
Initial Shockable Rhythm									
13	observational studies	not serious [a]	not serious [b]	not serious	not serious	strong association	Pooled Odds Ratio = 4.80 (95% CI 3.47-6.64)	⊕⊕⊕⊕ HIGH	CRITICAL
Intubation During Resuscitation									
5	observational studies	not serious	not serious [b]	serious [c]	not serious	none	Pooled Odds Ratio = 0.54	⊕⊕⊕◯ MODERATE	CRITICAL

№ of studies	Certainty assessment						impact	Certainty	Importance
	Study design	Risk of bias	Inconsistency	Indirectness	Imprecision	Other considerations			
							(95% CI 0.42-0.70)		
Duration of Resuscitation > 15 minutes									
2	observational studies	serious [d]	not serious	not serious	not serious	strong association	Pooled Odds Ratio = 0.12 (95% CI 0.07-0.19)	⨁⨁⨁⨁ HIGH	CRITICAL

Explanations

a. The majority of pooled estimate weight comes from low risk of bias studies. The one moderate risk of bias study is consistent with the low risk of bias studies.
b. Despite a high I-squared there is high degree of overlap between point estimates and confidence intervals.
c. Variable timing of intubation, unclear other confounding variables contributing to whether patient is intubated or not.
d. The majority of pooled estimate weight comes from data at moderate risk of bias.

Supplemental Table 10: CHARMS-PF Checklist Detailed Characteristics of the 30 Studies with Unadjusted Values Only
(Adapted from Riley *et al*., *BMJ*, 2019). Abbreviations: CPR = Cardiopulmonary Resuscitation; ED = Emergency Department; ICU = Intensive Care Unit; IHCA = In-Hospital Cardiac Arrest OHCA = Out-of-Hospital Cardiac Arrest; OR = Operating Room

Author (Year)	Journal	Type of Study	Sites	Country	Years	Sample Size	Survived to Hospital Discharge	% Survival	Inclusion Criteria	Exclusion Criteria
Andersen (2017)	*JAMA*	Prospective Cohort Study	668	USA	2000-2014	108079	24256	22.4	Adult patients experiencing cardiac arrest in-hospital	
Andreasson (1998)	*Resuscitation*	Prospective Cohort Study	1	Sweden	1994-1995	170	73	42.9	≥ 18 years, arrested and received CPR in-hospital	
Bedell (1983)	*N Engl J Med*	Prospective Cohort Study	1	USA	1981-1982	294	41	13.9	Adult patients with attempt at CPR following cardiac arrest in-hospital	
Cohn (2004)	*Int Med J*	Retrospective Cohort Study	1	Australia	2001-2003	105	22	21.0	≥ 18, received CPR	Admitted to ICU, non-ward location (ED, OR), incomplete record

Cooper (2006)	*Resuscitation*	Retrospective Cohort Study	1	United Kingdom	1993-2003	2121	338	15.9	Adult patients with in-hospital resuscitation following cardiac arrest	Age < 20, 'Do Not Resuscitate' order
Dodek (1998)	*Resuscitation*	Retrospective Cohort Study	1	Canada	1989-1990	271	69	25.5	Adult patients with attempt at CPR following cardiac arrest in-hospital	
Ebell (1997)	*Med Decis Making*	Retrospective Cohort Study	3	USA	1992-1993	656	35	5.3	Identified from CPR log at hospital	
George (1989)	*Am J Med*	Prospective Cohort Study	1	USA	1985	140	34	24.3	Consecutive patients requiring CPR in-hospital	
Huang (2002)	*Resuscitation*	Retrospective Cohort Study	1	Taiwan	1999-2000	103	18	17.5		Age <17, OHCA
Karetzky (1995)	*Arch Intern Med*	Retrospective Cohort Study	1	USA	1990-1992	668	55	8.2	Patients 18 years or older, suffering IHCA, receiving CPR	Ventilation without compressions

Marik (1997)	*J Crit Care*	Retrospective Cohort Study	1	USA	1991-1995	308	41	13.3	Adult patients with attempt at CPR following cardiac arrest in-hospital	
Ofoma (2018)	*J Am Coll Cardiol*	Prospective Cohort Study	470	USA	2000-2014	151071	28097	18.6	Adult patients experiencing cardiac arrest in-hospital	
O'Keeffe (1991)	*Q J Med*	Retrospective Cohort Study	1	Ireland		274	25	9.1	All patients receiving CPR in-hospital	
Patrick (1998)	*Resuscitation*	Prospective Cohort Study	1	New Zealand	1995-1996	133	35	26.3	Prospectively enrolled following cardiac arrest	
Peters (2007)	*Am J Crit Care*	Prospective Cohort Study	1	Australia	2004	128	41	32.0	Patients attended to by Cardiac Arrest Team, Loss of pulse	OHCA, respiratory arrest, DNR
Piscator (2016)	*Resuscitation*	Retrospective Cohort Study	1	Sweden	2014	174	41	23.6	All cases identified through the hospital's cardiac arrest sheet	

Radeschi (2017)	*Resuscitation*	Prospective Cohort Study	36	Italy	2011-2014	1539	228	14.8	Adult patients with in-hospital resuscitation following cardiac arrest	OHCA
Rakic (2005)	*Croat Med J*	Prospective Cohort Study	1	Croatia	2003	120	27	22.5	Patients attended to by Cardiac Arrest Team	
Roberts (1990)	*Chest*	Retrospective Cohort Study	1	Canada	1985-1986	310	30	9.7	All patients receiving CPR in-hospital	Arrests occurring the ER, OR
Robinson (1994)	*Chest*	Retrospective Cohort Study	1	USA	1989	83	24	28.9	Patients 18 years or older, suffering IHCA, receiving CPR	Arrests occurring the ER, OR; OHCA
Rosenberg (1992)	*Arch Intern Med*	Retrospective Cohort Study	2	USA	1988-1989	300	70	23.3	Absence of pulse and initiation of CPR	Arrests occurring the ER, OR; OHCA; Seizure
Rozenbaum (1988)	*Crit Care Med*	Prospective Cohort Study	1	Israel	1986	71	13	18.3	Patients 18 years or older, suffering IHCA, receiving CPR	Repeat arrests

Sandroni (2004)	*Resuscitation*	Prospective Cohort Study	1	Italy	2000-2002	114	37	32.5	>18; Patients attended to by Cardiac Arrest Team	OHCA; OR; outpatient
Schultz (1996)	*Resuscitation*	Retrospective Cohort Study	1	USA	1988-1991	266	24	9.0	Patients 18 years or older, suffering IHCA, receiving CPR	
Skogvoll (1999)	*Acta Anaesthesiologica Scandinavica*	Retrospective Cohort Study	1	Norway	1990-1994	244	43	17.6	Patients attended to by Cardiac Arrest Team	
Sowden (1984)	*Anaesthesia*	Retrospective Cohort Study	1	United Kingdom		108	23	21.3	Patients experiencing cardiac arrest in-hospital	
Taffett (1988)	*JAMA*	Retrospective Cohort Study	1	USA	1984-1985	399	22	5.5	Patients experiencing cardiac arrest in-hospital	
Tortolani (1990)	*Resuscitation*	Retrospective Cohort Study	1	USA		470	68	14.5	Patients attended to by Cardiac Arrest Team; unresponsive; apneic; pulseless	Respiratory arrests; syncope

