1) Supplementary Materials

Melanoma Risk and Vitamin D level and status

First author	location	Study design	Control group	cases (%male)	control (%male)	age cases/controls	assessment of Vitamin D status
Bade B., 2014	Germany	Retrospective case-control study	Healty controls	324 (54%)	141 (42%)	56.3 / 55.1	LIAISON-25-OH Vitamin D Immunoassay
Befon A., 2019	Greece	Prospective cohort study	Age and sex matched healthy patients	99 (46%)	97 (48%)	50/51	25-OH-Vitamin-D-Immunoassay
Cattaruzza M., 2019	Italy	case-control study	Age and sex matched healthy patients	137 (45%)	99 (32%)	13/129	LIAISON-25-OH Vitamin-D-Immunoassay
Davies J., 2011	UK	Case-control study	Age and sex matched healthy patients	880 (40%)	194 (40%)	NA	25-OH-vitamin-D-Immunoassay
Ene C., 2015	Romania	Case-control study	healthy controls of same geographic region as patients	88 (35%)	88 (38%)	18-45 both	25-OH-ELISA, Euroimmunkit Assay
Kwon G., 2018	USA	Embedded case-control study	Postmenopausal fair-skinned women from different centers	718 (0%)	718 (0%)	50-79	25-OH-D-liquid-chromatography with mass spectrometry
Lombardo M., 2021	Italy	retrospektive case-control study	Healthy controls	154 (51%)	125 (NA)	59.7 / NA	25-OH-D-liquid-chromatography with mass spectrometry
Major J., 2012	Finland	Embedded case-control study	Age-matched healthy patients	92 (100%)	276 (100%)	57.5 / 57	LIAISON 25-OH Vitamin-D-Immunoassay
Navarette-Dechent C., 2012	Chile	Case-control study	Age and sex matched healthy patients	40 (37,5%)	56 (37,5%)	48.5 / 48,4	25-OH-D-liquid-chromatography with mass spectrometry
Nürnberg B., 2009	Germany	Case-control study	Healthy controls	205 (55%)	141 (43%)	NA / NA	LIAISON 25-OH Vitamin-D-Immunoassay
Skaaby T., 2014	Denmark	Prospective cohort study	Cancer-free danish citizens	10485 (ca. 50%)	56 (NA)	40 - 71 both	25-OH-Vitamin-D-Immunoassay with HPLC
Spath L., 2016	Italy	Case-control study	Sex and age matched healthy controls of same geographic region as patients	105 (41%)	101 (ca. 41%)	54 both	LIAISON 25-OH Vitamin-D-Immunoassay
Stenehjem J., 2020	Norway	prospective embedded case-control study	Age and sex matched healthy patients	708 (57%)	708 (57%)	42 both	25-OH-D-liquid-chromatography with mass spectrometry
Van der Pols J., 2013	Australia	Prospective cohort study	Cancer-free citizens	17 (30%)	1174 (45%)	58 / 54	LIAISON 25-OH Vitamin-D-Immunoassay
Vojdeman, F., 2019	Denmark	Prospective cohort study	Cancer-free danish citizens	684 (NA)	216560 (34,7%)	NA / 48.8	LIAISON 25-OH Vitamin-D-Immunoassay

