

Supplementary table S1. Search Strategy

Search date: 1st January, 2020

Databases searched:

Ovid MEDLINE(R) Epub Ahead of Print, In-Process & Other Non-Indexed Citations, Ovid MEDLINE(R) Daily and Ovid MEDLINE(R) <1946 to Present>; Elsevier Embase; Wiley Cochrane.

Searches

- 1 immune checkpoint inhibitors
(cytotoxic T-lymphocyte protein-4 antibody or anti programmed cell death protein-1 or anti-PD-1 antibodies or Ipilimumab or nivolumab or pembrolizumab or cemiplimab or anti-PD-L1 inhibitors or atezolizumab or avelumab or durvalumab)
- 2
- 3 1 AND 2
- 4 (immune-related adverse side effects or Immune related adverse side effects or immune related adverse)
- 5 irAEs
- 6 4 OR 5
- 7 3 AND 6
- 8 (body mass index or body composition or weight or overweight or obesity)
- 9 7 AND 8
- 10 Limit 9 to humans
- 11 Limit 10 to adults
- 12 Limit 11 to English

Supplementary table S2. Additional characteristics of the included studies.

Author, year	OR	ECOG PS	Number of metastatic sites	Treatment line of Immunotherapy	Patients with irAEs any grade	Grade 3-4 irAEs	Race
Cortellini, et al 2019	3.71 (2.83-4.87)	0-1: 831 (85.1%). ≥2: 145 (14.9%)	≥2: 467 (47.9%) >2: 509 (52.1%)	First-line treatment in 260 patients (26.6%).	393 (40.3%)	63 (6.5%)	--
Daly, et al 2017	2.46 (0.67-9.02)*	--	--	First-line treatment in 29 patients (34.5%).	47 (56%)	25 (29.8%)	--
Eun, et al 2018	3.65 (1.58-8.42)*	--	--	--	67 (17.1%)	14 (3.6%)	Asians
Hirsch, et al 2020	1.42 (0.49-4.11)	0-1: 56 (60.9%); ≥ 2: 36 (39.1%)	1: 32 (34.8%); ≥ 2: 60 (65.2%)	First-line treatment in 11 patients (12.0%)	17	70	--
Leiter, et al 2019	1.79 (1.09-2.96)*	--	--	--	98	300	White (214) Black (40) Hispanic (39) Asian (31) Other (74)

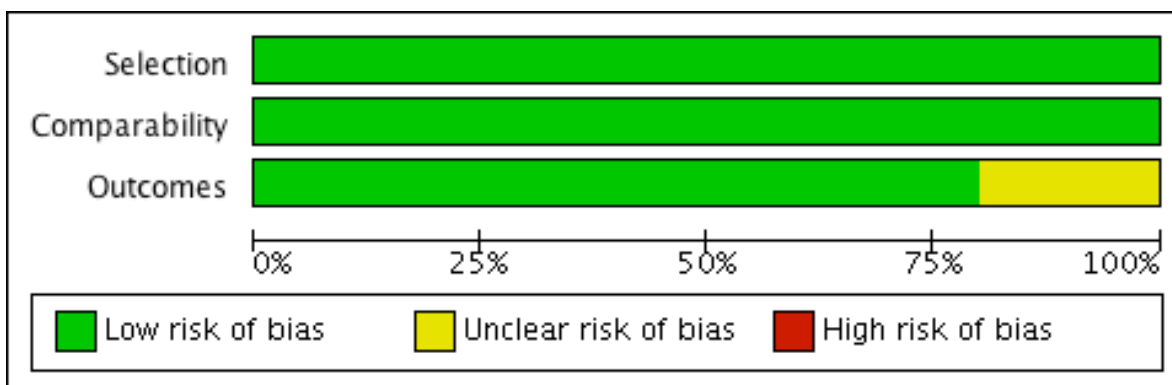
* Adjusted OR.

ECOG PS: Eastern Cooperative Oncology Group performance status. irAEs: Immune-related adverse effects.

Supplementary table S3a. Risk of bias summary for cohort studies using Newcastle–Ottawa quality assessment scale: review authors’ judgements about each risk of bias item for each included study.

Author (year)	Selection				Comparability Control for important factor or additional factor	Outcomes			Total
	Representativeness of exposed group	Selection of the non-exposed group	Ascertainment of exposure	Outcome of interest was not at start of study		Assessment of outcome	Follow-up long enough for outcomes to occur	Adequacy of follow up of cohorts	
Cortellini, et al 2019	☆	☆	☆	☆	☆	☆	-	☆	7/9
Daly, et al 2017	☆	☆	☆	☆	☆	☆	-	☆	7/9
Eun, et al 2018	☆	☆	☆	☆	☆	-	☆	☆	7/9
Hirsch, et al 2020	☆	☆	☆	☆	☆	☆	-	☆	7/9
Leiter, et al 2019	☆	☆	☆	☆	☆	-	☆	-	6/9

Supplementary table S3b. Risk of bias graph: review authors' judgements about each risk of bias item presented as percentages across all included studies.