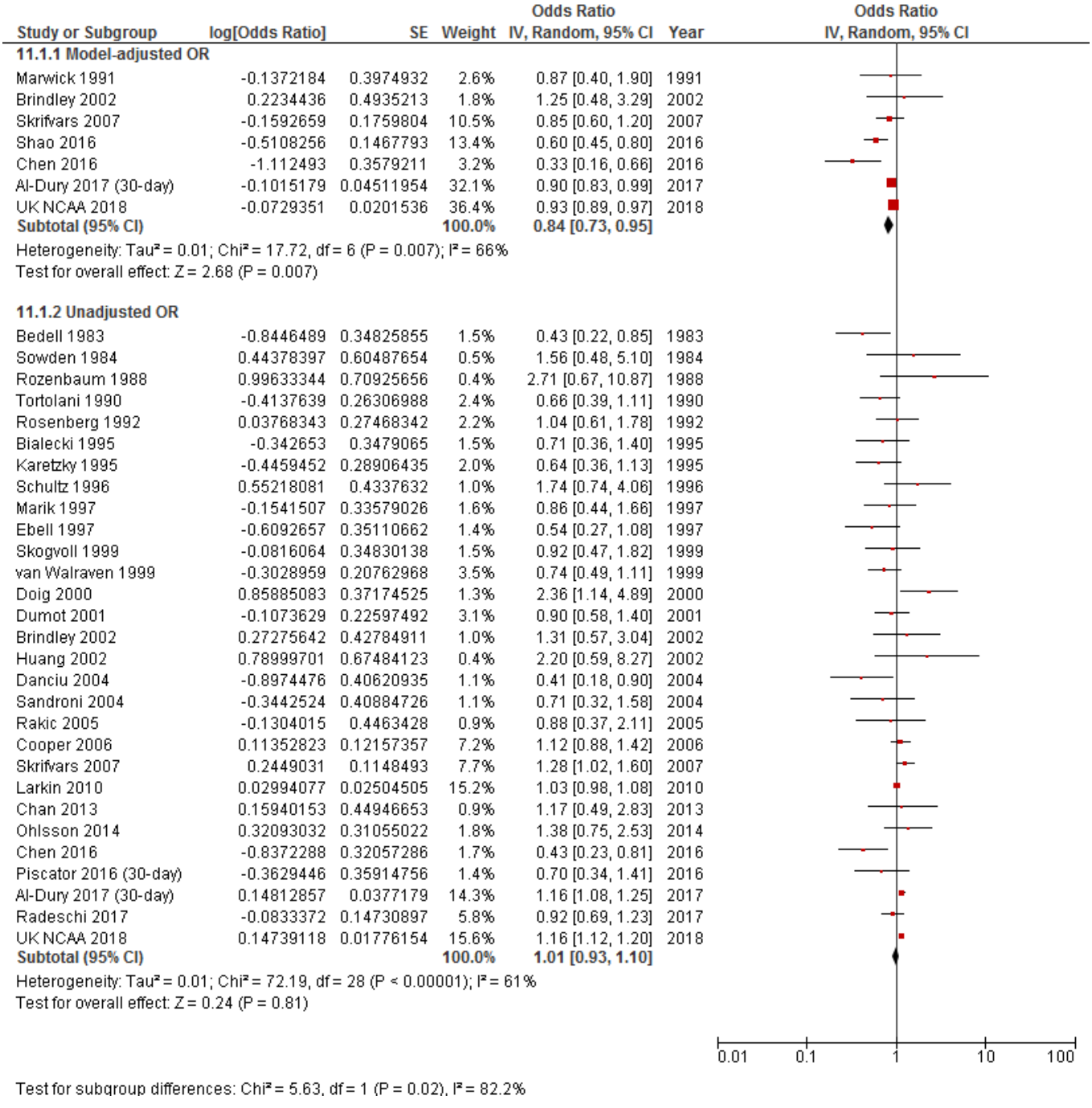
van Walraven (1999)	*Arch Intern Med*	Prospective Cohort Study	5	Canada	1989-1995	1077	103	9.6	Patients experiencing cardiac arrest in-hospital	<16; Terminal illness; Absence of CPR >15 mins from arrest; trauma; exanguination; OR; detectable pulse
van Walraven (2000)	*JAMA*	Prospective Cohort Study	1	USA	1987-1996	2181	327	15.0	Patients experiencing cardiac arrest in-hospital	NICU

Supplemental Table 11: Results of Meta-Analysis of Unadjusted Analyses for Prediction of Survival Following In-Hospital Cardiac Arrest. Abbreviations: CHF = Congestive Heart Failure; CI = confidence interval; COPD = Chronic Obstructive Pulmonary Disease; OR = Odds ratio

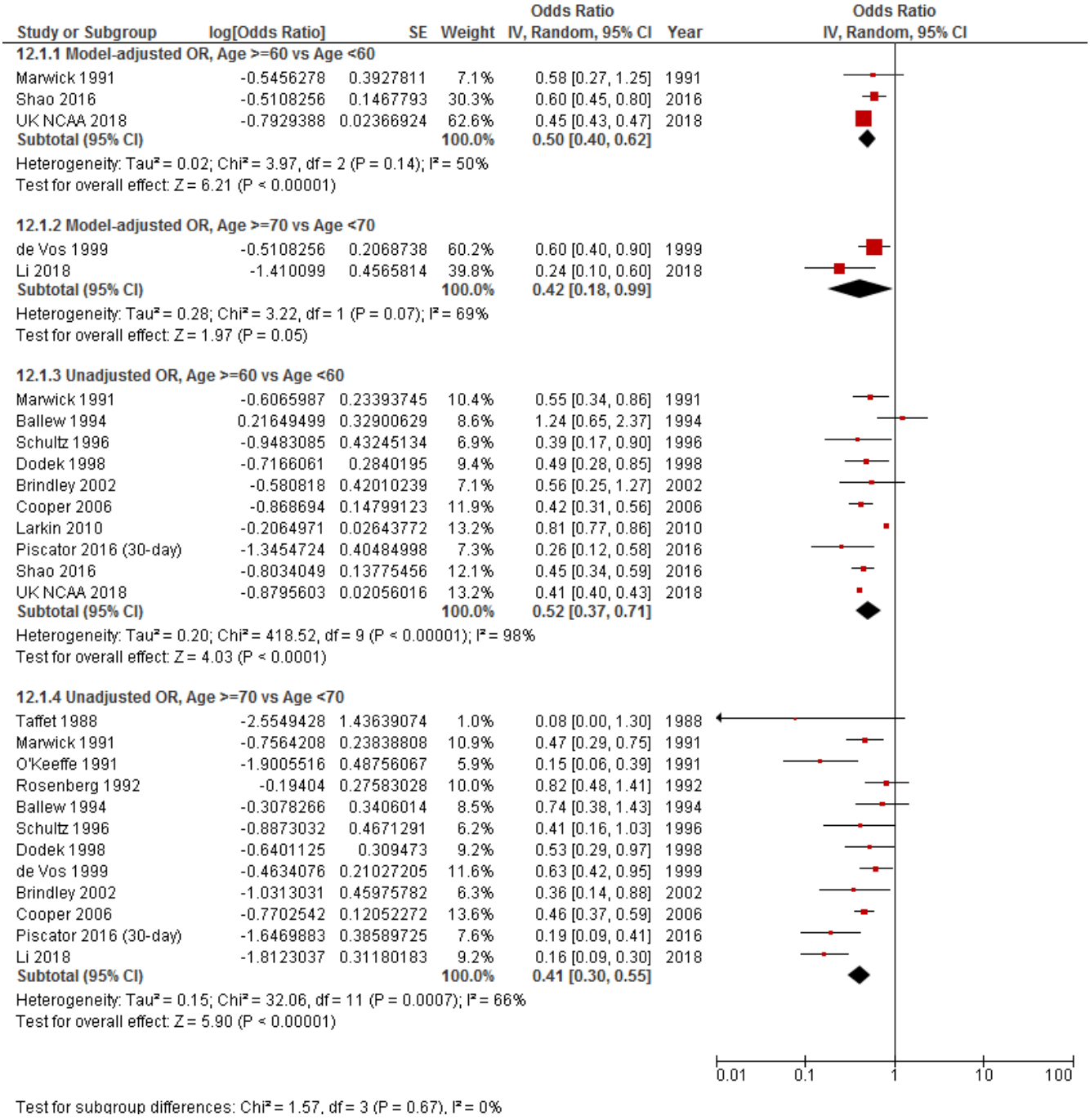
	Studies	OR	95% CI	*P* ǂ	I^2
Pre-Arrest Factors					
Demographics					
Male Sex	29	1.01	0.93-1.10	0.810	61%
Age ≥ 60	10	0.52	0.37-0.71	<0.001	98%
Age ≥ 70	12	0.41	0.30-0.55	<0.001	66%
Comorbidities at Admission					
Active Malignancy	17	0.51	0.42-0.62	<0.001	50%
CHF	10	0.83	0.62-1.10	0.200	92%
Chronic Kidney Disease	14	0.64	0.49-0.85	0.002	90%
COPD	6	0.92	0.50-1.70	0.260	79%
Diabetes Mellitus	9	0.85	0.71-1.03	0.090	77%
Admission Diagnosis					
Acute Coronary Syndrome	10	1.17	0.80-1.72	0.410	96%
Sepsis	8	0.49	0.29-0.83	0.009	46%
Intra-Arrest Factors					
Witnessed Arrest	18	4.04	2.94-5.55	<0.001	84%
Monitored Patient	14	2.28	1.58-3.28	<0.001	97%
Arrest During Daytime Hours	13	1.45	1.27-1.67	<0.001	96%
Ventricular Tachycardia	11	3.82	2.76-5.28	<0.001	95%
Ventricular Fibrillation	11	3.47	2.69-4.47	<0.001	94%
Asystole	21	0.35	0.31-0.41	<0.001	72%
Pulseless Electrical Activity	19	0.43	0.36-0.50	<0.001	80%
Shockable Rhythm	38	5.77	5.03-6.61	<0.001	87%
Intubation During Arrest	10	0.17	0.10-0.29	<0.001	87%
Resuscitation Duration ≥ 15 min.	8	0.14	0.10-0.20	<0.001	78%

ǂ: *P*-values obtained from the test for overall effect.