Melanoma Prognosis and Vitamin D level and status

First author	location	study design	Recruitment of participants	Outcome(s)	Sample size	age	assessment of Vitamin D status
Befon A., 2019	Greece	Prospective cohort study	99 patients with histologically confirmed primary MM and serum vitamin D determination within one month after diagnosis were included (Athens Hospital, 2011-2014)	Tumor thickness <1 vs. >4 mm in vitamin D-deficient patients	66	50	25-OH-Vitamin-D-Immunoassay
Fang S., 2016	USA	Prospective cohort study	1042 patients with histologically confirmed primary MM and vitamin D serum determination within Ø7 months after diagnosis were included (Texas Hospital, 1997-2009)	SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness SMD of vitamin D values for patients with vs. without ulceration SMD of vitamin D mean values for patients with tumor stage ≥3 vs. <3 SMD of vitamin D mean values for patients with vs. without evidence of mitosis	519 / 409 176 / 664 349 / 693 455 / 199	54.8	25-OH-Vitamin-D-Immunoassay
Gambichler T., 2012	Germany	Prospective cohort study	764 patients with histologically confirmed primary MM and vitamin D serum determination at the time of diagnosis were included (Bochum Hospital, 2009-2012)	Tumor thickness <1 vs. >4 mm in vitamin D deficient patients Tumor stage 0 vs. ≥1 in vitamin D deficient patients SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness SMD of vitamin D mean values for patients with tumor stage 4 vs. 0	425 753 371 / 367 67 / 61	18-79	25-OH-Vitamin-D-Immunoassay
Johansson H., 2021	Italy	Case-control study	104 patients with histologically confirmed primary MM and serum vitamin D determination at the time of diagnosis were included (hospitals in northern Italy)	Tumor stage 2a vs. 2b/c in Vitamin-D-deficient patients	104	50	25-OH-Vitamin-D-Immunoassay

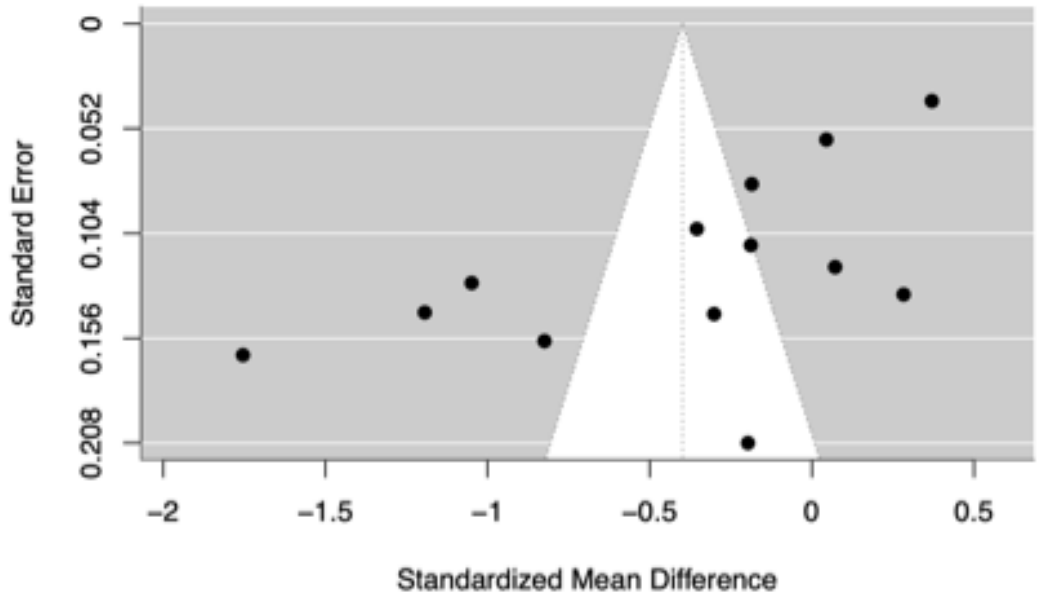
Lim A., 2017	Australia	retrospective cohort study	109 patients with histologically confirmed primary MM and vitamin D serum determination up to 6 months after diagnosis were included (Melbourne Hospitals, 2001-2013)	SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness SMD of vitamin D mean values for patients with vs. without evidence of mitosis SMD of vitamin D mean values for patients with tumor stage >2 vs. ≤2	55 / 54 39 / 31 22 / 62	57.7	NA
Lipplaa A., 2018	UK	Retrospective cohort study	341 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis were included (2007-2012)	SMD of vitamin D levels for patients with vs. without ulceration SMD of vitamin D mean levels for patients with tumor stage 3 vs. 2	137 / 151 251 / 90	55 stage 3: 53 stage 2: 64	25-OH-D liquid chromatography with mass spectrometry
Lombardo M., 2021	Italy	Retrospective case-control study	154 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis were included (Varese Hospital)	Mitoses positive vs. negative in vitamin D-deficient patients SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness SMD of vitamin D mean values for patients with tumor stage 3 vs. 1 SMD of vitamin D mean values for patients with vs. without mitoses SMD of vitamin D values for patients with vs. without ulceration	153 65 / 83 22 / 104 80 / 65 23 / 131	59.7	25-OH-D liquid chromatography with mass spectrometry
Newton-Bishop J., 2009	UK	Prospective cohort study	1132 patients with histologically confirmed primary MM and serum vitamin D determination at diagnosis (or within 3-6 months) were included (Northern England hospitals, 2000-2008)	SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness.	719 / 411	NA	25-OH-D liquid chromatography with mass spectrometry
Ogbah Z., 2013	Spain	Retrospektive cohort studie	81 patients with histologically confirmed primary MM and serum vitamin D determination at diagnosis (or within 3 months) were included (Barcelona Hospital, 2000-2008)	SMD of vitamin D levels for patients with >1 vs. ≤1mm tumor thickness.	22 / 46	NA	LIAISON 25-OH Vitamin-D-Immunoassay

