

Supplemental Materials

Cancer incidence and mortality among petroleum industry workers and residents living in oil producing communities: A systematic review and meta-analysis

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Search Strategy

PubMed: #1 "Refinery worker*" OR "Petroleum worker*" OR "Oil and gas worker*" OR "Refinery staff" OR "Refinery technic*" OR "Refinery employ*" OR "Petroleum staff" OR "Petroleum employ*" OR "Petroleum technic*" OR "Oil and gas staff*" OR "Oil and gas employ*" OR "Oil and gas technic*" OR "Petroleum"[Mesh] OR Petroleum OR "Petroleum Pollution"[Mesh] OR "Oil and Gas Indust*"[Mesh] OR "Oil and Gas" OR "Oil and Gas Indust*" OR "Crude Oil Indust*" OR "Petroleum refiner*" OR "Oil refiner*" #2 "Environmental Pollution"[Mesh] OR "Environmental Exposure" OR "Occupational Exposure"[Mesh] #3 "Neoplasms"[Mesh] OR cancer OR cancers OR cancerous OR carcinoma* OR neoplasm* OR tumor OR tumors OR tumour* OR malignan* OR Leukemia* OR Leukaemia* OR Mesothelioma* OR Myeloma* #4 "Case-Control Stud*"[Mesh] OR "Case-Control Stud*" OR cohort OR "Cross-Sectional "[Mesh] OR "Cross-Sectional" OR "Epidemiology"[SH] #5 #1 AND #2 AND #3 AND #4 #6 "Animals"[MH] NOT Humans [MH] #7 #5 NOT #6"

Web of Science: #1 TS= ("Refinery worker*" OR "Petroleum worker*" OR "Oil and gas worker*" OR "Refinery staff" OR "Refinery technic*" OR "Refinery employ*" OR "Petroleum staff" OR "Petroleum employ*" OR "Petroleum technic*" OR "Oil and gas staff*" OR "Oil and gas employ*" OR "Oil and gas technic*" OR Petroleum OR "Petroleum Pollution" OR "Oil and Gas" OR "Oil and Gas Indust*" OR "Crude Oil Indust*" OR "Petroleum refiner*" OR "Oil refiner*") #2 TS= ("Environmental Pollution" OR "Environmental Exposure" OR "Occupational Exposure") #3 TS= (Neoplasm* OR cancer OR cancers OR cancerous OR carcinoma* OR tumor OR tumors OR tumour* OR malignan* OR Leukemia* OR Leukaemia* OR Mesothelioma* OR Myeloma*) #4 TS= ("Case-Control Stud*" OR cohort OR "Cross-Sectional" OR Epidemiology) #5 #1 AND #2 AND #3 AND #4"

Table S1- S5: JBI quality appraisal checklist for studies evaluating cancer incidence and mortality among petroleum industry workers and residents of oil producing communities.

Table S1: JBI quality appraisal checklist for cohort studies on petroleum workers

First author, year	Free of selection bias?	Clear exposure measurement?	Valid & reliable exposure measurement?	Identified confounders?	Confounder management strategies stated?	Free of outcome sample?	Valid & reliable outcome measure?	Sufficient follow-up time?	Follow-up complete?	Incomplete follow-up strategies?	Appropriate statistical analysis?	Overall
Christie, 1991	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	10/11
Gun, 2004	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	10/11
Gun, 2006a	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	Unclear	Yes	8/11
Gun, 2006b	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	11/11
Schnatter, 1993	Yes	Yes	Yes	Unclear	No	Yes	Yes	Yes	Unclear	Yes	Yes	8/11
Lewis, 2003	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Unclear	No	Yes	7/11
Schnatter, 2012	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	10/11
Schnatter, 2019	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Yes	Yes	10/11
Gennaro, 1994	Yes	Yes	Yes	No	No	Yes	Yes	Yes	No	No	Yes	7/11
Consonni, 1999	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	No	Yes	8/11
Pasetto, 2012	Yes	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	No	Yes	9/11
Bonzini, 2019	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Unclear	No	Yes	7/11
Koh, 2011	Yes	Yes	Yes	No	No	Yes	Yes	No	Unclear	No	Yes	6/11
Koh, 2014	Yes	Unclear	Unclear	No	No	Yes	Yes	No	Yes	Unclear	Yes	5/11
Aas, 2009	Yes	Unclear	Unclear	No	No	Yes	Yes	Yes	Yes	Yes	Yes	7/11
Stenehjem, 2014	Yes	Yes	Yes	No	No	Yes	Yes	No	Yes	Unclear	Yes	7/11
Kirkeleit, 2007	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	Unclear	Yes	8/11
Jarvholm, 1997	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	7/11
Rushton, 1993	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	8/11
Sorahan, 2007	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	8/11
Satin, 1996	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	8/11
Divine, 1999a	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Unclear	No	Yes	7/11
Gamble, 2000	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	No	Yes	8/11
Huebner, 2000	Yes	Unclear	Yes	No	No	Yes	Yes	No	Yes	Yes	Yes	8/11
Sathiakumar, 2001	Yes	Yes	Yes	Yes	Yes	Yes	Yes	No	Yes	No	Yes	9/11
Wong, 2001a	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Yes	Unclear	Yes	9/11
Satin, 2002	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	8/11
Tsai, 2003	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	8/11
Huebner, 2004	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Unclear	Yes	8/11
Buffler, 2004	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	Unclear	Yes	8/11
Tsai, 2004	Yes	Yes	Yes	Yes	No	Yes	Yes	No	Unclear	Unclear	Yes	7/11

Tsai, 2007	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	Unclear	Yes	8/11
Huebner 2009	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	Yes	Yes	9/11
Divine, 1999b	Yes	Yes	Yes	No	No	Yes	Yes	Yes	Yes	No	Yes	8/11
Wong, 2001b	Yes	Yes	Yes	Yes	No	Yes	Yes	Yes	Unclear	No	Yes	8/11
Percentage (%)	100	91	94	54	11	100	100	77	66	26	100	74

Yes=1, No=0, Unclear =0

Table S2: JBI critical appraisal checklist for case-control studies on petroleum workers

First author, year [reference]	Free of selection bias?	Appropriate sampling?	The same criteria used for cases and control?	Standard, valid and reliable exposure measurement?	Exposure measured the same way for cases and control?	Identified confounders?	Confounding management strategies stated?	Valid & reliable outcome measure?	Sufficient exposure time?	Appropriate statistical analysis?	Overall
Finkelstein, 1996	Yes	Yes	Yes	Yes	Unclear	No	No	Yes	Unclear	Yes	6/10
Schnatter, 1996	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9/10
Anttila, 2015	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	10/10
Rushton, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9/10
Glass, 2014	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9/10
Stenehjem, 2015	Unclear	No	No	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6/10
Rushton, 1997	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9/10
Poole, 1993	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	9/10
Percentage (%)	88	88	88	100	88	88	88	100	13	100	84

Yes=1, No=0, Unclear =0

Table S3: JBI critical appraisal checklist for cohort studies on residents living near petroleum facilities

First author, year [reference]	Free of selection bias?	Clear exposure measurement?	Valid & reliable exposure measurement?	Identified confounders?	Confounding management strategies stated?	Free of outcome sample?	Valid & reliable outcome measure?	Sufficient follow-up time?	Follow-up complete?	Incomplete follow-up strategies?	Appropriate statistical analysis?	Overall
Hurtig, 2002	Yes	Unclear	No	Yes	No	Unclear	Yes	No	No	No	Yes	4/11
Hurtig, 2004	Yes	Yes	Unclear	No	No	Unclear	Yes	Yes	No	Yes	Yes	6/11
Kelsh, 2009	Yes	Yes	Yes	No	No	Unclear	Yes	No	No	No	Yes	5/11
Ramis, 2012	Unclear	Unclear	Yes	Yes	No	Unclear	Yes	No	No	No	Yes	4/11
Barregard, 2009	Unclear	Unclear	Unclear	No	No	Unclear	Yes	Yes	Yes	Yes	Yes	5/11
Sans, 1995	Unclear	Unclear	Unclear	Yes	Yes	Unclear	Yes	No	No	No	Yes	4/11
Percentage (%)	50	33	33	33	17	0	100	33	17	33	100	41

Yes=1, No=0, Unclear =0

Table S4: JBI critical appraisal checklist for cross-sectional studies on residents living near petroleum facilities

First author, year [reference]	Criteria for inclusion clearly defined?	Subjects and setting described in detail?	Valid and reliable exposure measurement?	Objective, standard criteria used for measurement of the condition?	Identified confounders?	Confounder management strategies stated?	Valid & reliable outcome measure?	Appropriate statistical analysis?	Overall
Choi, 2018	Yes	Yes	Yes	Unclear	No	No	Yes	Yes	5/8
Lyons, 1995	Yes	Yes	Yes	Yes	No	No	Yes	Yes	6/8
Percentage (%)	100	100	100	50	0	0	100	100	61

Yes=1, No=0, Unclear =0

Table S5: JBI critical appraisal checklist for case-control studies on residents living near petroleum facilities

First author, year [reference]	Free of selection bias?	Appropriate sampling?	The same criteria used for cases and control?	Standard, valid and reliable exposure measurement?	Exposure measured the same way for cases and control?	Identified confounders?	Confounder management strategies stated?	Valid & reliable outcome measure?	Sufficient exposure time?	Appropriate statistical analysis?	Overall
Tsai, 2009	No	No	No	Yes	Yes	Yes	Yes	Yes	Unclear	Yes	6/10
Weng, 2008	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	8/10
Liu, 2008	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	8/10
Yu, 2005	Yes	Yes	Yes	Unclear	Yes	No	No	Yes	Unclear	Yes	6/10
Micheli, 2014	Yes	Yes	Yes	Unclear	Yes	Yes	Yes	Yes	Unclear	Yes	8/10
McKenzie, 2017	Unclear	No	Unclear	Unclear	Yes	Yes	Yes	Yes	Yes	Yes	6/10
Percentage (%)	67	67	67	17	100	83	83	100	17	100	70

Yes=1, No=0, Unclear =0

Figure S1: Forest and funnel plot of studies evaluating cancer incidence and mortality among petroleum workers