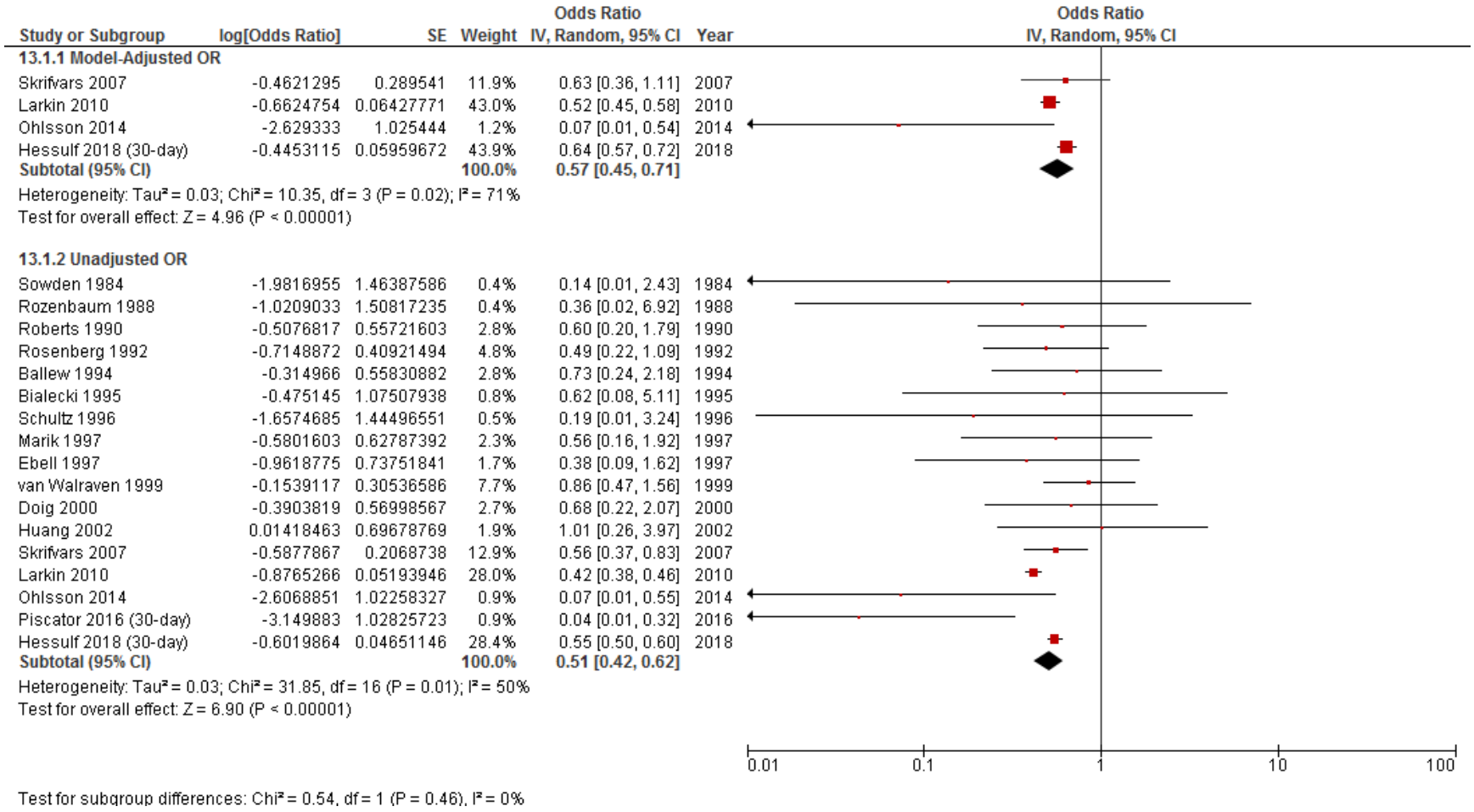
<u>Supplemental Figure 2:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Male Sex and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



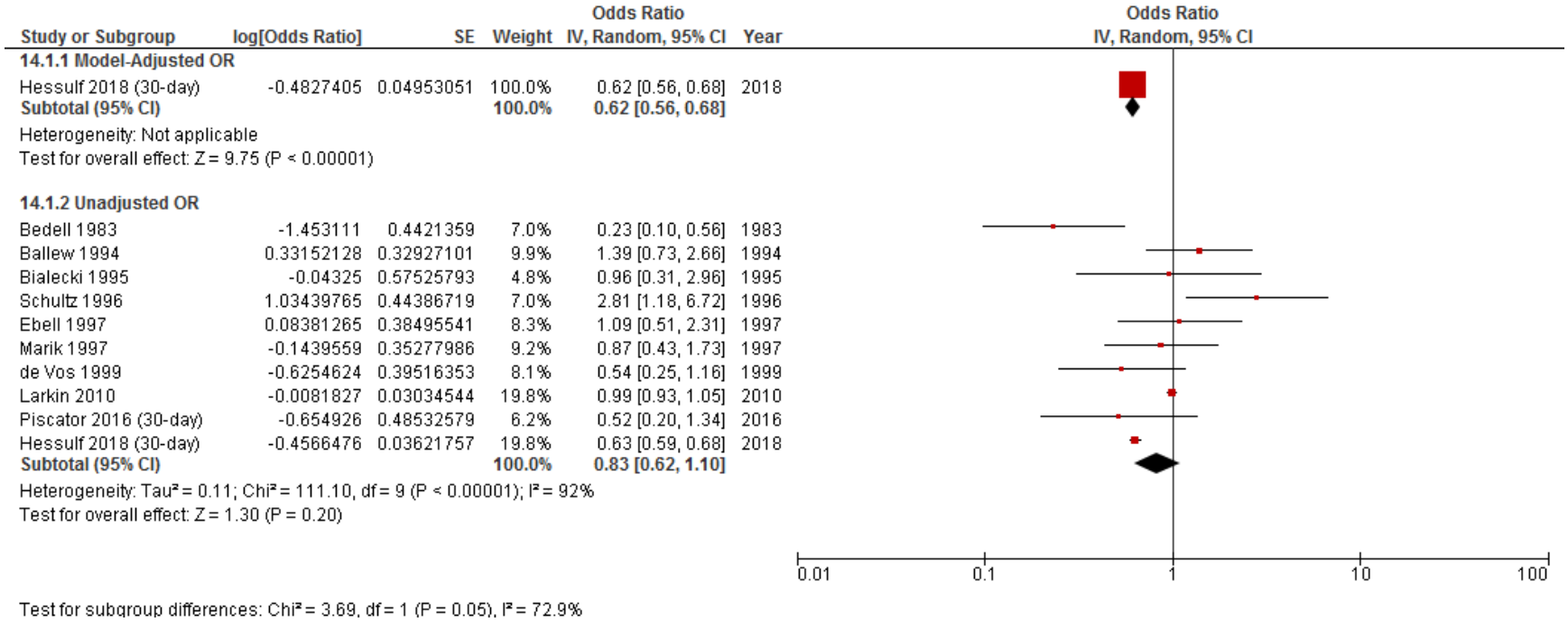
<u>Supplemental Figure 3:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Age and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



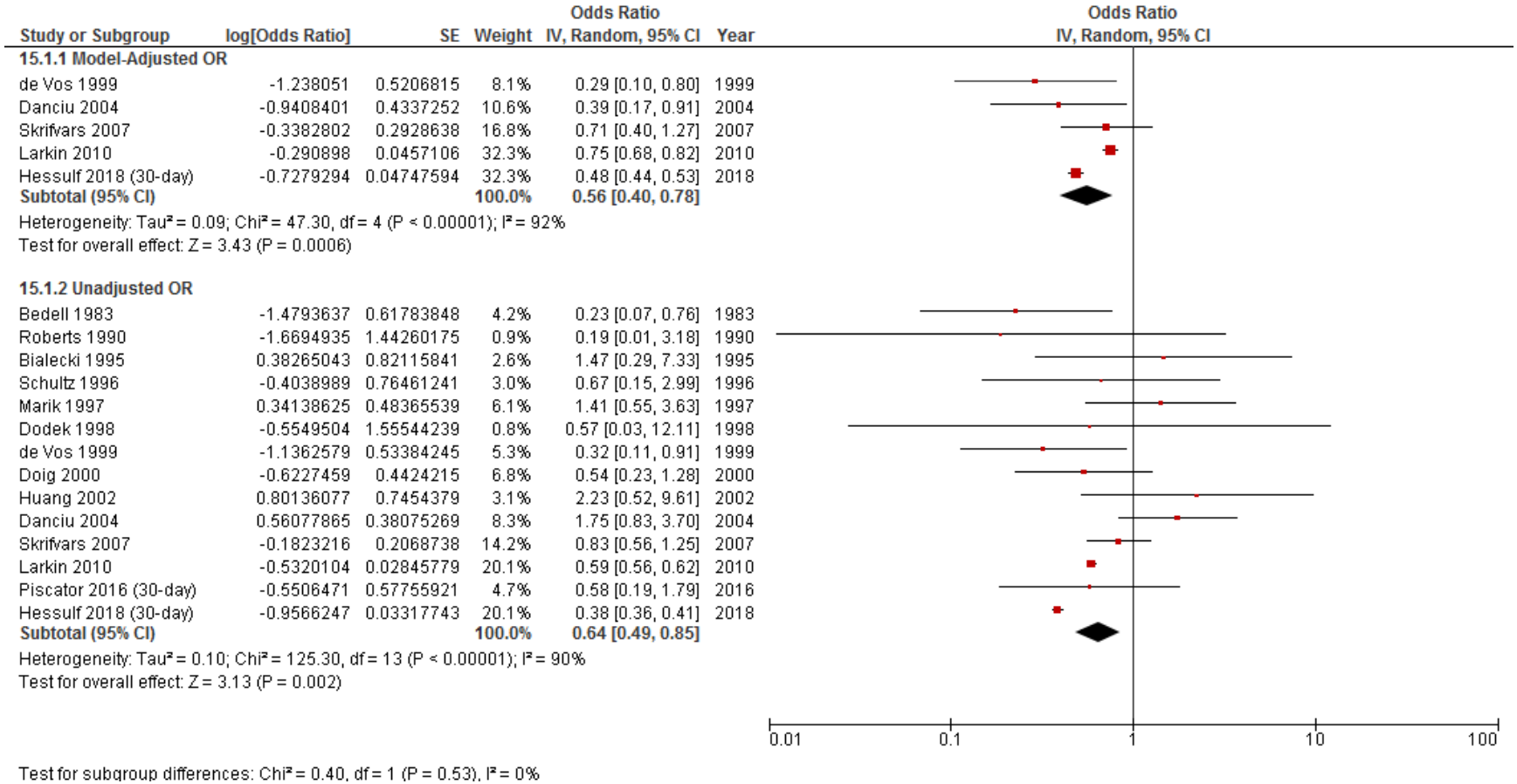
<u>Supplemental Figure 4:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Malignancy and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