Randerson-Moor J., 2009	UK	Case-control study	1043 patients with histologically confirmed primary MM and serum vitamin D determination at diagnosis (or within 3-6 months) were included (Leeds Hospital, 2000-2006)	SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness	477 / 342	18-75	25-OH Vitamin-D-Immunoassay
Saiag P., 2015	France	Prospective cohort study	1171 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis were included (Paris Hospital, 2003-2013)	SMD of vitamin D levels for patients with >1 vs. ≤1mm tumor thickness SMD of mean vitamin D levels for patients with tumor stage 4 vs. 1 SMD of vitamin D levels for patients with vs. without ulceration	675 / 451 70 / 425 225 / 781	54,2	25-OH-D liquid chromatography with mass spectrometry
Spath L., 2016	Italy	Cohort study	105 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis were included (Rome Hospital, 2003-2013)	Tumor thickness >4 vs. <1mm in vitamin D-deficient patients Tumor stage ≥3 vs. <3 in vitamin D-deficient patients SMD of vitamin D values for patients with >1 vs. ≤1mm tumor thickness SMD of vitamin D mean values for patients with tumor stage ≥3 vs. <3	105 49 45 / 60 14 / 36	53.7	LIAISON 25-OH Vitamin-D-Immunoassay
Timerman D., 2016	USA	Retrospective cohort study	252 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis (up to a maximum of 1 year afterward) were included (Rome Hospital, 2003-2013)	Tumor thickness ≥0.75 mm vs. <0.75 mm in vitamin D-deficient patients Tumor stage >1 vs. ≤1 in vitamin D-deficient patients Mitotic detection positive vs. negative in vitamin D-deficient patients	81 252 196	55,4	NA
Wyatt C., 2015	Australia	Cohort study	100 patients with histologically confirmed primary MM and vitamin D serum determination for diagnosis were included (Brisbane Hospitals, 2003-2013)	Tumor thickness ≥0.75 vs. <0.75 mm in vitamin D-deficient patients Mitotic evidence positive vs. negative in vitamin D-deficient patients SMD of vitamin D mean values for patients with vs. without mitoses	100 100 23 / 77	61	LIAISON 25-OH Vitamin-D-Immunoassay

2) Egger´s Tests and Funnel Plots:

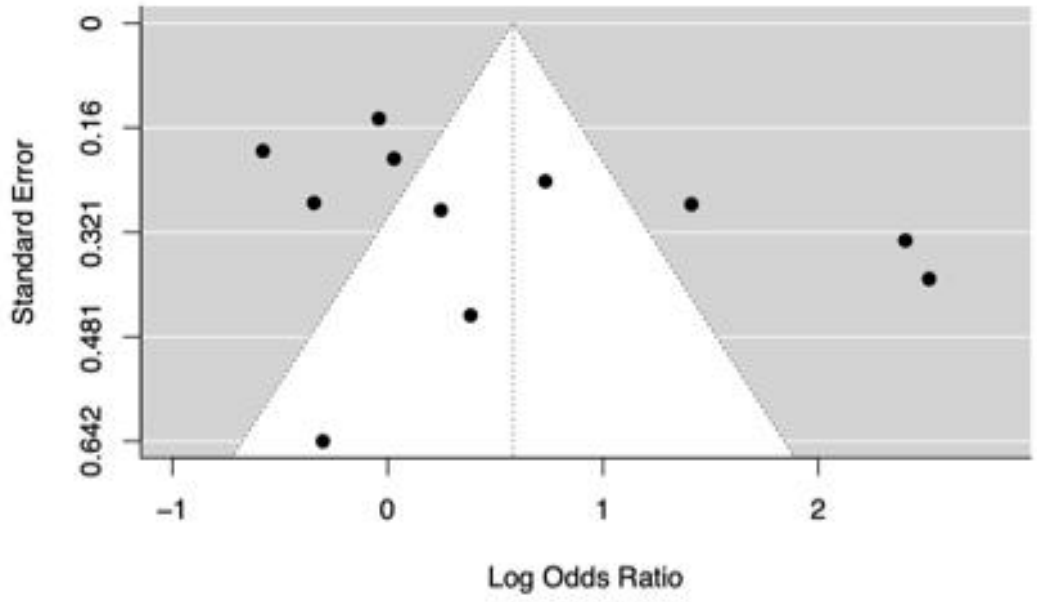
Analysis – Melanoma Risk and Vitamin D levels:

Test for Funnel Plot Asymmetry (with modified standard error): *p* = 0.15



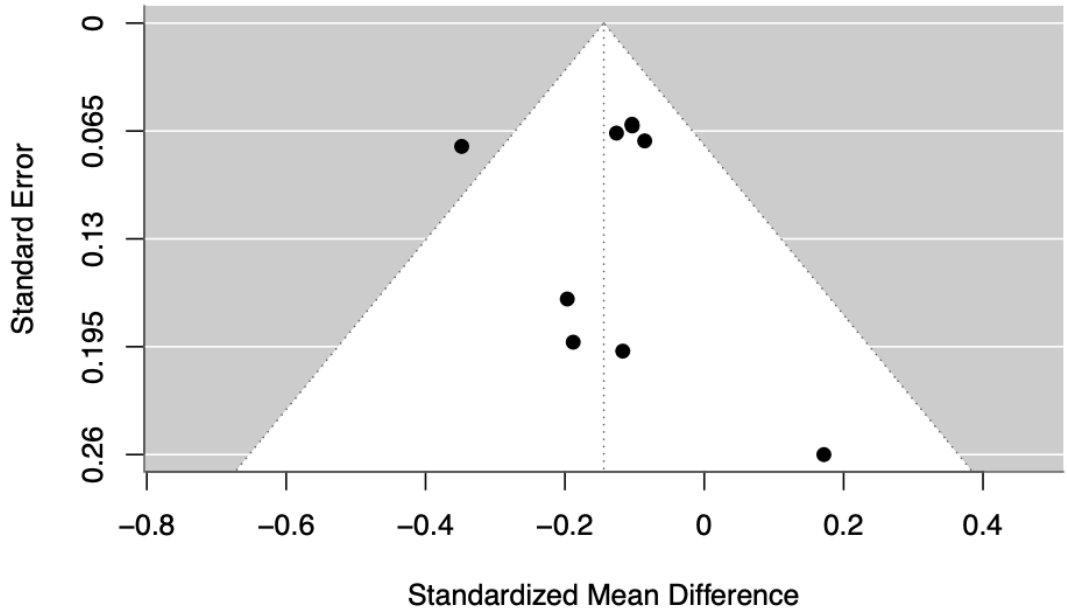
Analysis – Melanoma Risk and Vitamin D Deficiency:

Test for Funnel Plot Asymmetry: *p* = 0.58



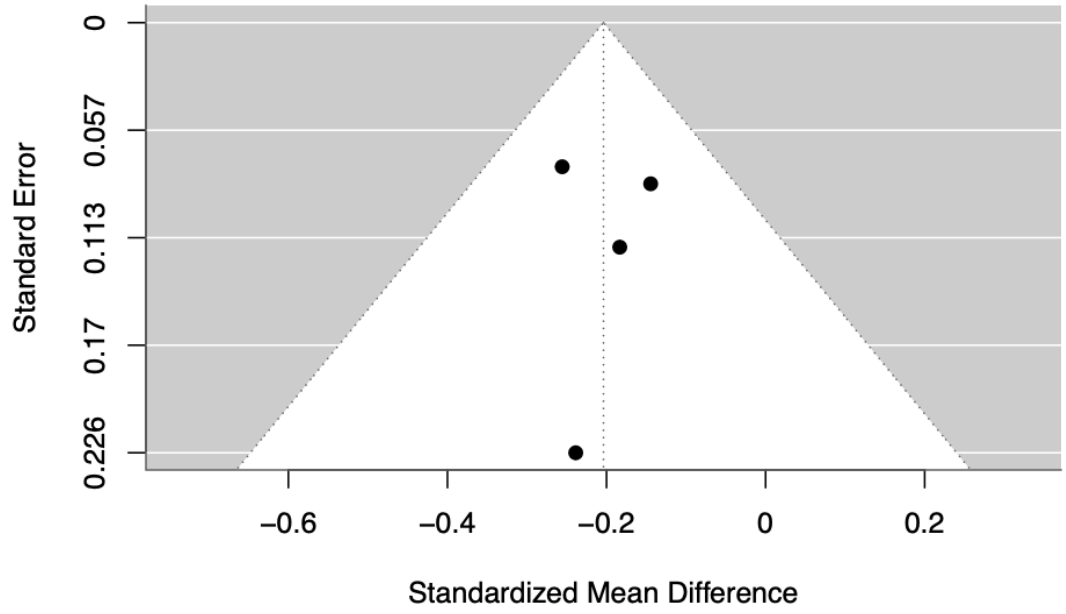
Analysis – Melanoma Prognosis (Tumor thickness and Vitamin D level):

Test for Funnel Plot Asymmetry: *p* = 0.69



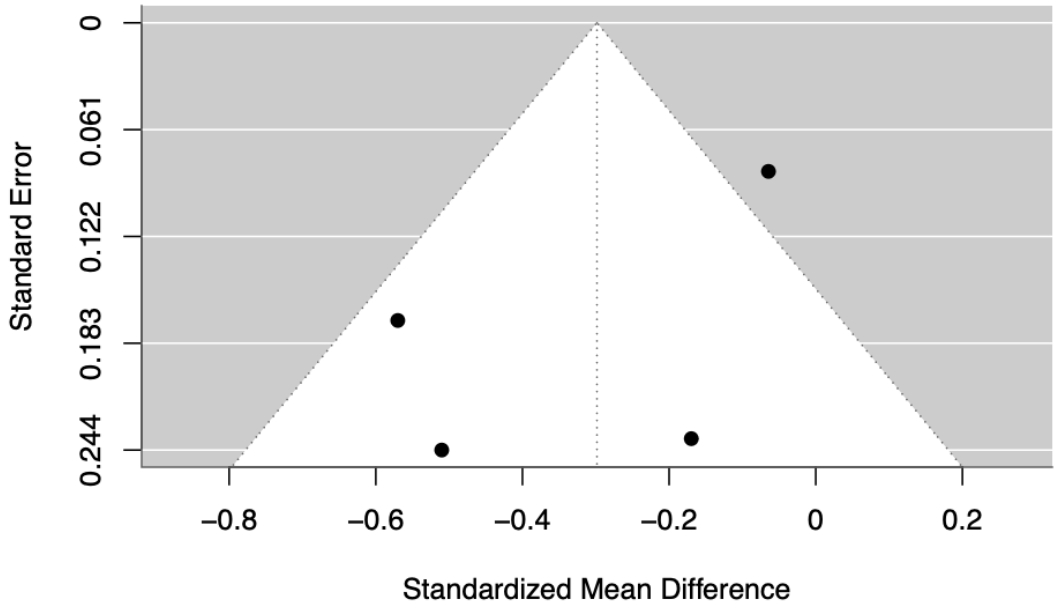
Analysis – Melanoma Prognosis (Ulcerations status and Vitamin D level):