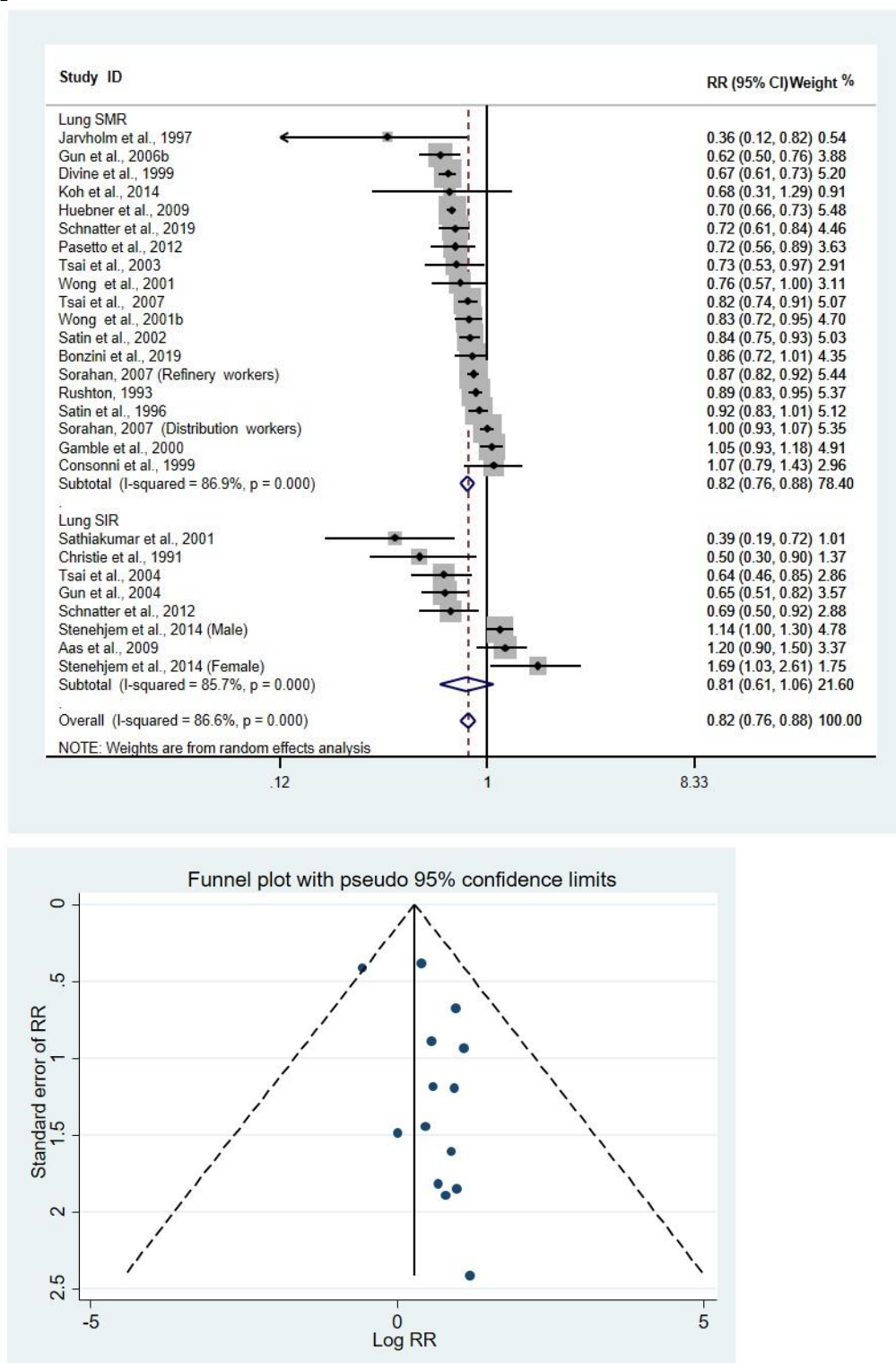


Figure S1a: Forest and funnel plot of studies evaluating lung cancer incidence and mortality among petroleum workers. Egger's regression test for Lung cancer publication bias P = 0.990

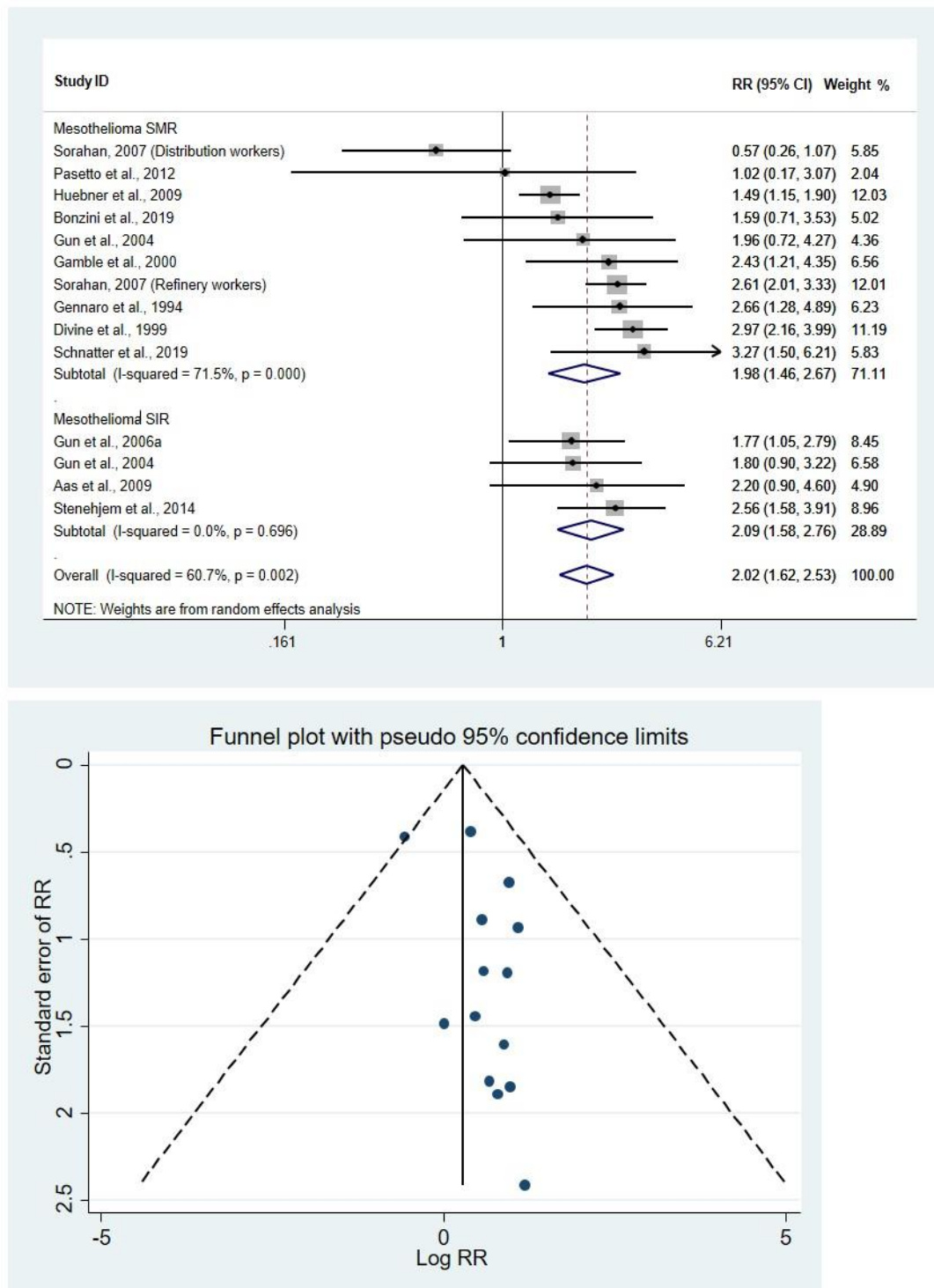
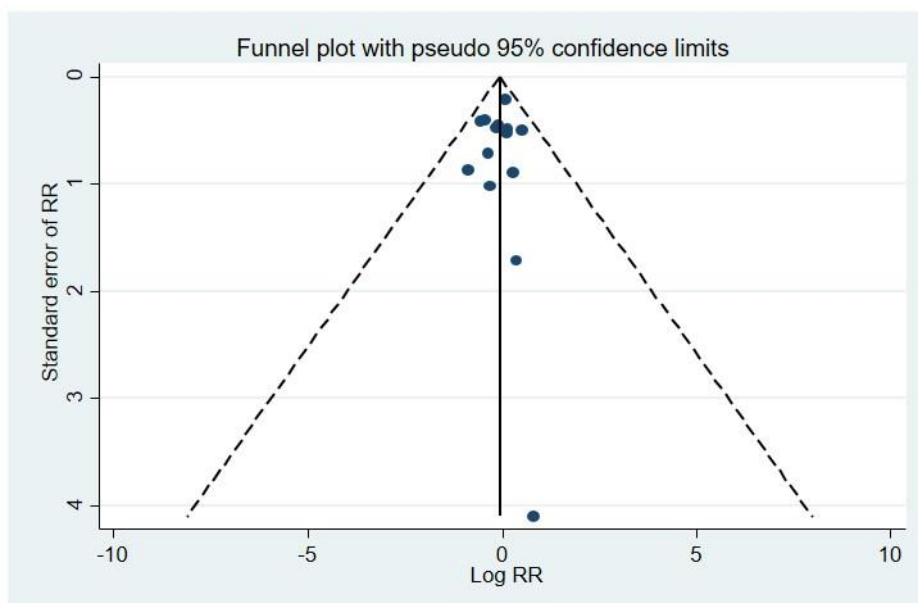
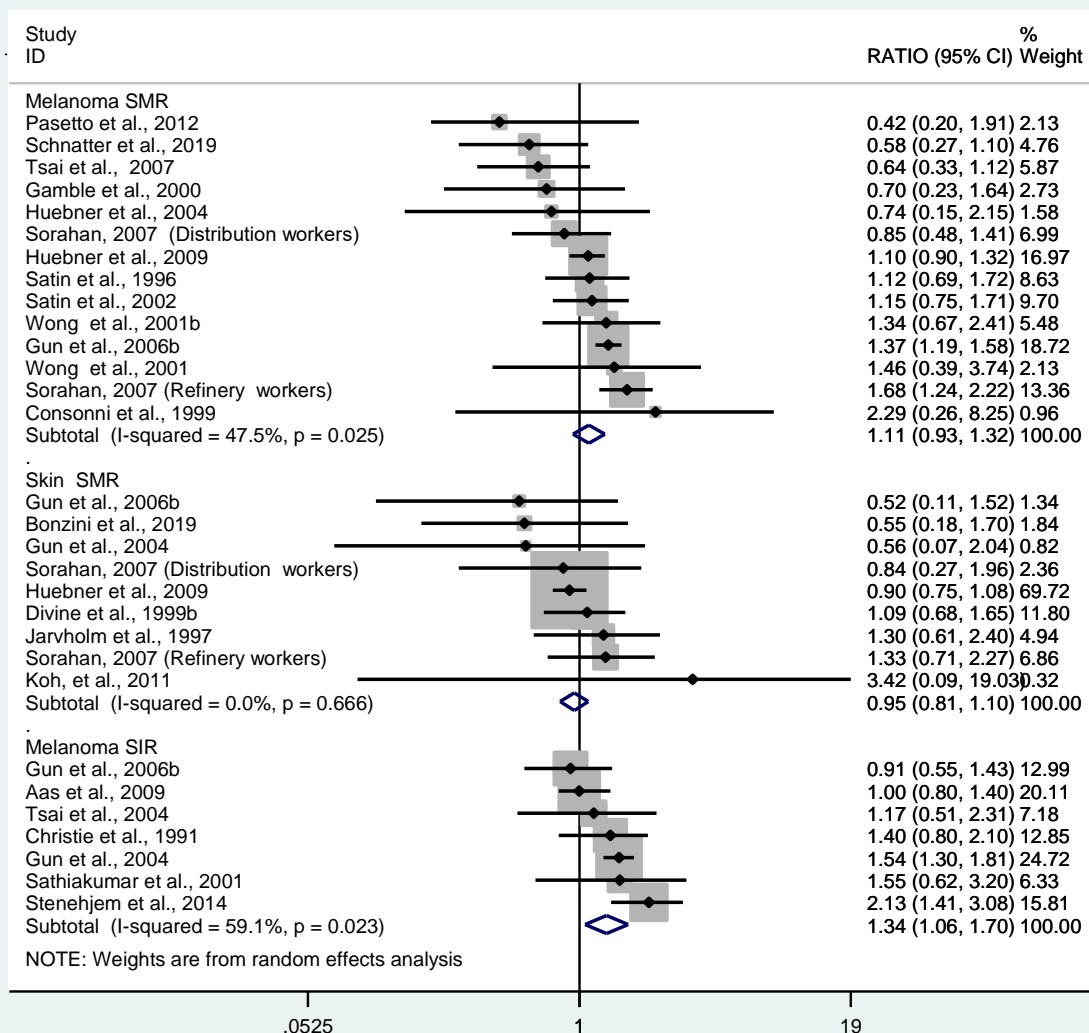
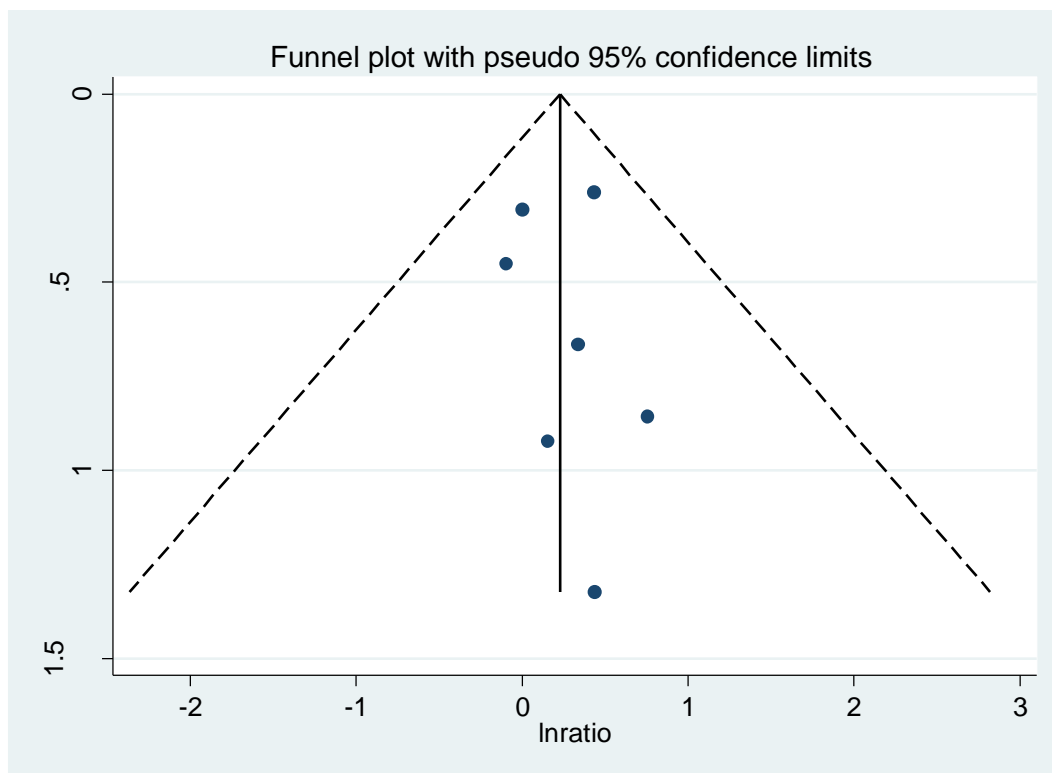