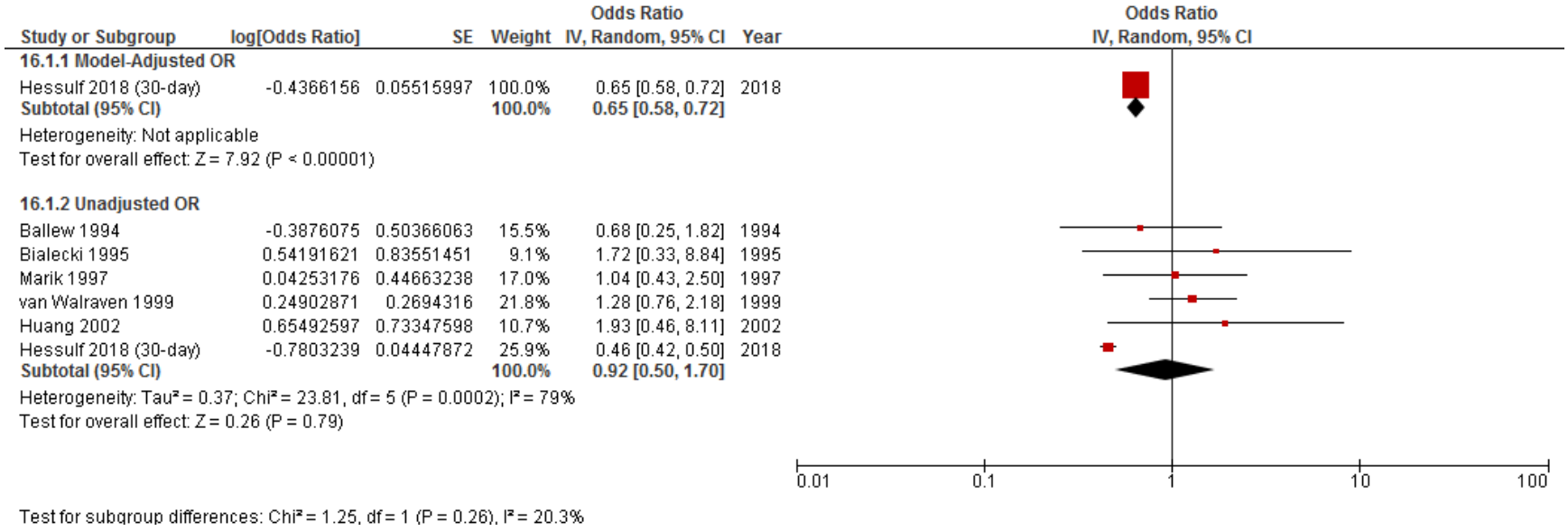
<u>Supplemental Figure 5:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Congestive Heart Failure and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



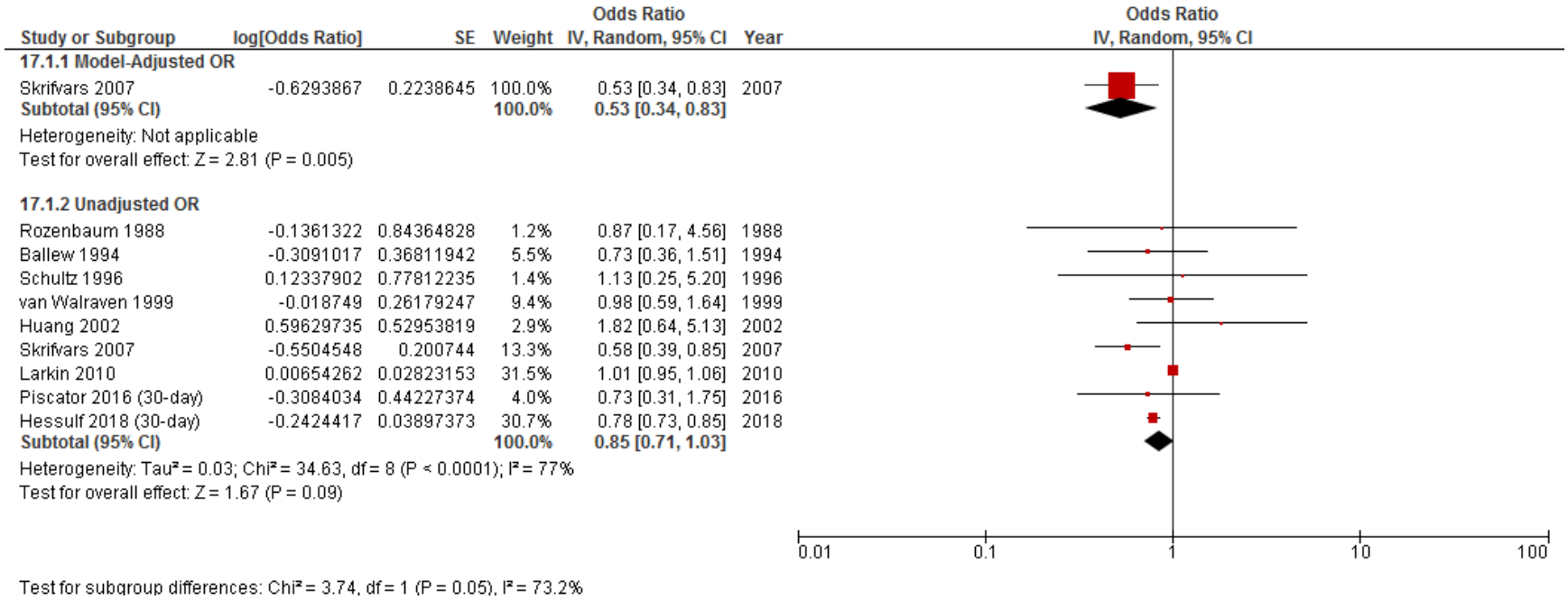
<u>Supplemental Figure 6:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Chronic Kidney Disease and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



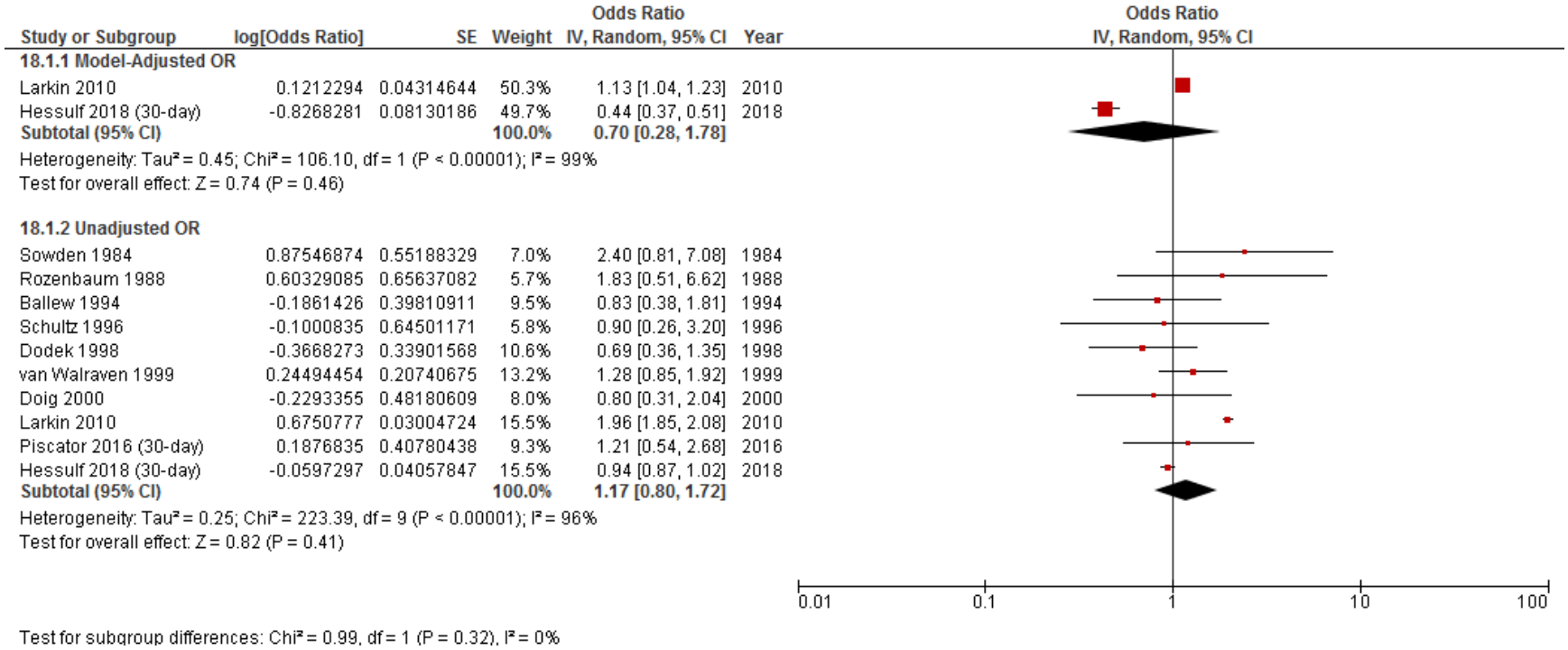
<u>Supplemental Figure 7:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Chronic Obstructive Pulmonary Disease and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