Test for Funnel Plot Asymmetry: *p* = 0.96



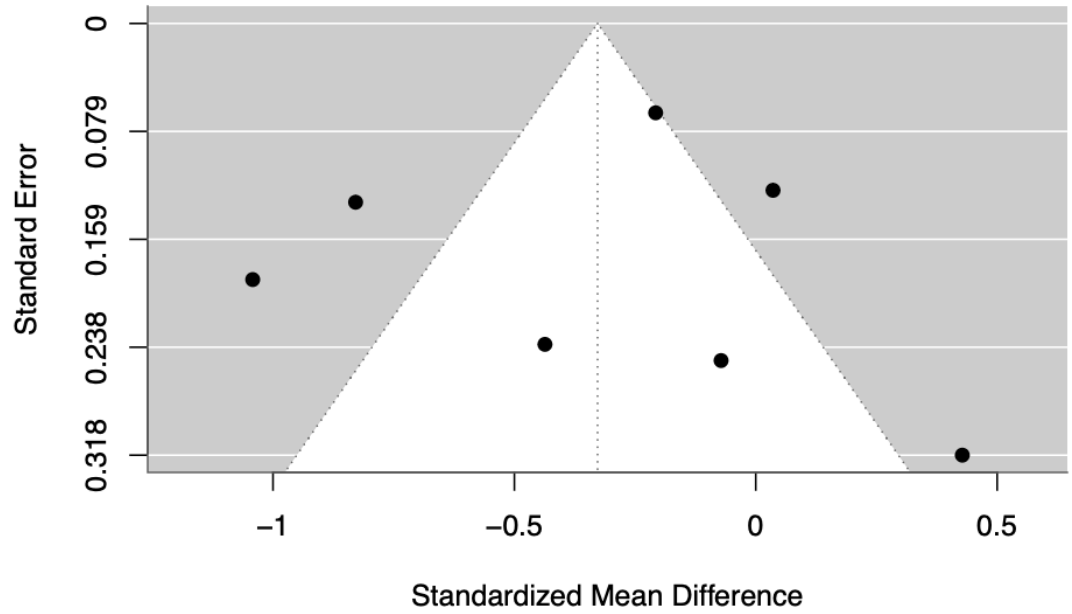
Analysis – Melanoma Prognosis (Mitotic Rate and Vitamin D level):