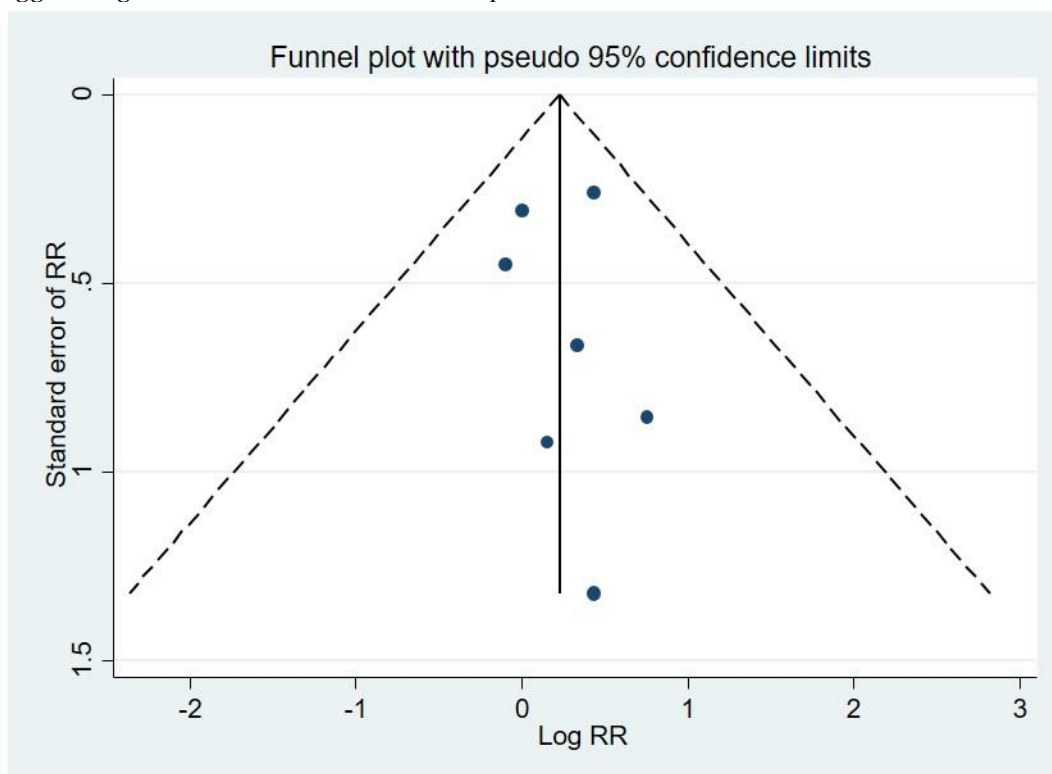
Figure S1b: Forest and funnel plot of studies evaluating mesothelioma incidence and mortality among petroleum workers. Egger's regression test for mesothelioma publication bias $P = 0.066$



Egger's regression test for melanoma SMR publication bias $P = 0.661$

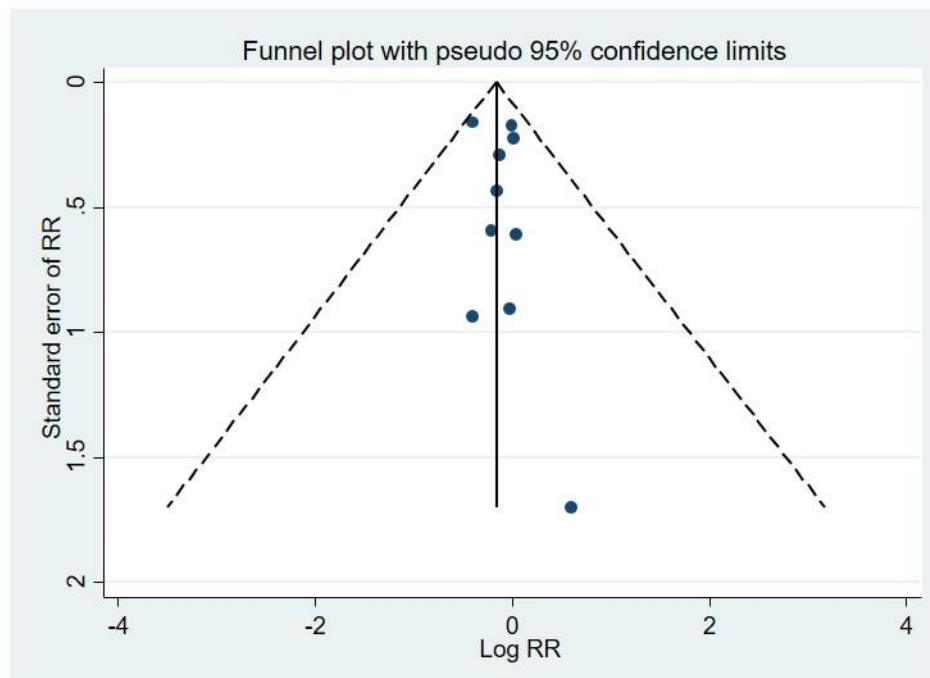
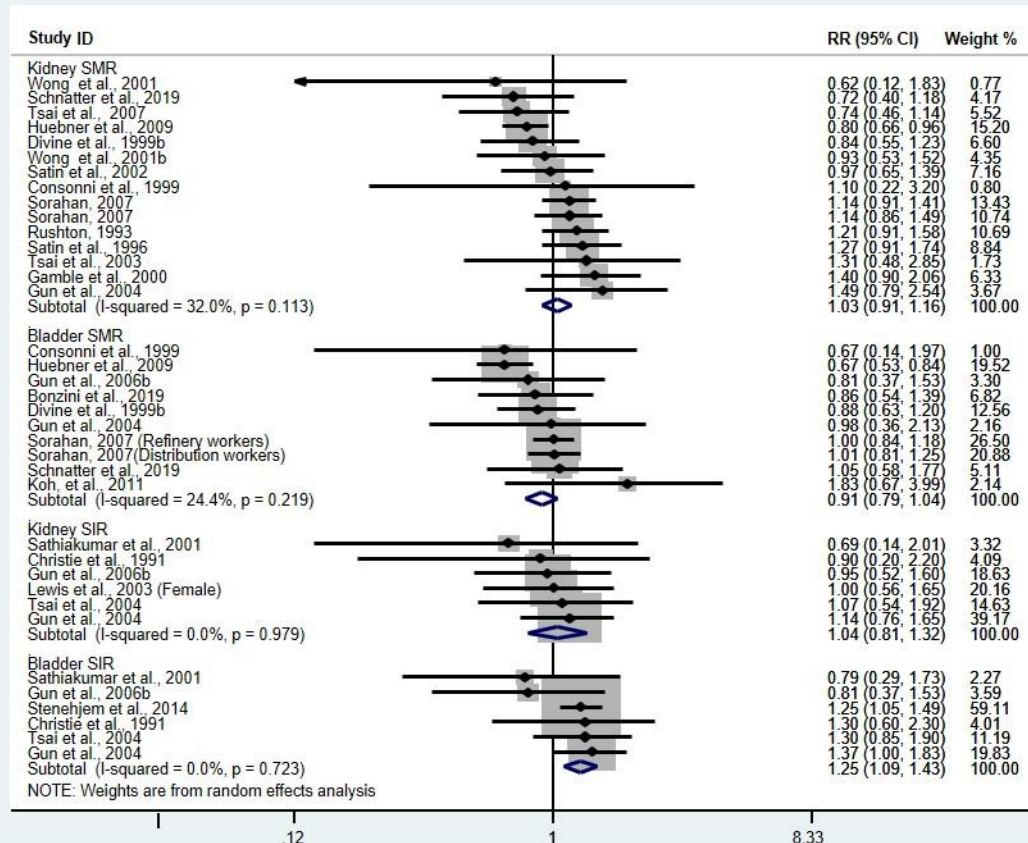