<u>Supplemental Figure 8:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Diabetes Mellitus and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error

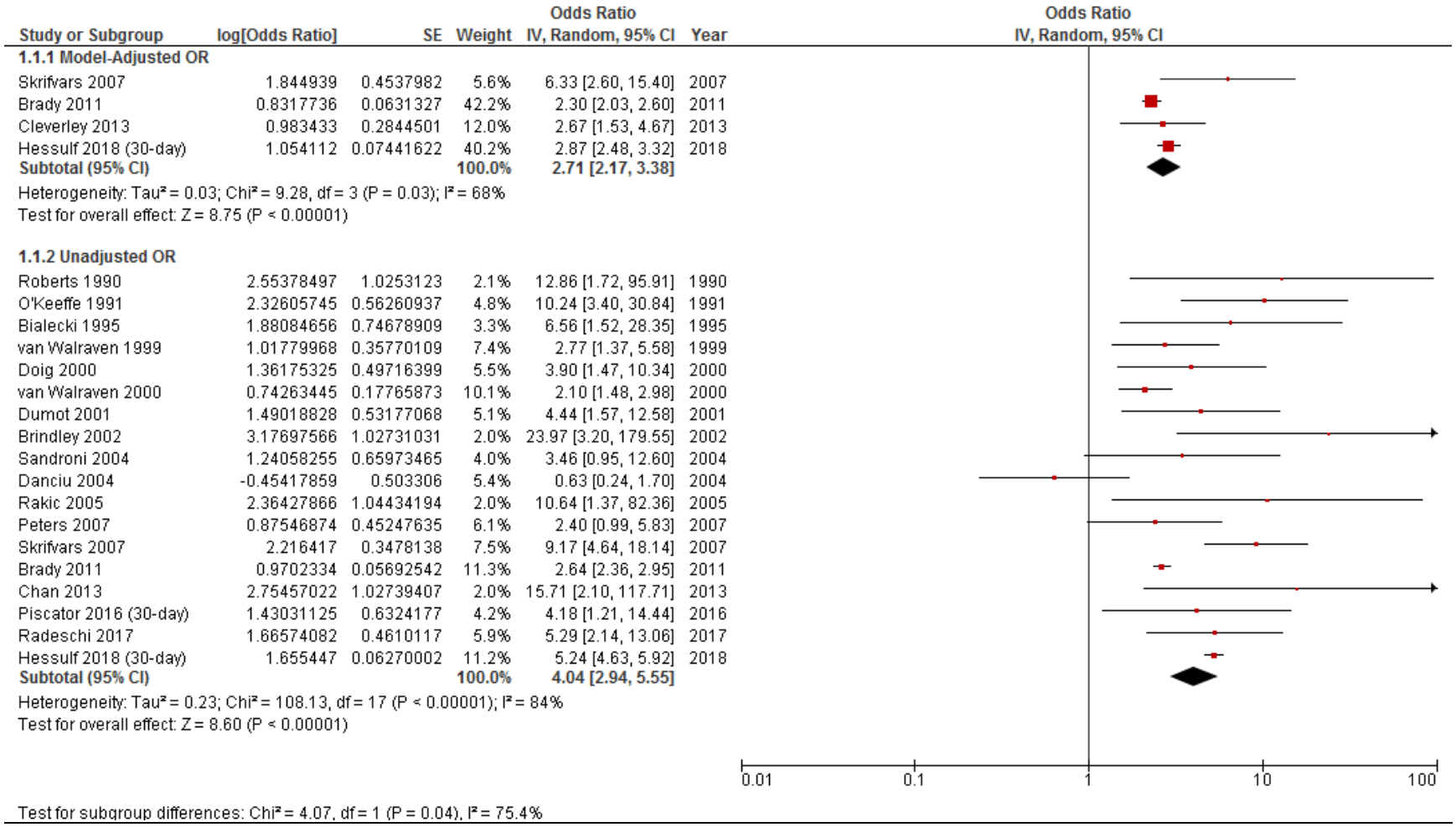


<u>Supplemental Figure 9:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Acute Coronary Syndrome and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error

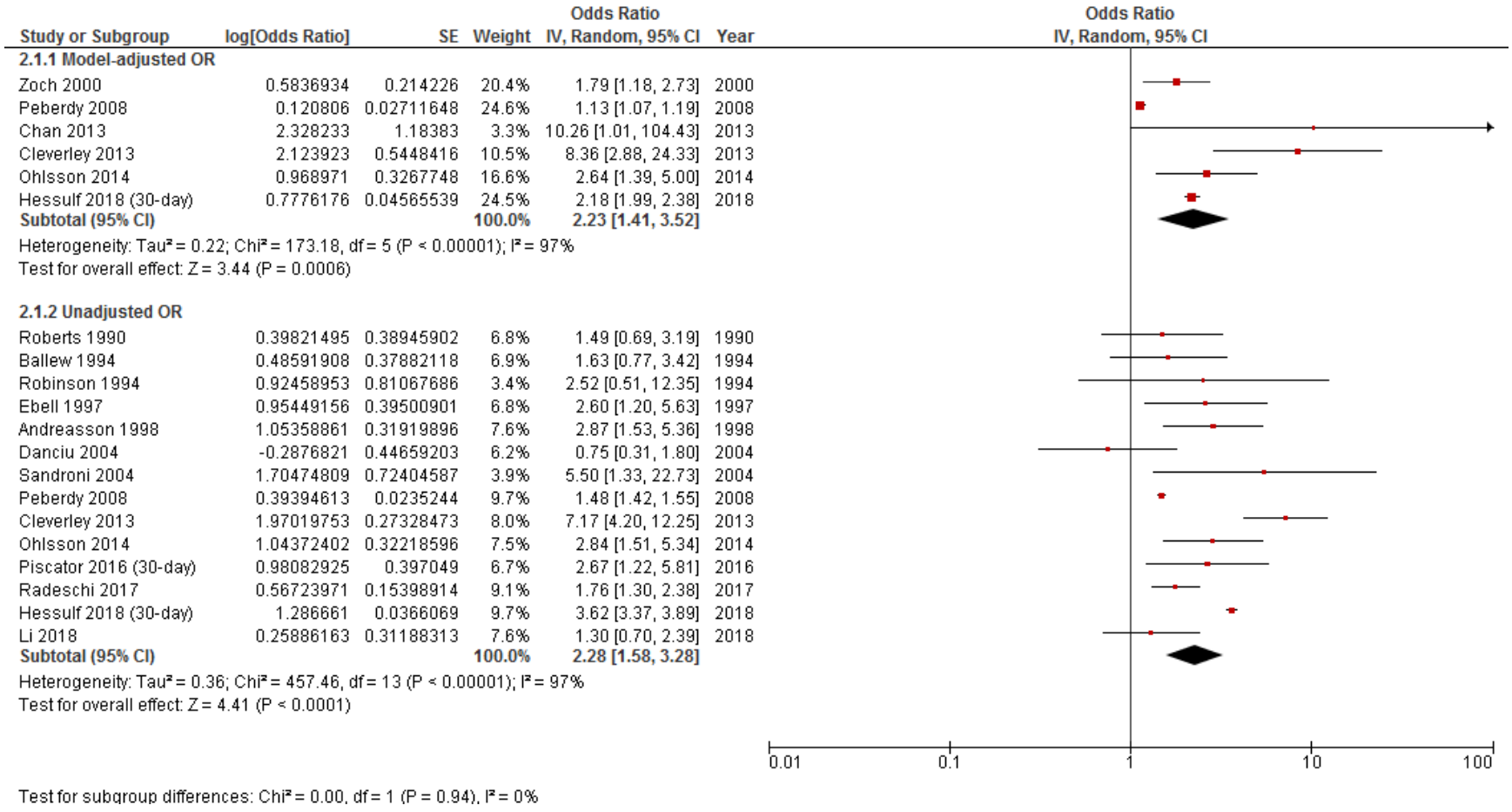


<u>Supplemental Figure 10:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Sepsis and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error