Supplementary table S4. GRADE Approach to Evaluate the Quality of Evidence of included studies.

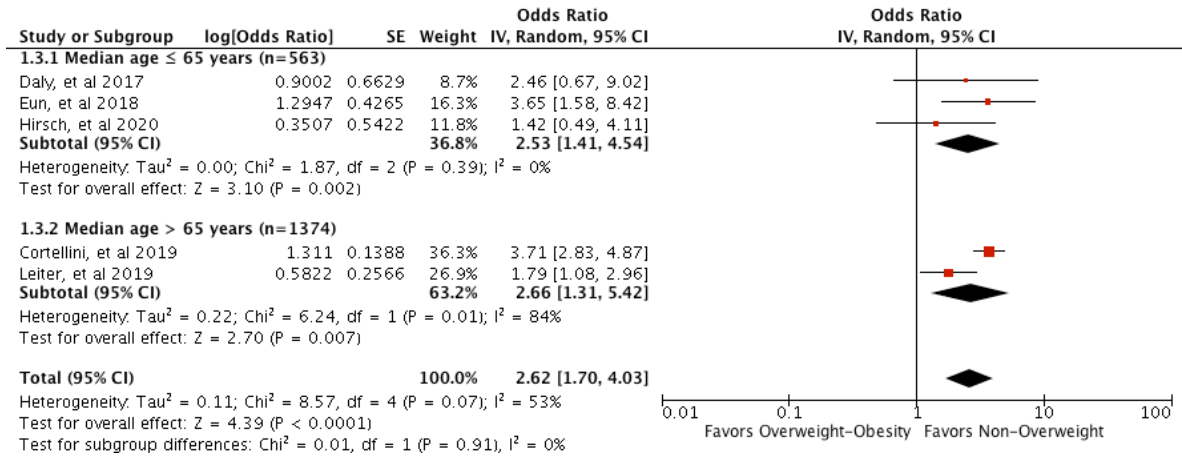
No. of studies	Quality Assessment					Summary of findings			
	Design	Quality	Consistency	Directness	Other modifying factors	No. of Patients	Effect	Quality	Importance
4	Observational retrospective	Not serious limitations	Not important inconsistency	Direct	None	1850	OR: 2.85 95% CI: 1.84-4.42	Moderate	Critical
1	Observational prospective	Not serious limitations	Not important inconsistency	Direct	None	87	OR 1.42; 95% CI: (0.49-4.11)	Moderate	Critical

CI: Confidence interval.

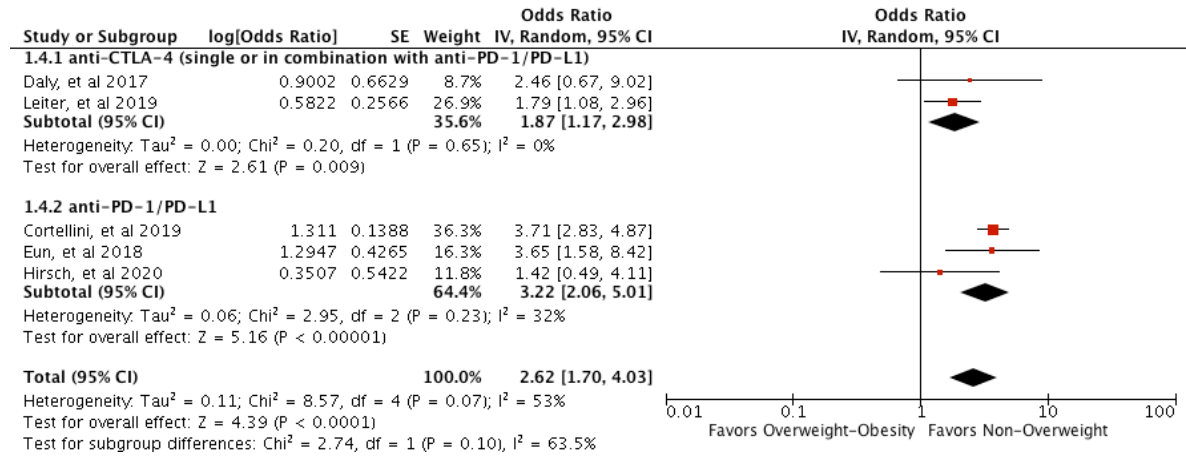
Supplementary table S5. Description of excluded studies.