Egger's regression test for melanoma SIR publication bias $P = 0.827$

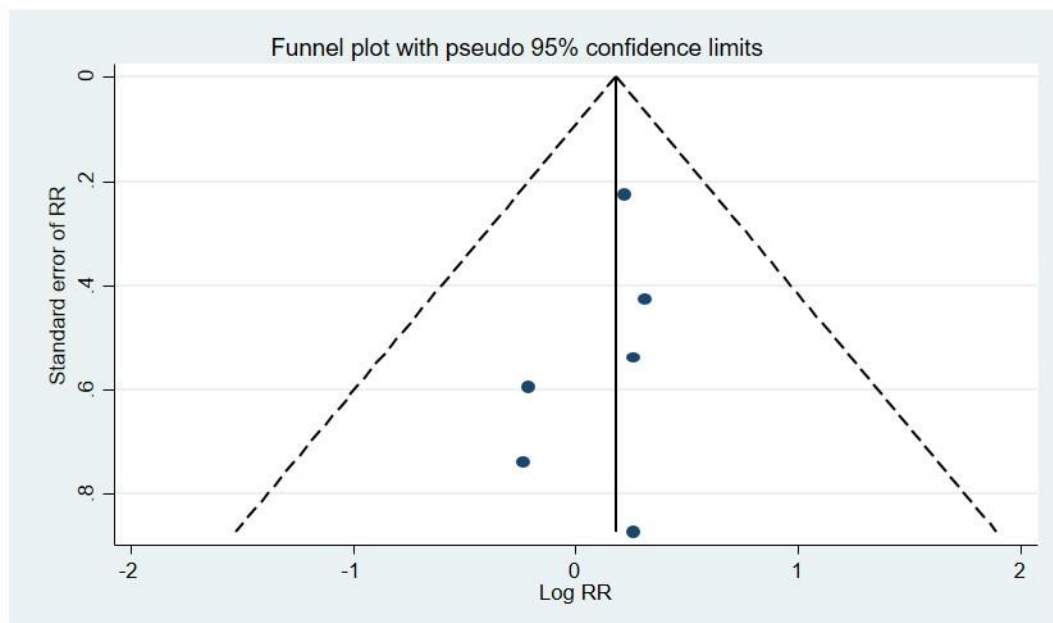


Egger's regression test for skin cancer publication bias $P = 0.745$

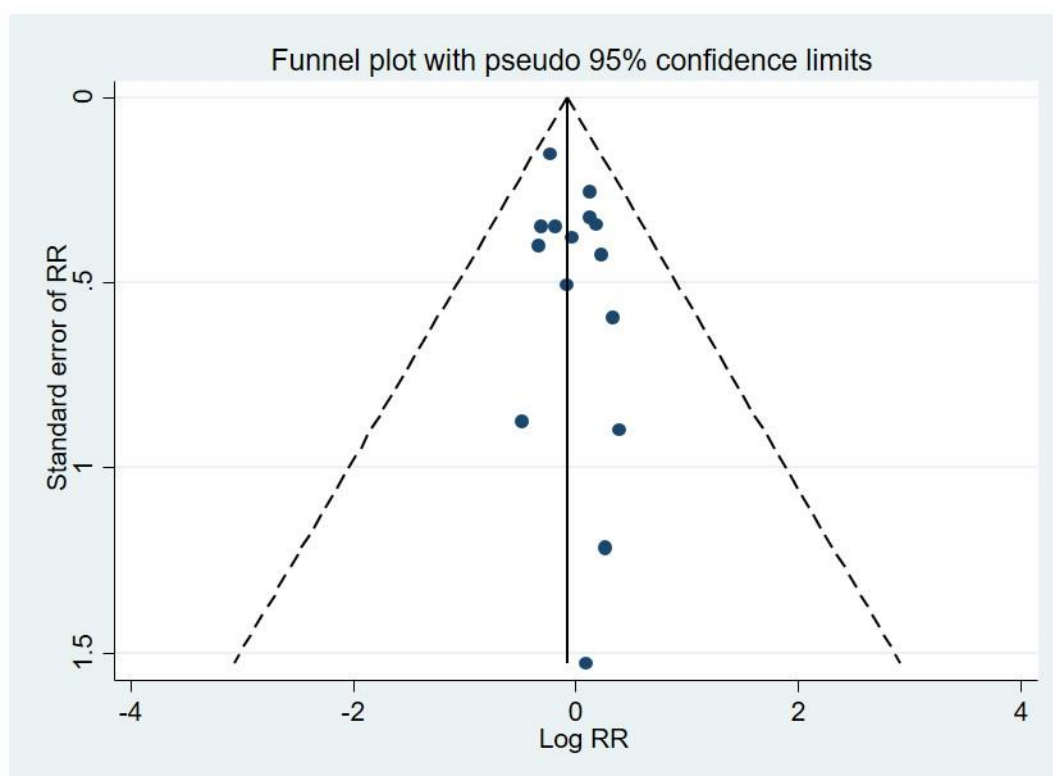
Figure S1c: Forest and funnel plot of studies evaluating melanoma and other skin cancer incidence and mortality among petroleum workers.



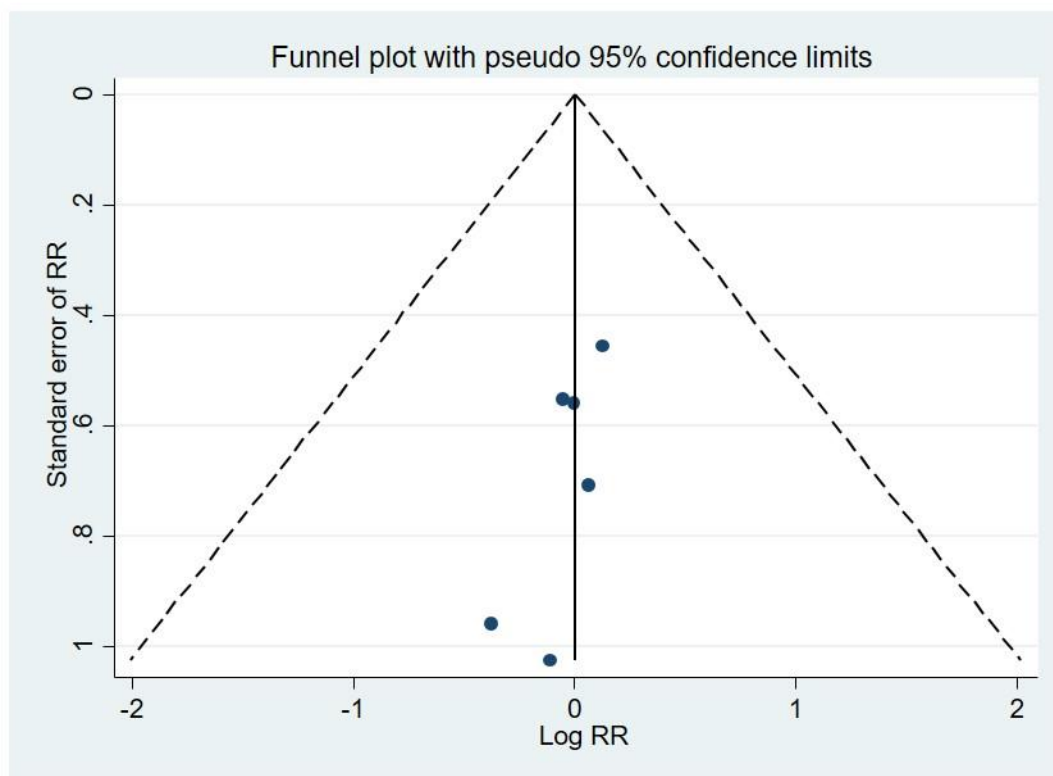
Egger's regression test for *Urinary bladder SMR* publication bias $P = 0.504$



Egger's regression test for *Urinary bladder SIR* publication bias $P = 0.341$



Egger's regression test for *Kidney SMR* publication bias $P = 0.184$



Egger's regression test for *Kidney SIR* publication bias $P = 0.085$

Figure S1d: Forest and funnel plot of studies evaluating urinary cancer incidence and mortality among petroleum workers.

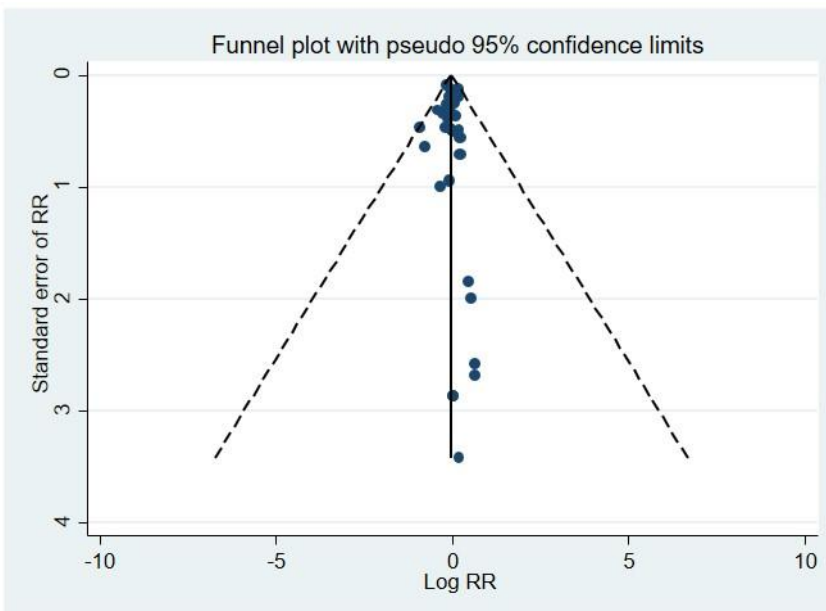
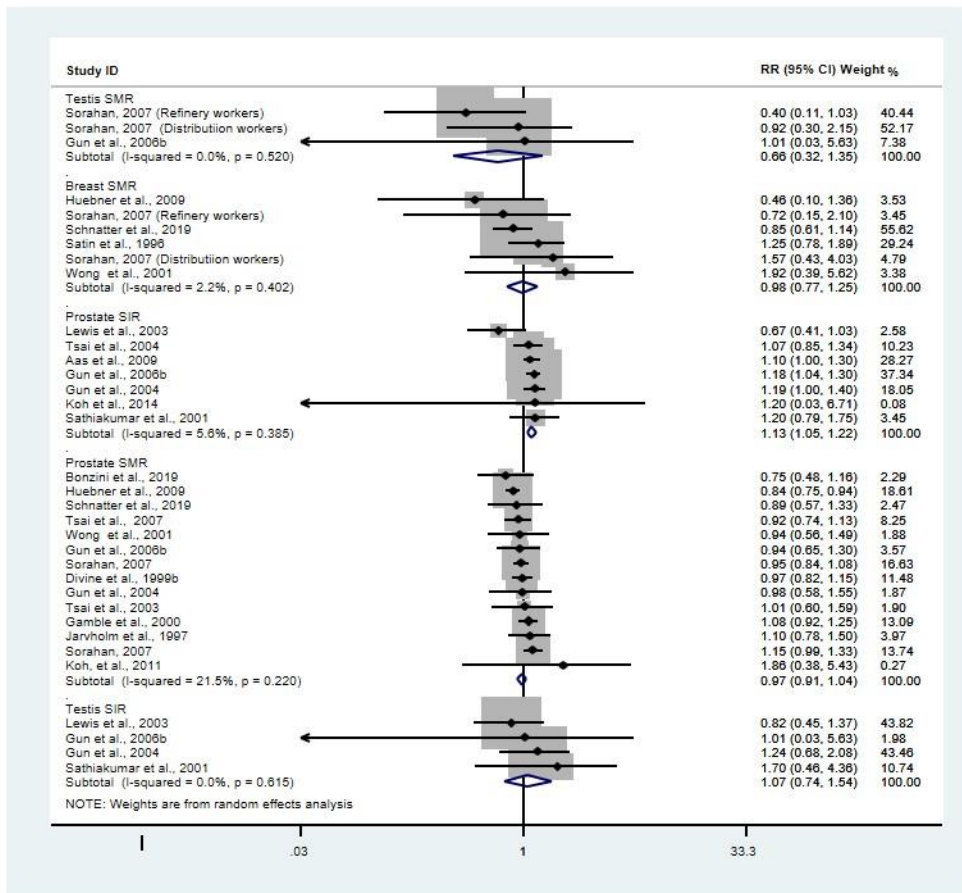
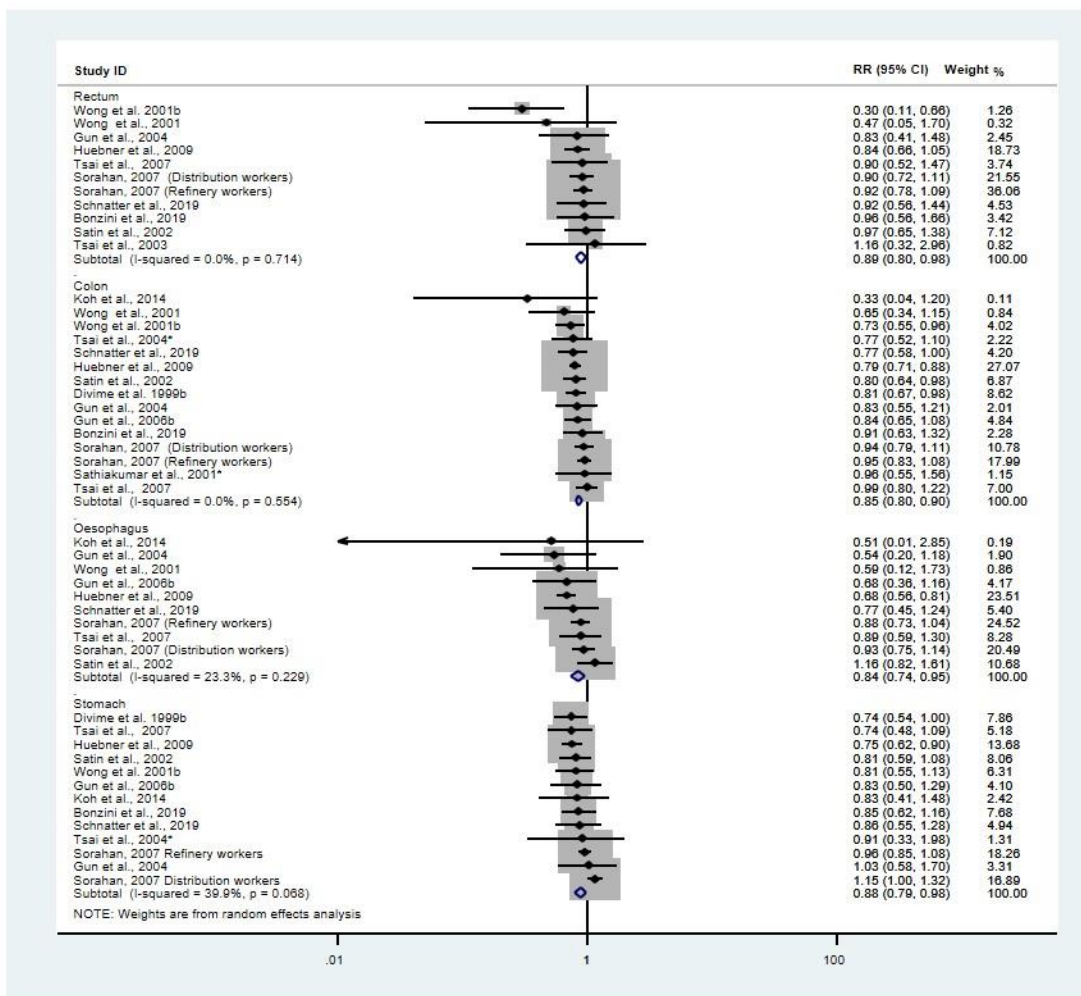