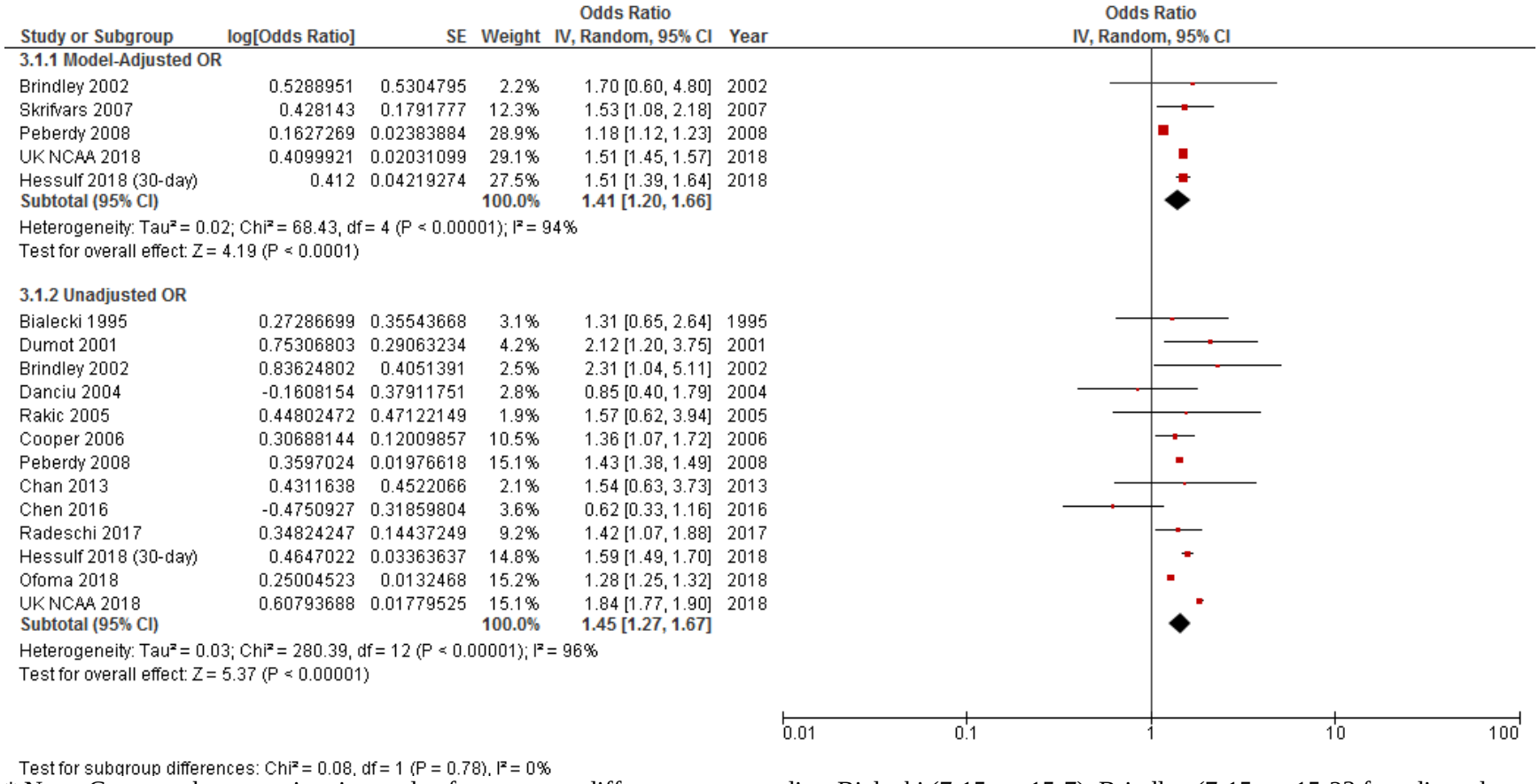
<u>Supplemental Figure 11:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Witnessed Arrest and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



<u>Supplemental Figure 12:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Monitored Arrest and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error

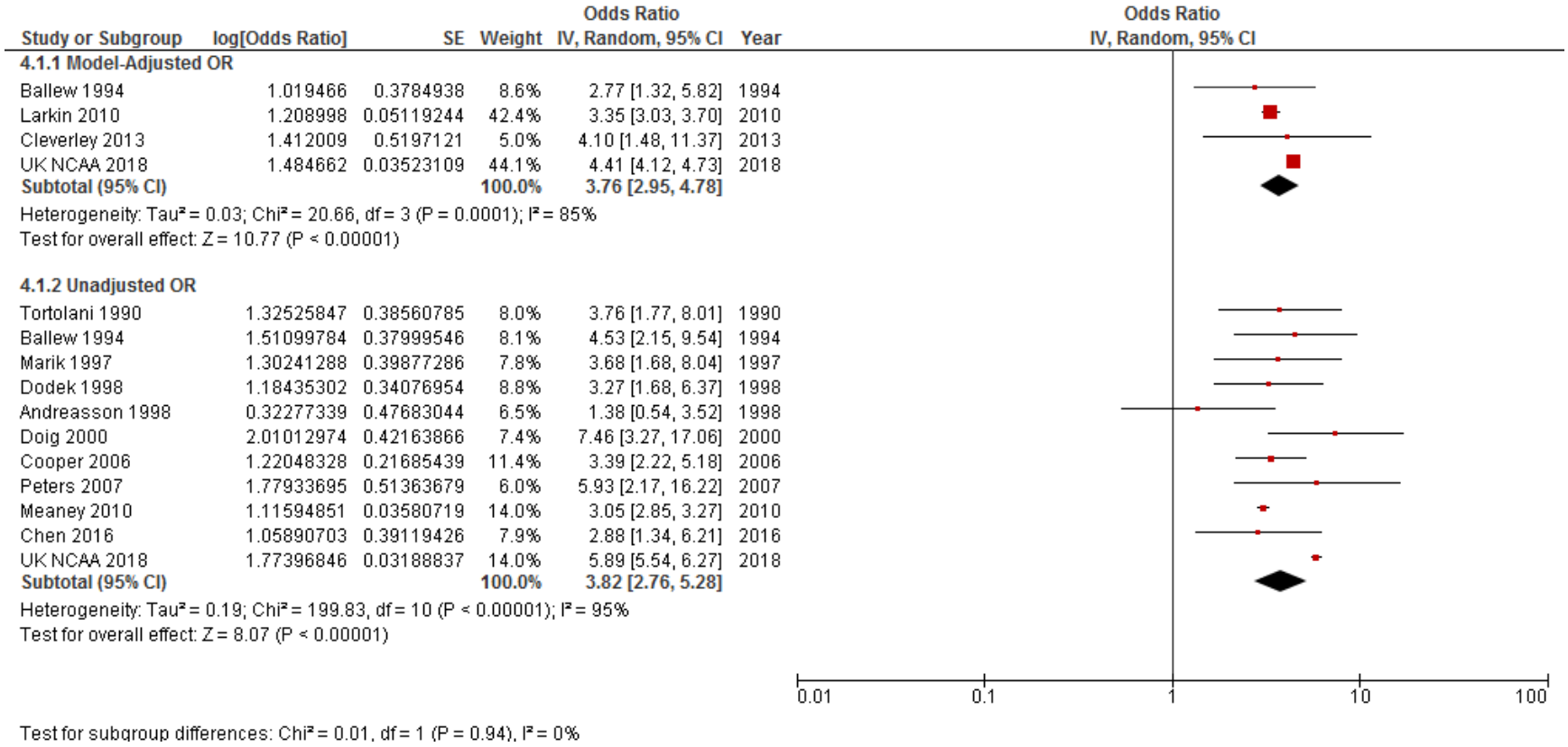


<u>Supplemental Figure 13:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Arrest During Daytime Hours and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error