Author, year	Reference	Reason(s)
Richtig G., et al 2009	Richtig G, Hoeller C, Wolf M, Wolf I, Rainer BM, Schalter G, Richtig M, Grüber MR, Gappmayer A, Haidn T, Kofler J. Body mass index may predict the response to ipilimumab in metastatic melanoma: An observational multi-centre study. <i>PloS one</i> . 2018;13(10).	Did not link BMI with irAEs.
Cortellini, Verna, et al 2019	Cortellini A, Verna L, Porzio G, Bozzetti F, Palumbo P, Masciocchi C, Cannita K, Parisi A, Brocco D, Tinari N, Ficarella C. Predictive value of skeletal muscle mass for immunotherapy with nivolumab in non-small cell lung cancer patients: A “hypothesis-generator” preliminary report. <i>Thoracic cancer</i> . 2019 Feb;10(2):347-51.	Did not link BMI with irAEs.
Kichenadasse, et al 2019	Kichenadasse G, Miners JO, Mangoni AA, Rowland A, Hopkins AM, Sorich MJ. Association Between Body Mass Index and Overall Survival With Immune Checkpoint Inhibitor Therapy for Advanced Non–Small Cell Lung Cancer. <i>JAMA oncology</i> . 2019 Dec 26.	The design is post hoc analysis of randomized clinical trials.
Heidelberger, et al 2017	Heidelberger V, Goldwasser F, Kramkimel N, Jouinot A, Huillard O, Boudou-Rouquette P, Chanal J, Arrondeau J, Franck N, Alexandre J, Blanchet B. Sarcopenic overweight is associated with early acute limiting toxicity of anti-PD1 checkpoint inhibitors in melanoma patients. <i>Investigational new drugs</i> . 2017 Aug 1;35(4):436-41.	Did not specify the data about patients with and without all irAEs.
Donnelly, et al 2019	Donnelly D, Bajaj S, Yu J, Hsu M, Balar A, Pavlick A, Weber J, Osman I, Zhong J. The complex relationship between body mass index and response to immune checkpoint inhibition in metastatic melanoma patients. <i>Journal for immunotherapy of cancer</i> . 2019 Dec 1;7(1):222.	Insufficient data to calculate clinical outcome statistical measures.
Eun, et al 2019	Eun Y, Kim IY, Sun JM, Lee J, Cha HS, Koh EM, Kim H, Lee J. Risk factors for immune-related adverse events associated with anti-PD-1 pembrolizumab. <i>Scientific reports</i> . 2019 Oct 1;9(1):1-8.	A cohort already included in the meta-analysis

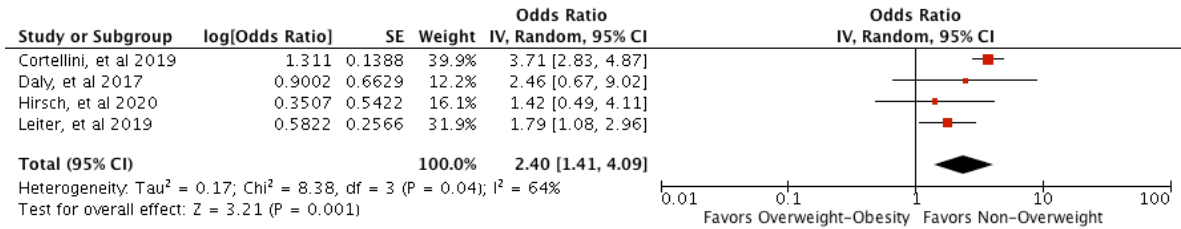
Supplementary figure S1. Forest plot of studies included in meta-analysis of BMI and irAEs in patients on ICIs by age.



Supplementary figure S2. Forest plot of studies included in meta-analysis of BMI and irAEs in patients on ICIs by type of ICIs.



Supplementary figure S3. Forest plot of studies included in meta-analysis of BMI and irAEs in patients on ICIs by BMI categories: underweight, BMI < 18.5 kg/m²; normal, 18.5 ≤ BMI ≤ 24.9 kg/m²; overweight, 25 ≤ BMI ≤ 29.9 kg/m²; obesity, BMI ≥ 30 kg/m².



Supplementary table S6. Sensitivity analysis

Excluded studies	OR 95% CI	P	I²	P_{heterogeneity}
Cortellini, et al 2019	2.07 (1.41-3.04)	0.0002	0%	0.45
Daly, et al 2017	2.61 (1.60-4.26)	0.0001	65%	0.04
Eun, et al 2018	2.40 (1.41-4.09)	0.001	64%	0.04
Hirsch, et al 2020	2.85 (1.84-4.42)	0.00001	54%	0.09
Leiter, et al 2019	3.37 (2.50-4.54)	0.00001	7%	0.36

Supplementary figure S4. Funnel plot.