Figure S1e: Forest and funnel plot of studies evaluating reproductive cancer incidence and mortality among petroleum workers. Egger's regression test for Reproductive cancer publication bias $P = 0.747$



*Incidence cases

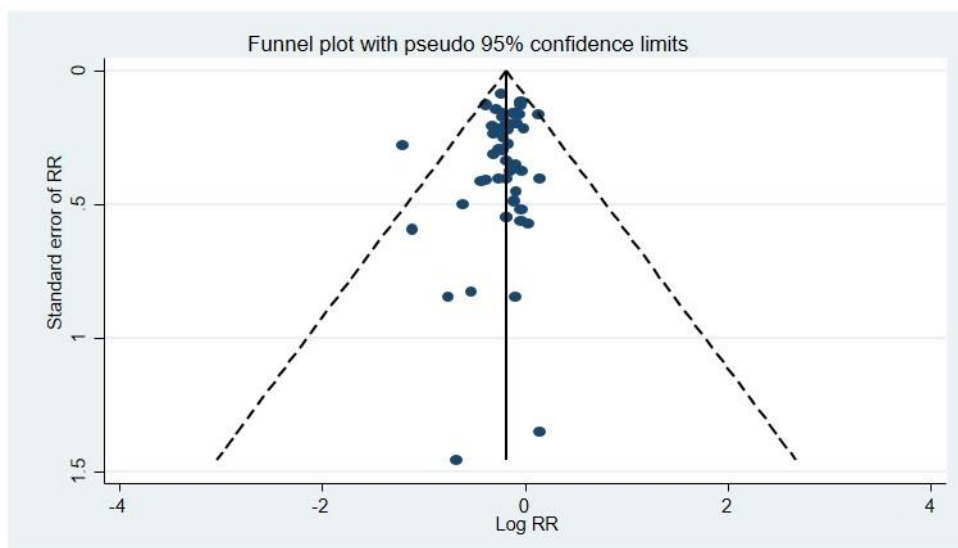


Figure S1f: Forest plot of studies digestive organ cancer incidence and mortality among petroleum workers

Egger's regression test for digestive organ cancer publication bias $P = 0.302$

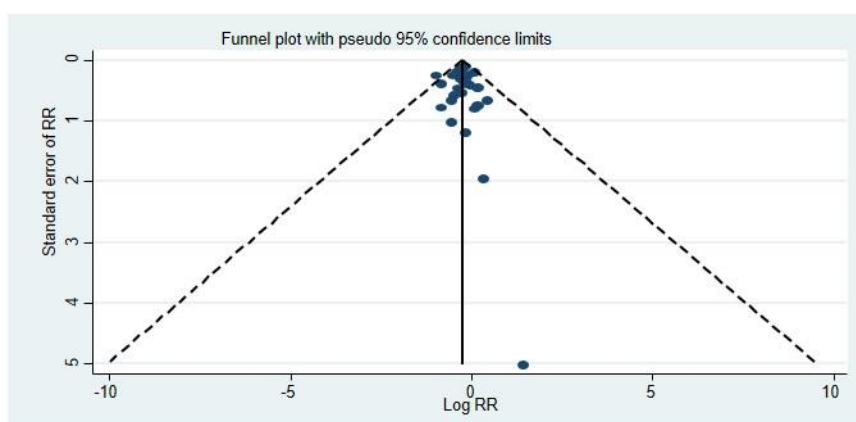
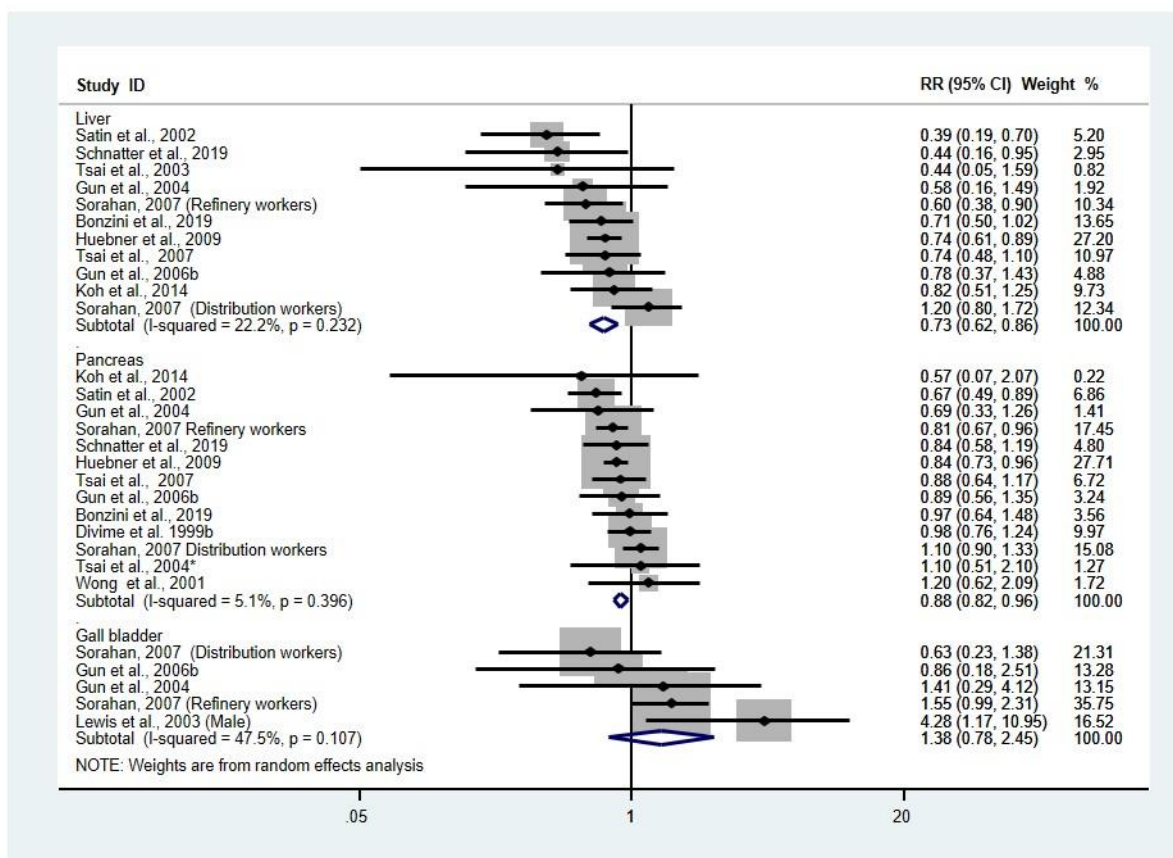


Figure S1g: Forest and funnel plot of studies accessory digestive organ cancer incidence and mortality among petroleum workers. Egger's regression test for Accessory digestive organ cancer incidence and mortality publication bias $P = 0.977$

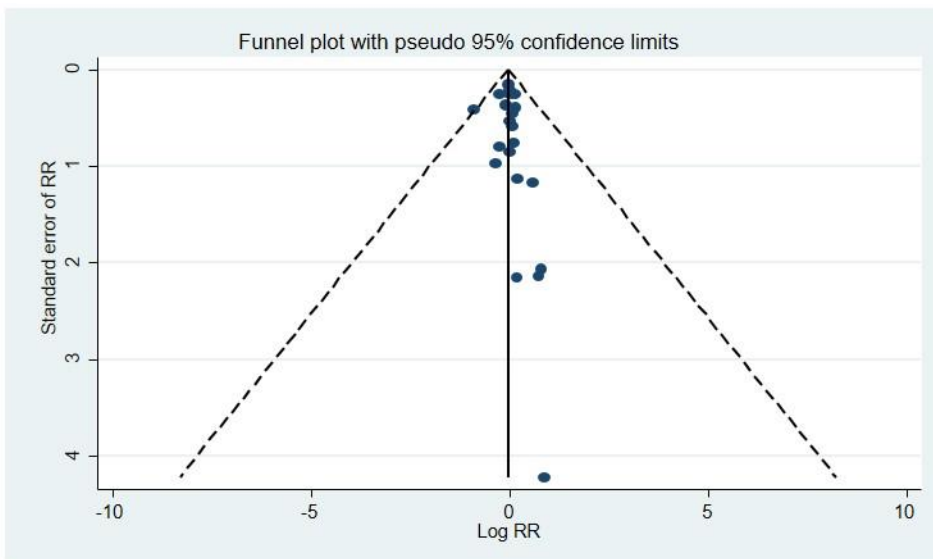
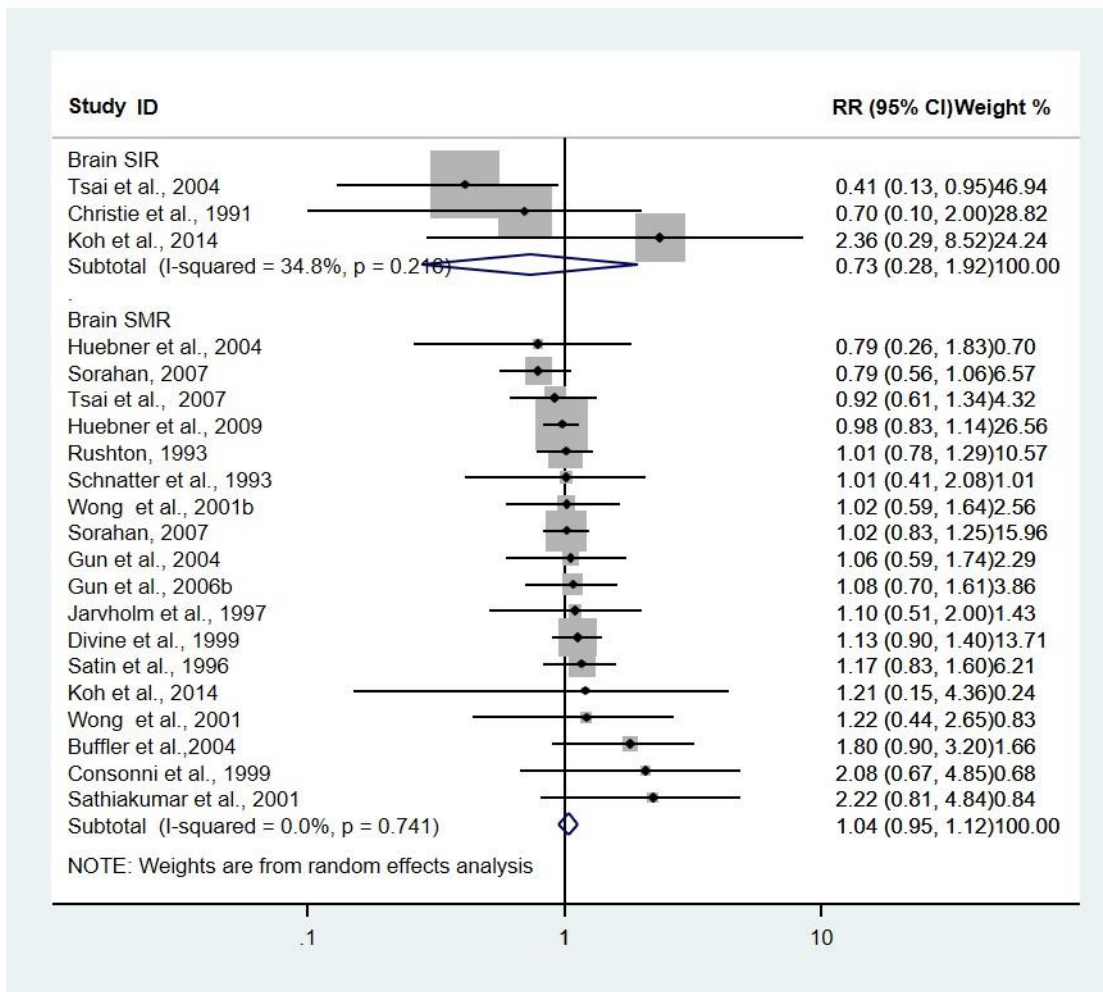