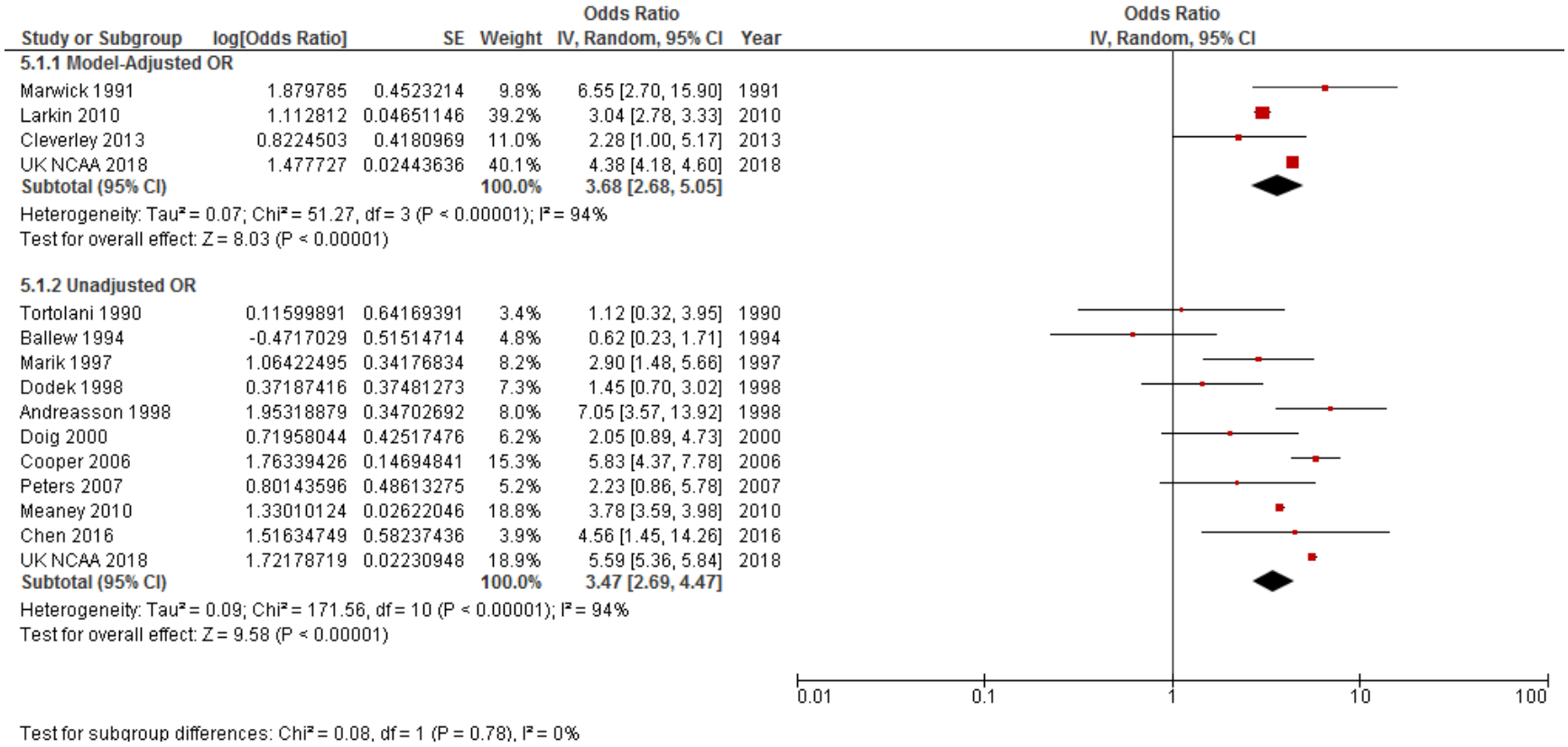


* Note: Contrasts between time intervals of arrest were different across studies: Bialecki (7-15 vs. 15-7), Brindley (7-15 vs. 15-23 for adjusted analysis, 7-15 vs. 15-7 for unadjusted analysis), Chan (7-14 vs. 14-7), Chen (8-20 vs. 20-8), Cooper (7-15 vs. 15-7), Danciu (6-18 vs. 18-6), Dumot (6-24 vs. 0-6), Hessulf (8-20 M-F vs. other), Ofoma (7-23 M-F vs. other), Peberdy (7-23 vs. 23-7), Rakic (8-16 vs. 16-8), Skrifvars (mixture of 8-17 and 8-15:45 M-F vs. other) , UK NCAA (8-20 vs. 20-8)

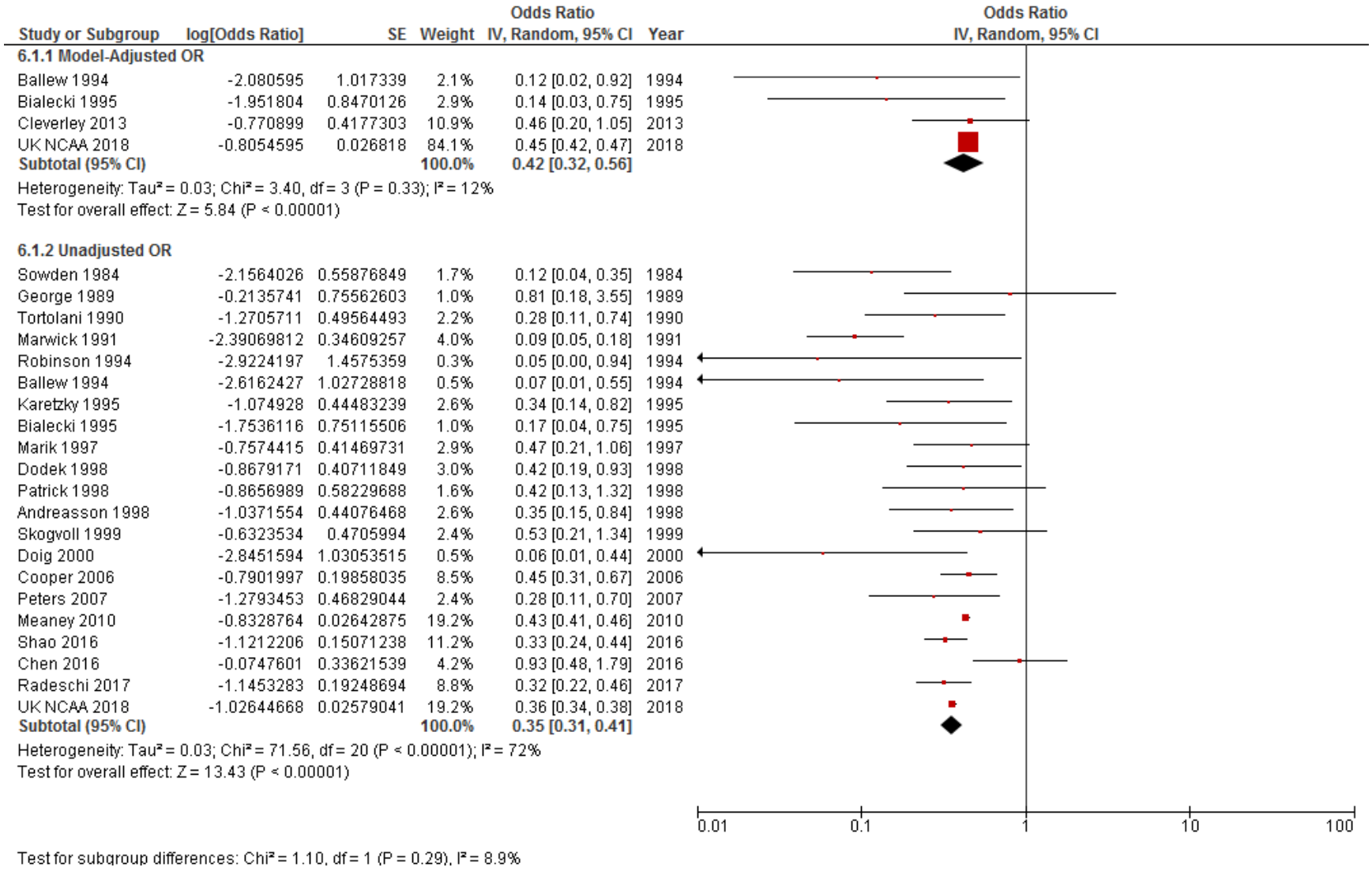
<u>Supplemental Figure 14:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Ventricular Tachycardia and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



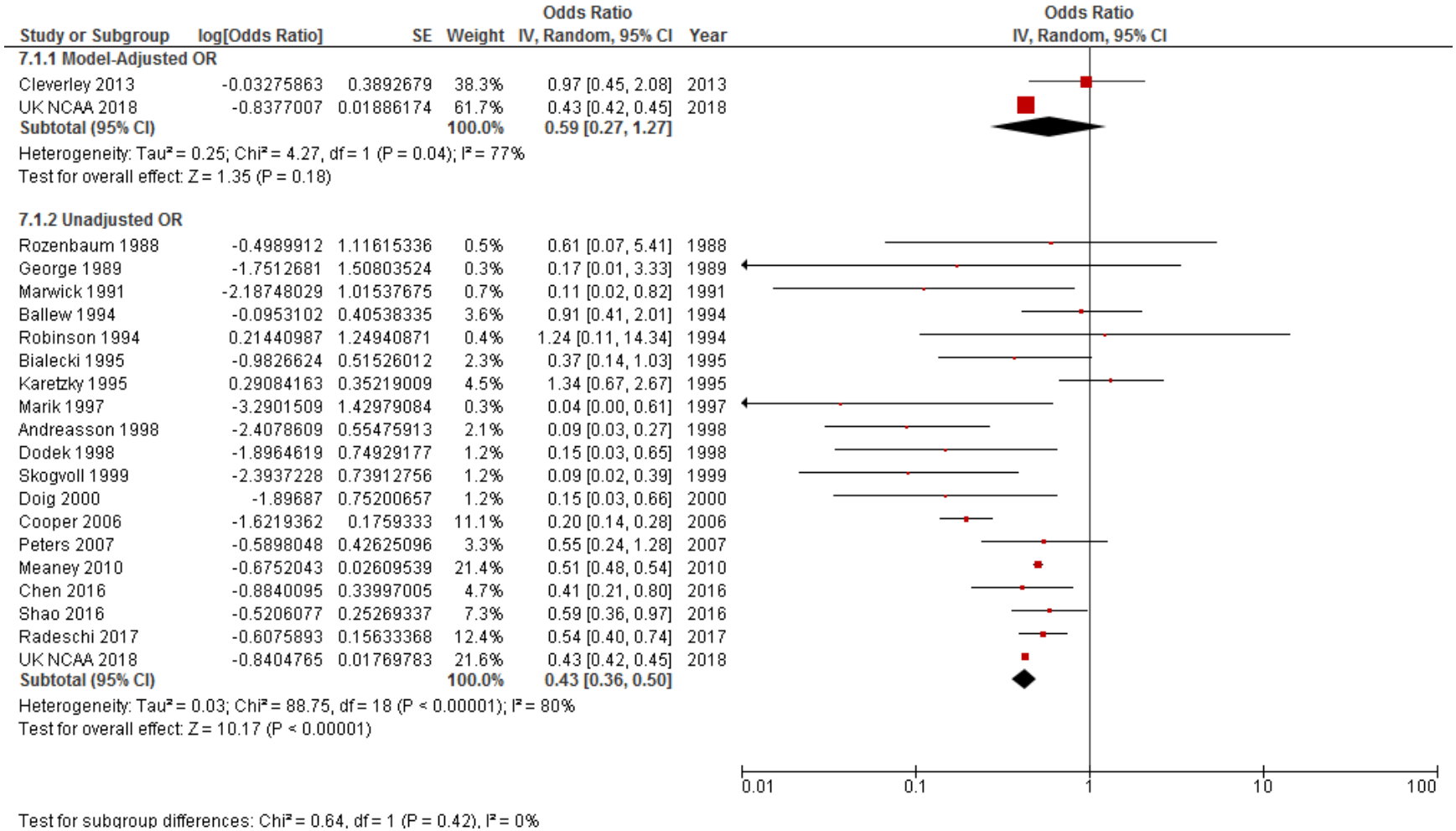
<u>Supplemental Figure 15:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Ventricular Fibrillation and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