Figure S1h: Forest and funnel plot of studies brain cancer incidence and mortality among petroleum workers
 Egger's regression test for brain cancer incidence and mortality publication bias $P = 0.632$

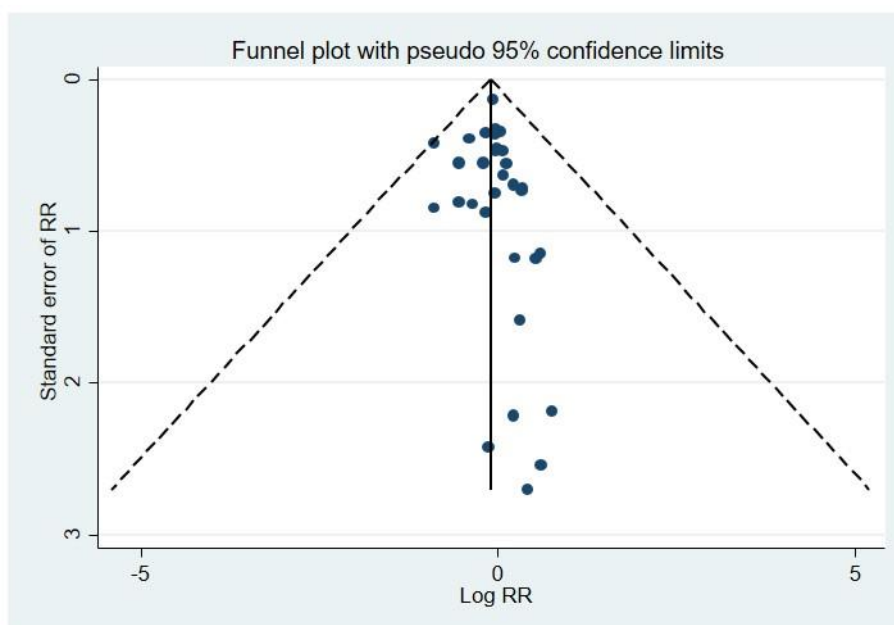
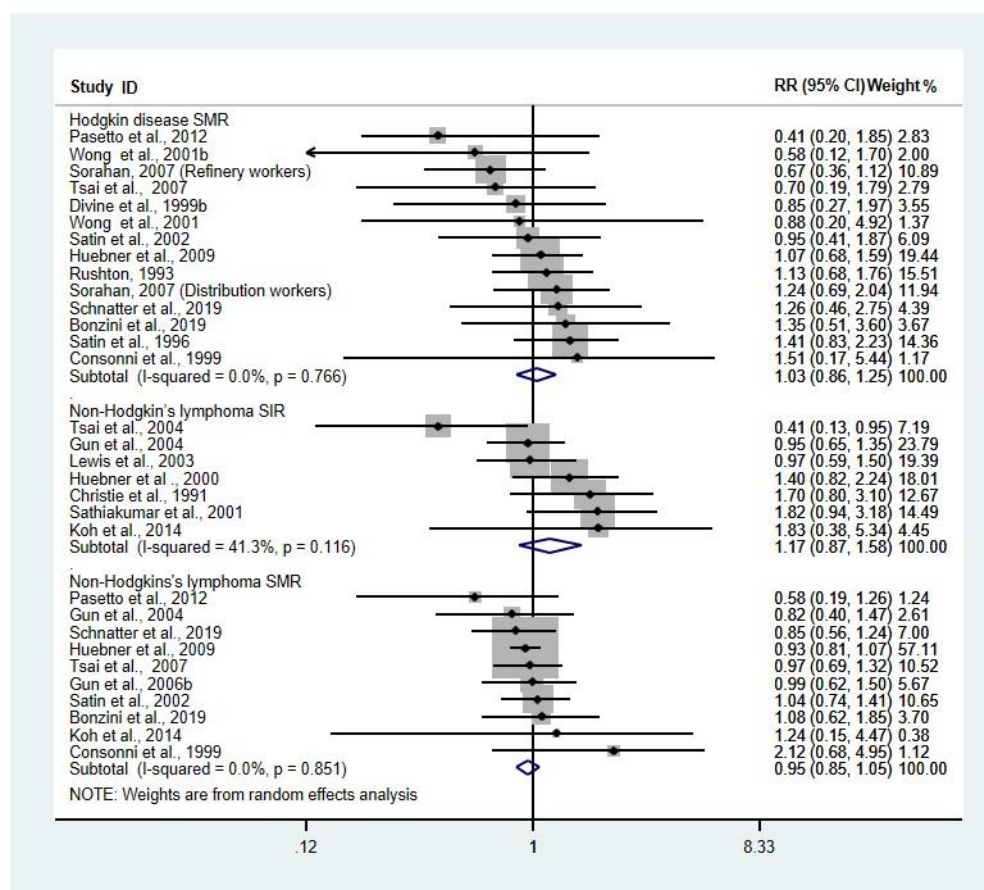


Figure S1i: Forest and funnel plot of studies for Hodgkin's and Non-Hodgkin's Lymphoma incidence and mortality among petroleum workers. Egger's regression test HL and NHL incidence and mortality publication bias $P = 0.533$

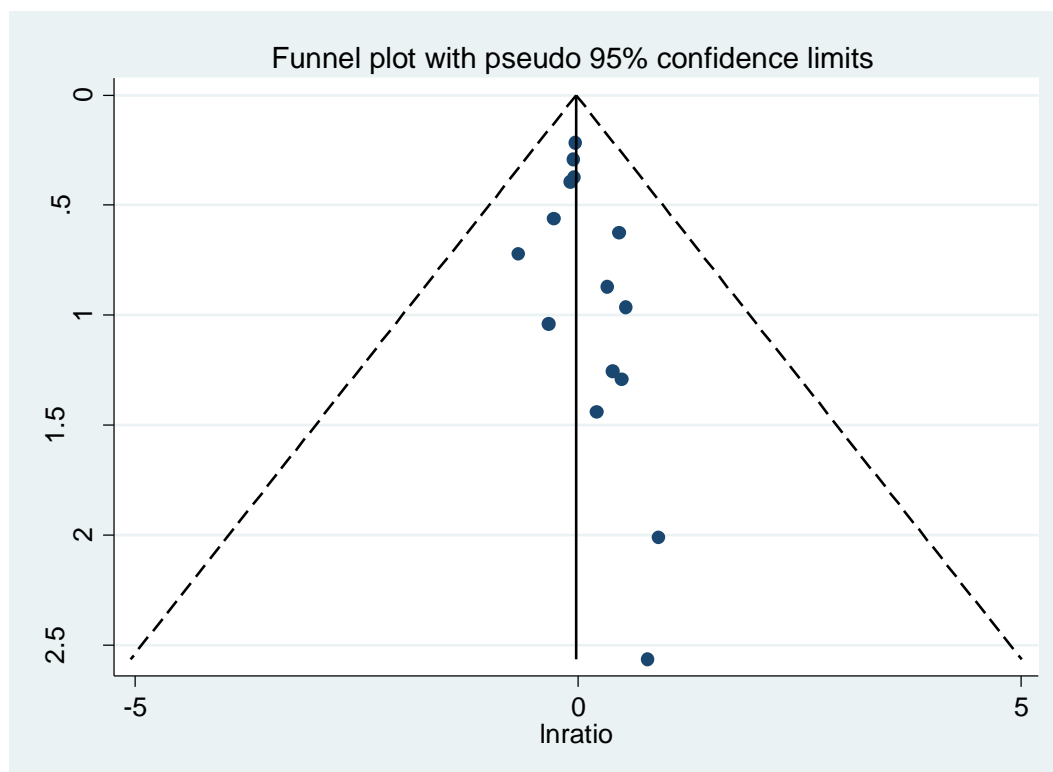
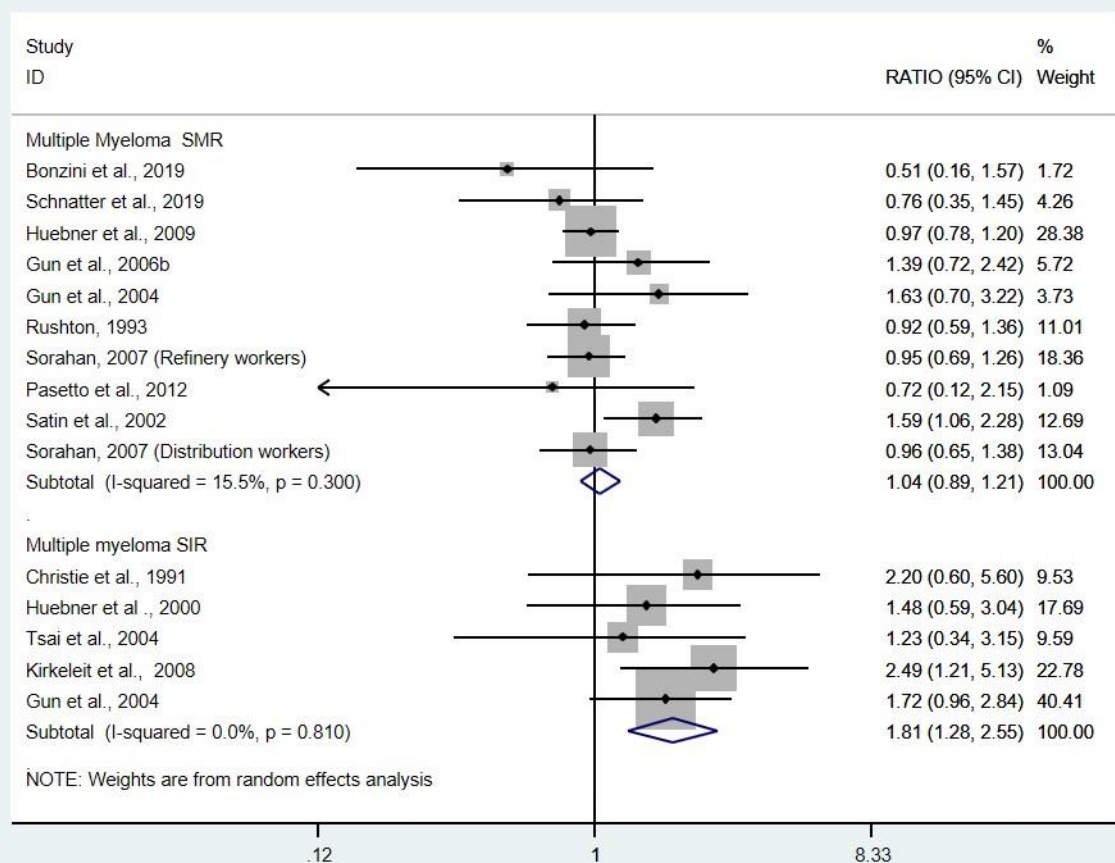
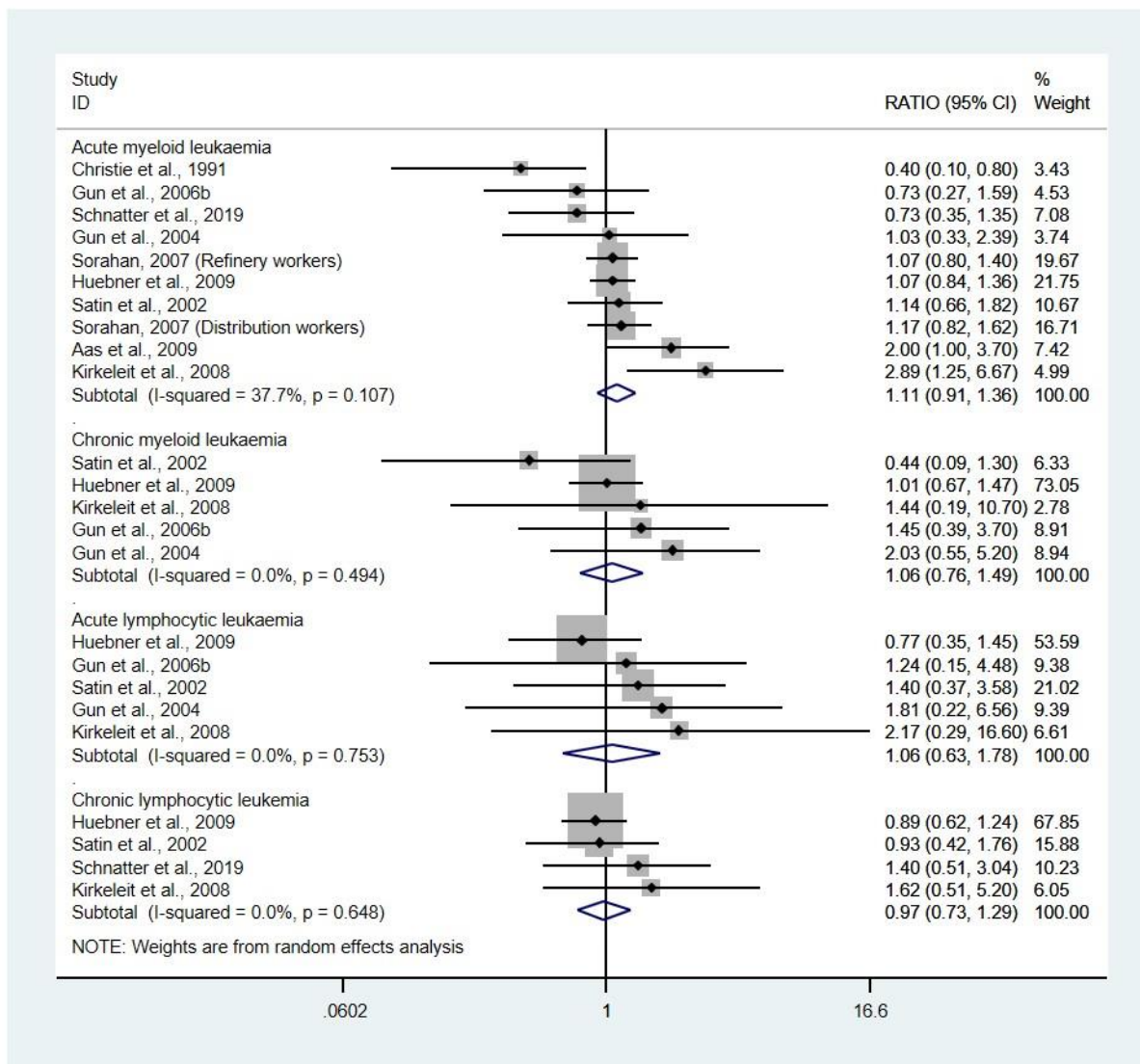


Figure S1j: Forest and funnel plot of studies for Multiple myeloma incidence and mortality among petroleum workers. Egger's regression test Multiple myeloma incidence and mortality publication bias $P = 0.162$



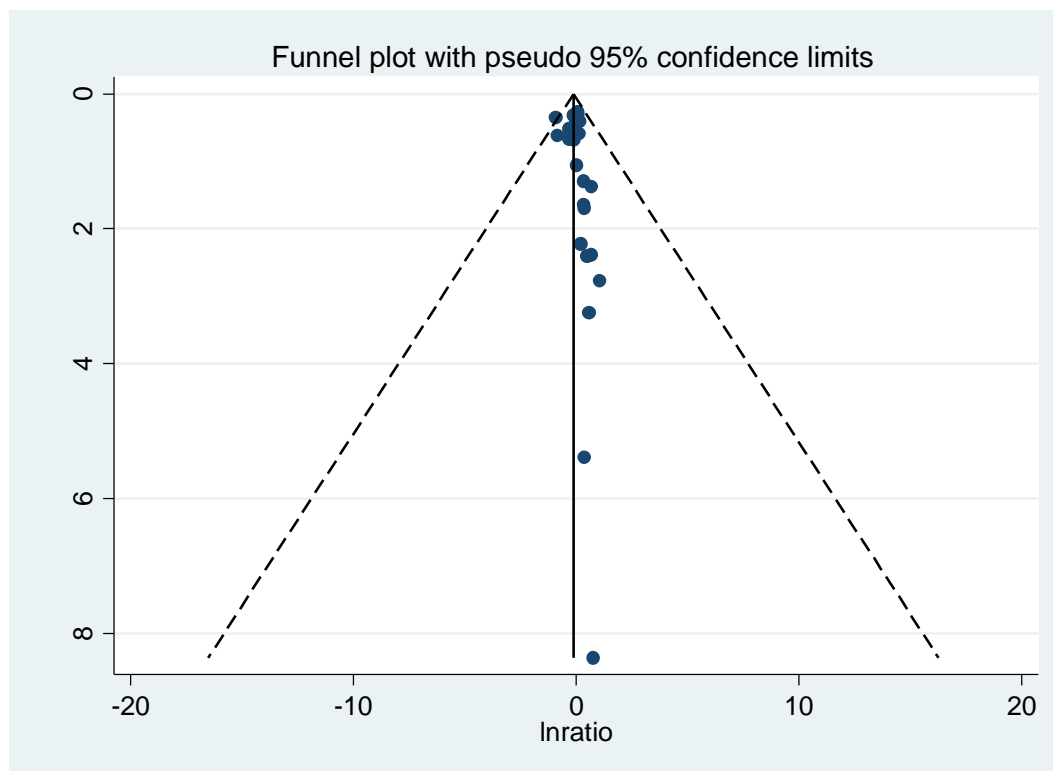
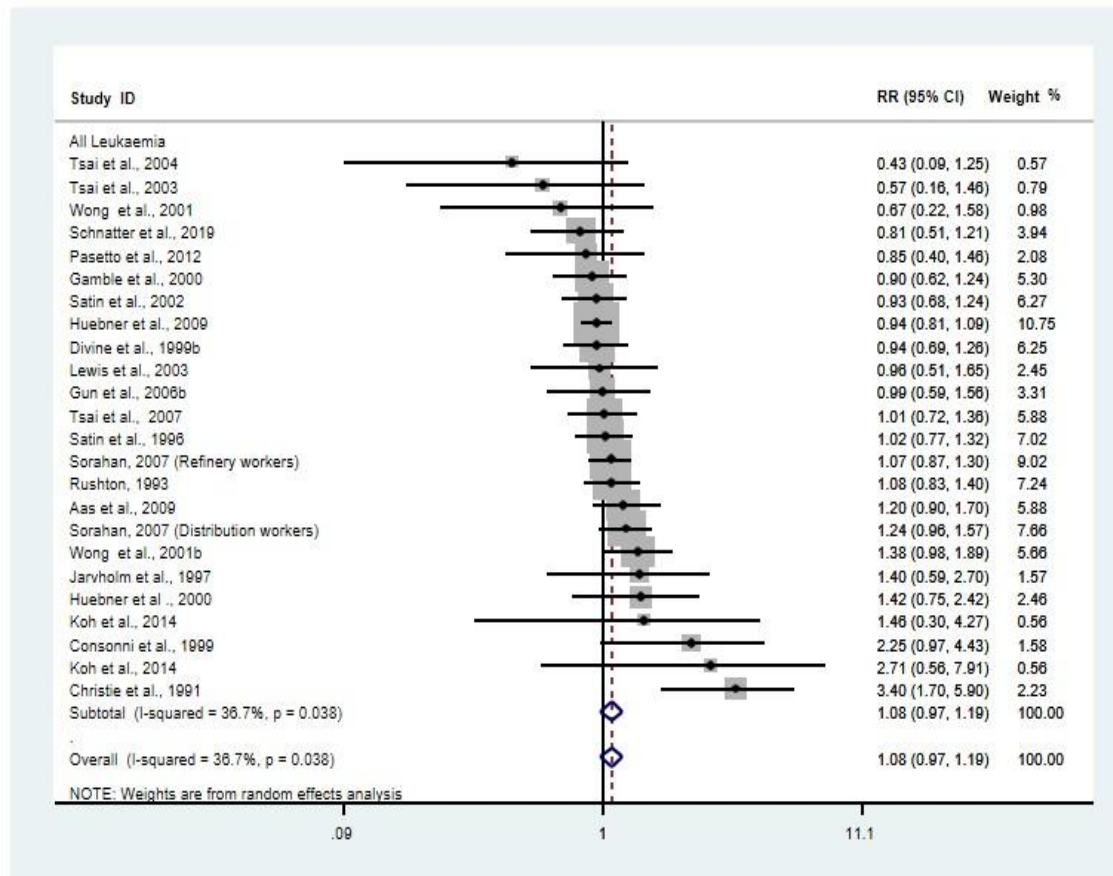


Figure S1k: Forest and funnel plot of studies for subtypes of leukaemia incidence and mortality among petroleum workers Egger's regression test leukaemia subtype incidence and mortality publication bias $P = 0.355$