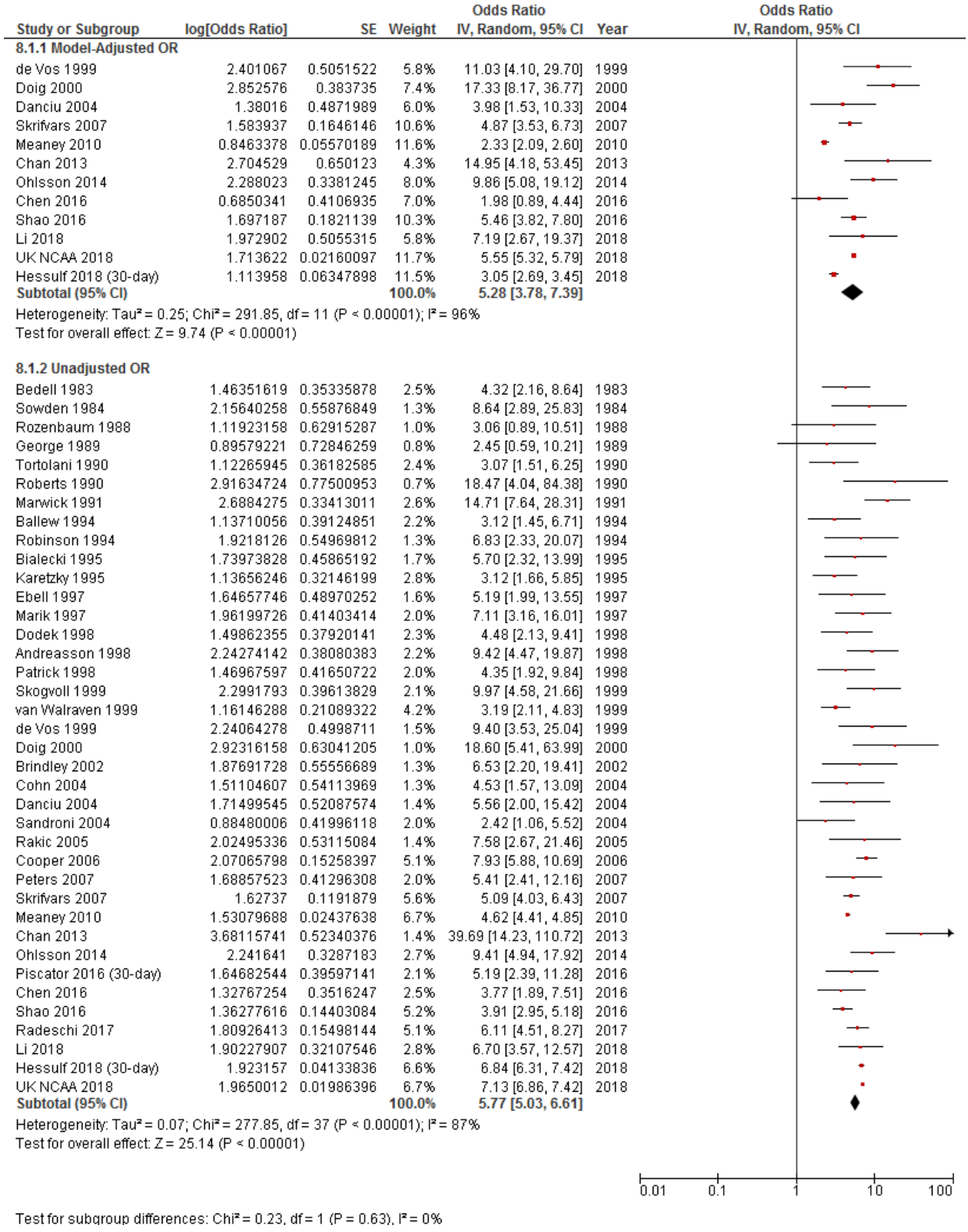
<u>Supplemental Figure 16:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Asystole and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



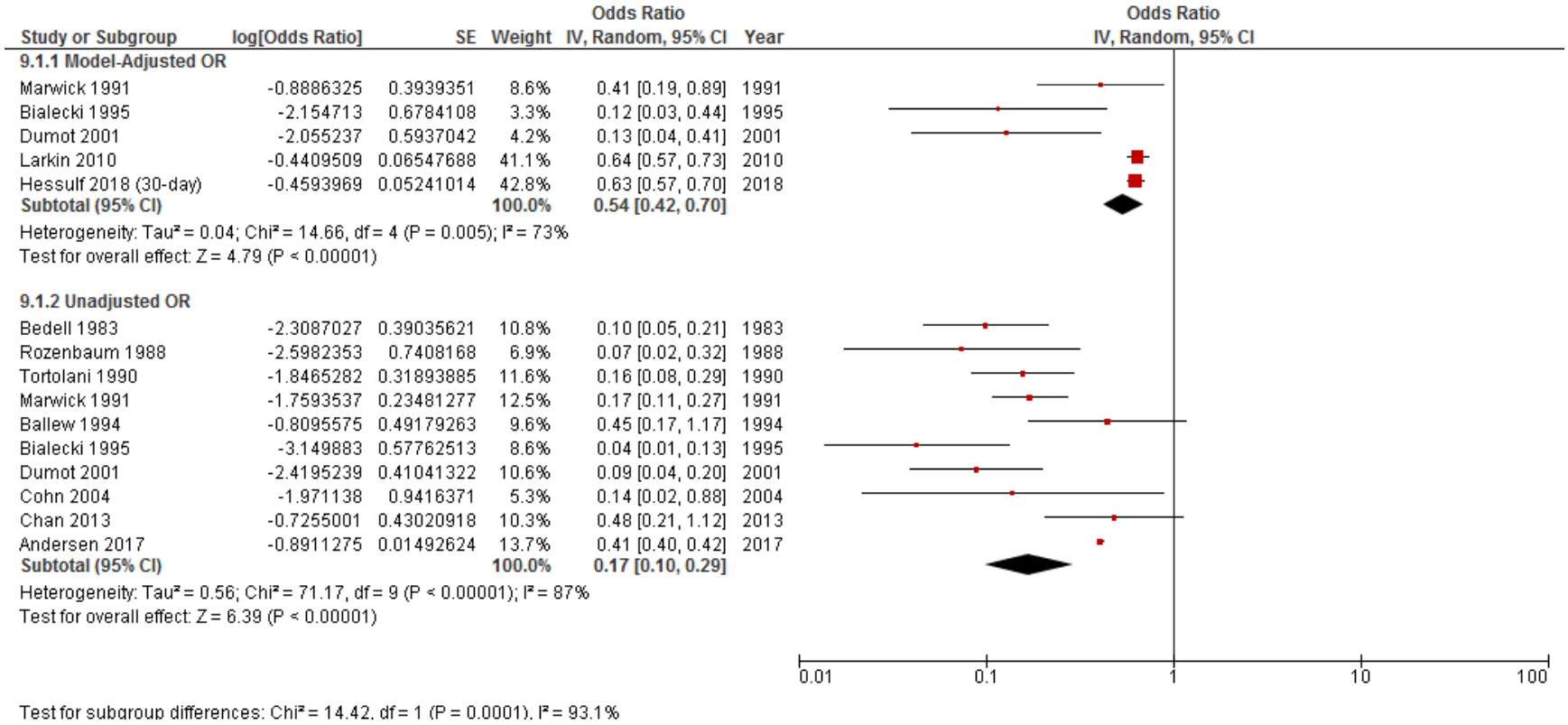
<u>Supplemental Figure 17:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Pulseless Electric Activity and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



<u>Supplemental Figure 18:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Shockable Rhythm and Survival Following In-Hospital Cardiac Arrest.
Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



<u>Supplemental Figure 19:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Endotracheal Intubation and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error



<u>Supplemental Figure 20:</u> Forest Plots of Adjusted and Unadjusted Analyses for Association Between Resuscitation Duration > 15 minutes and Survival Following In-Hospital Cardiac Arrest. Abbreviations: CI = Confidence Interval; OR = Odds Ratio; SE = Standard Error