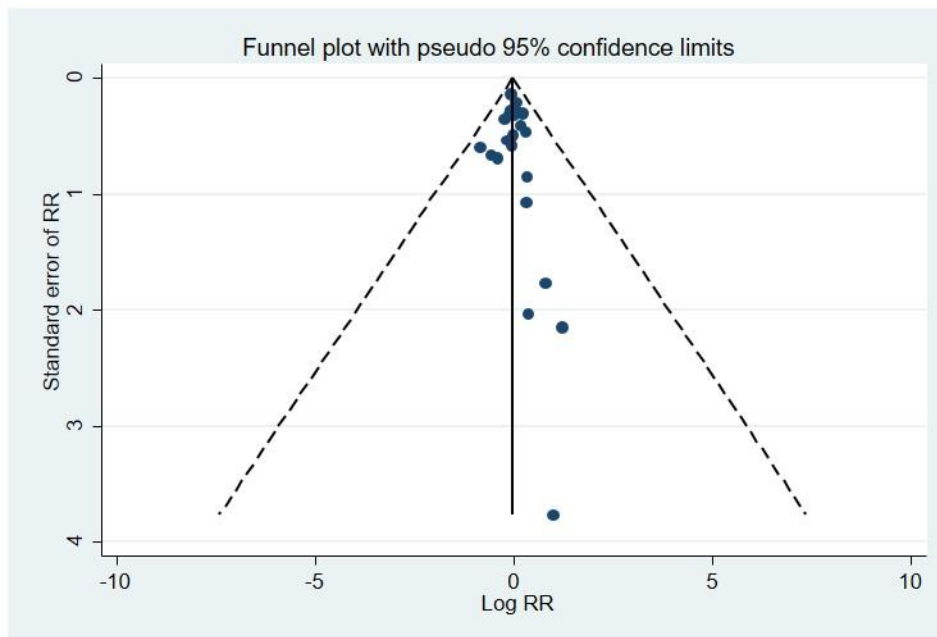
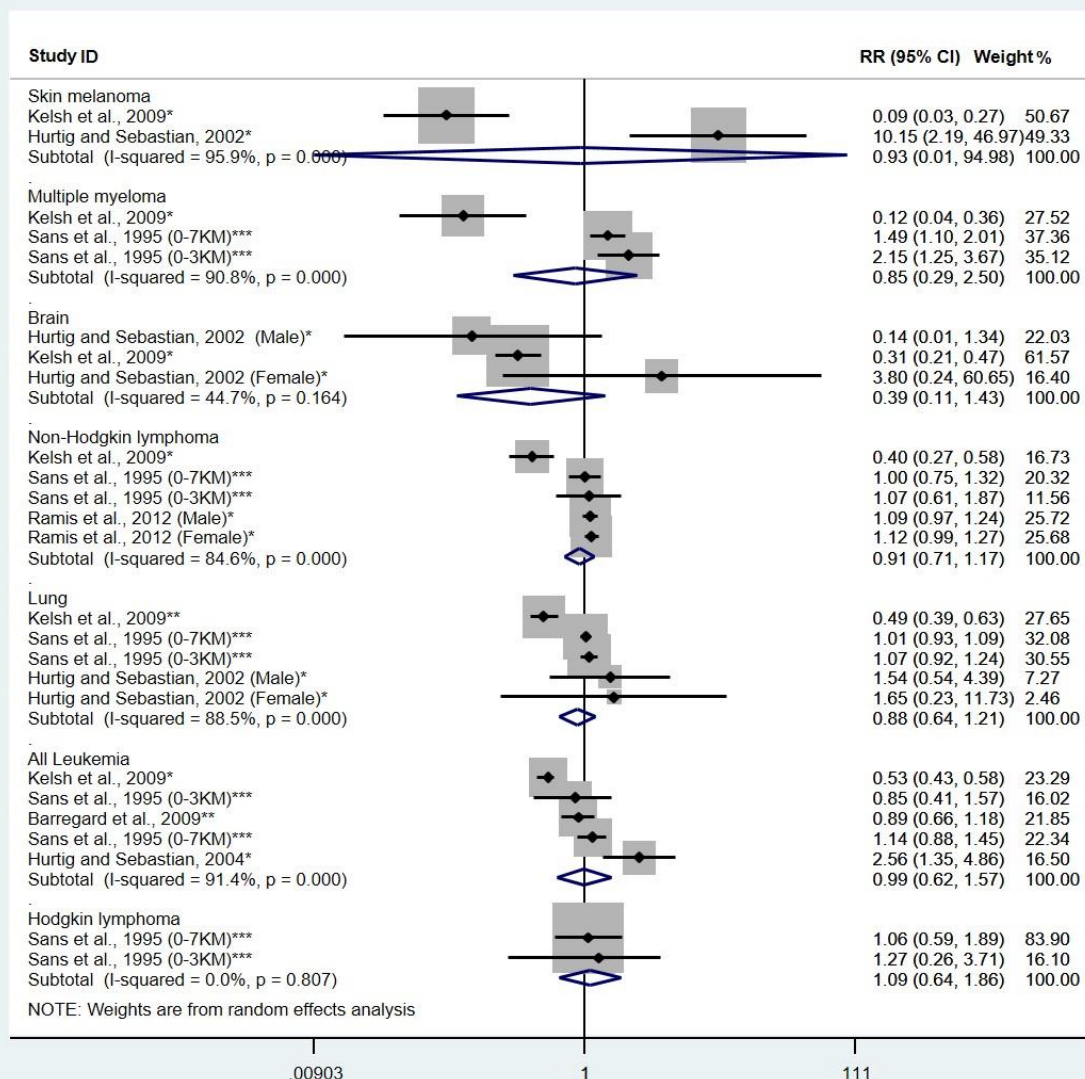


Figure S11: Forest and funnel plot of studies of leukaemia incidence and mortality among petroleum workers.

Egger's regression test Leukaemia incidence and mortality publication bias $P = 0.592$

Figure S2: Forest and funnel plot of studies evaluating cancer incidence and mortality among residents of oil producing communities.



* Relative risk ** incidence studies *** mortality studies

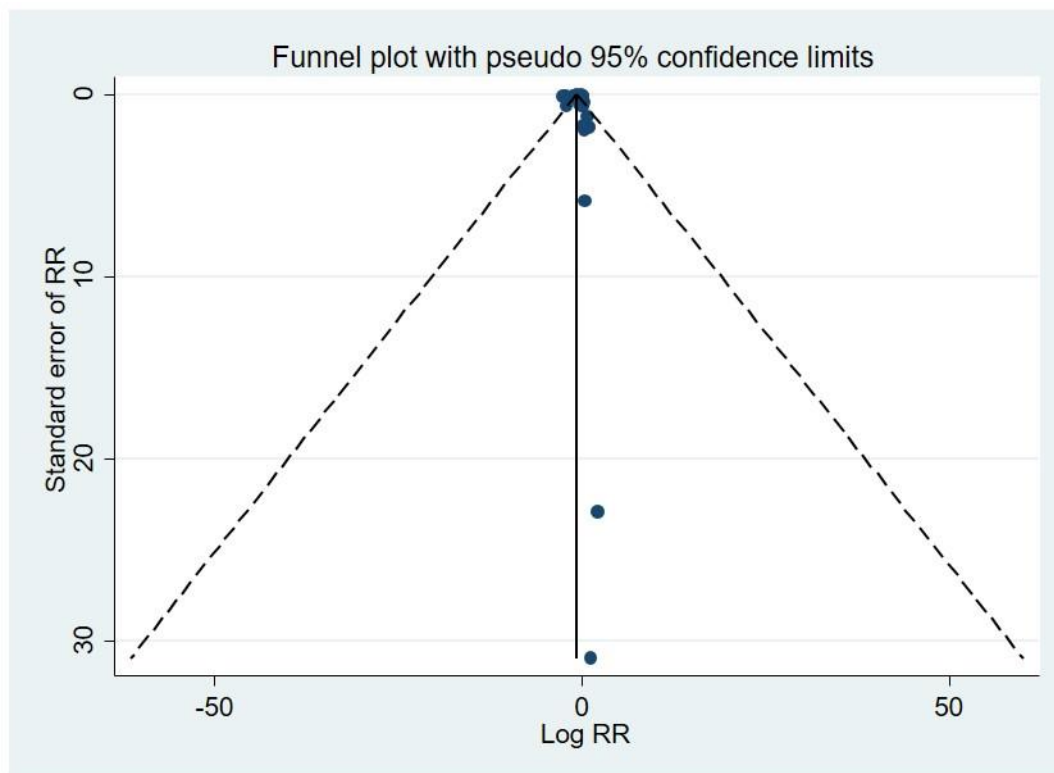
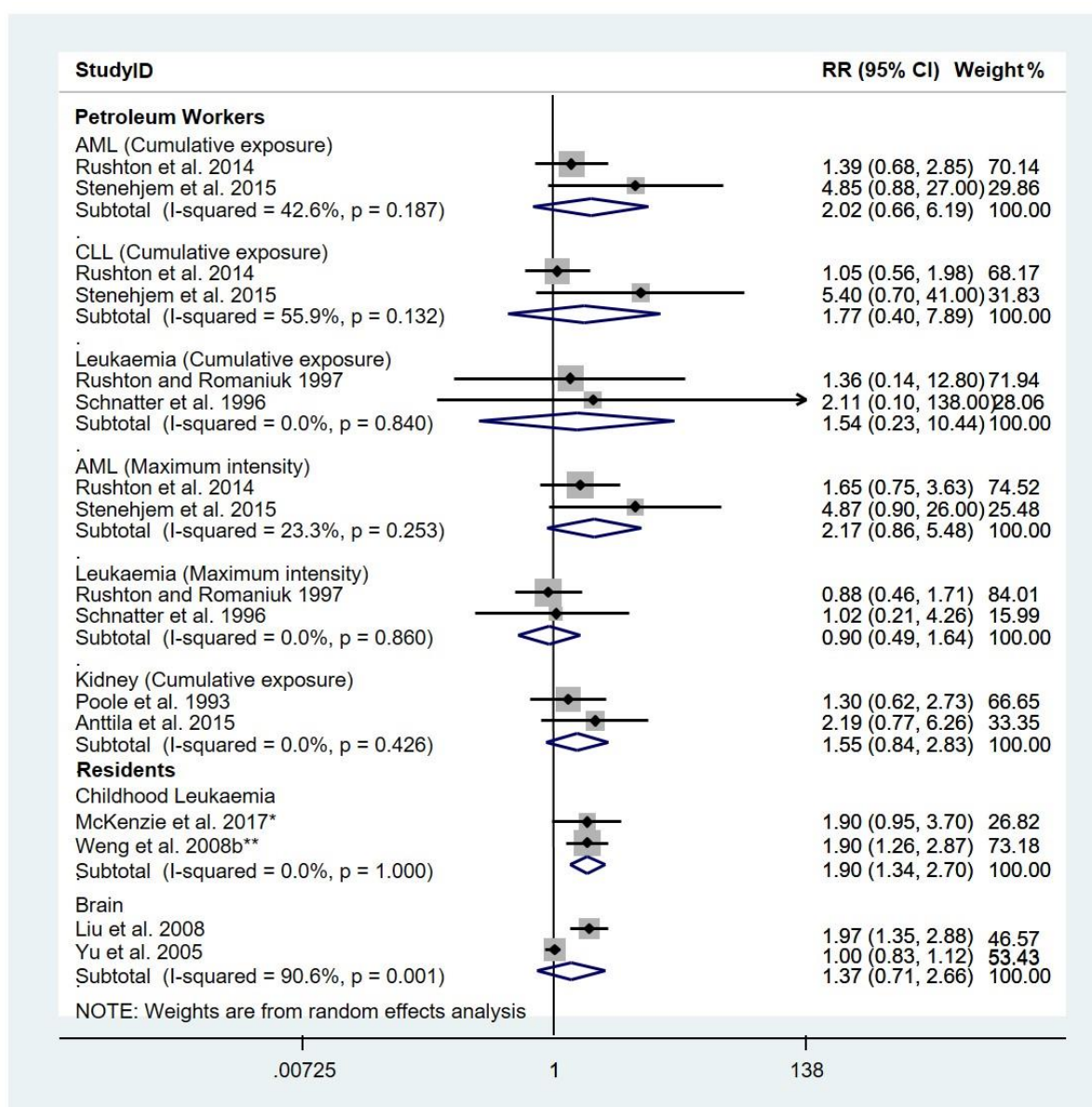


Figure S2: Forest and funnel plot of studies evaluating cancer incidence and mortality among residents of oil producing communities. Egger's regression test for publication bias on all cancers for residents living in oil producing communities $P = 0.755$

Figure S3: Forest plot of nested case-control studies evaluating cancer among petroleum industry workers and case-control studies evaluating cancer risk among residents living in proximity to petroleum facilities



* Childhood leukaemia (Age 0-24); ** Childhood leukaemia (Age 0-19)

Figure S3: Forest plot of nested case-control studies evaluating cancer among petroleum industry workers and case-control studies evaluating cancer risk among residents living in proximity to petroleum facilities

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