Test for Funnel Plot Asymmetry: p = 0.37



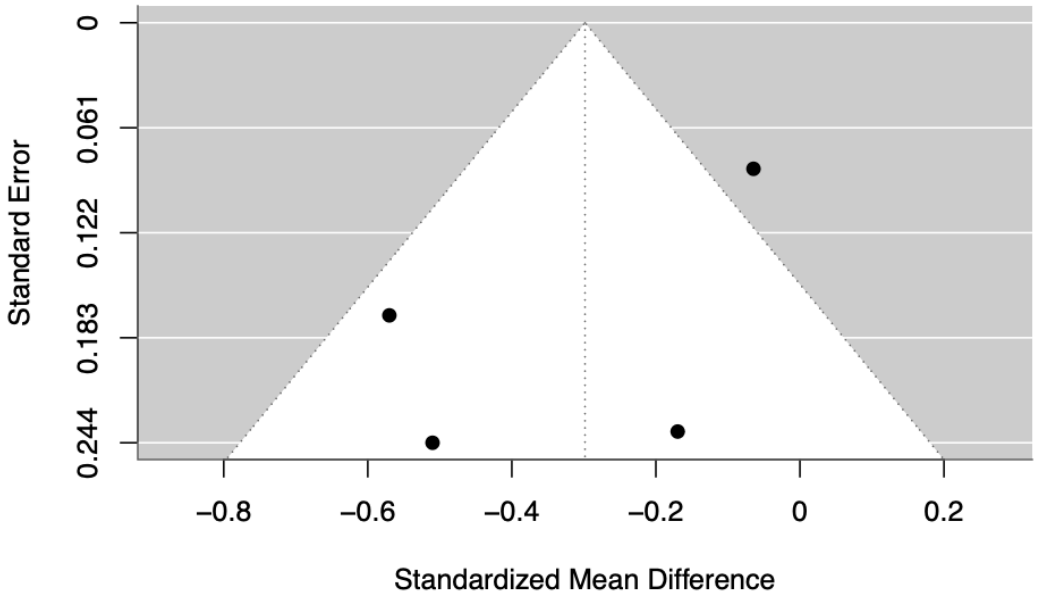
Analysis – Melanoma Prognosis (Tumor stage and Vitamin D level):

Test for Funnel Plot Asymmetry: p = 0.43



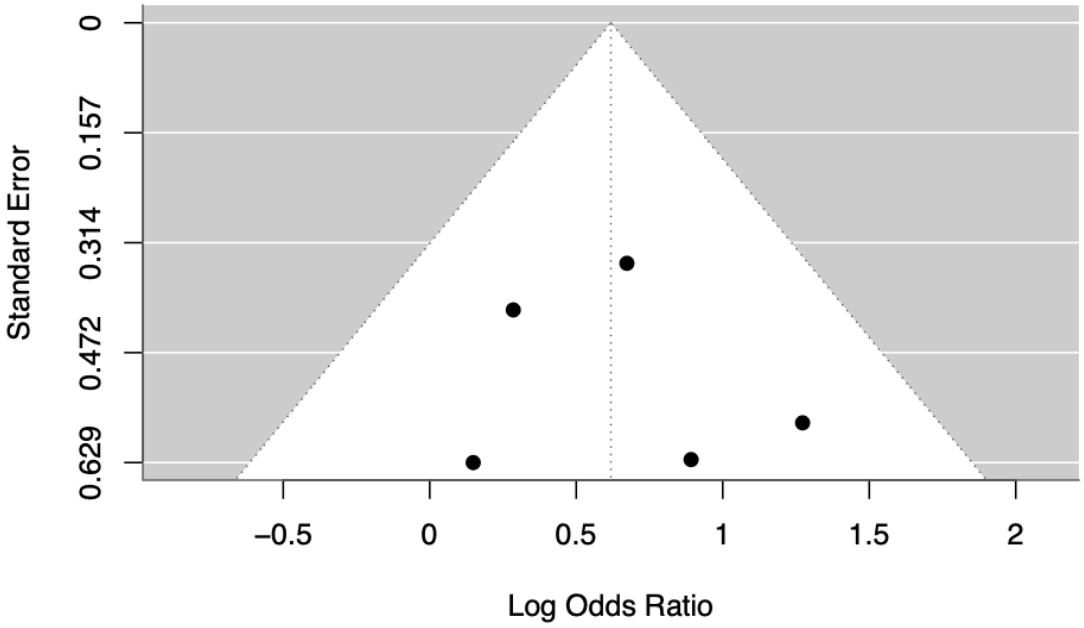
Analysis – Melanoma Prognosis (Mitotic Rate and Vitamin D level):

Test for Funnel Plot Asymmetry: p = 0.34



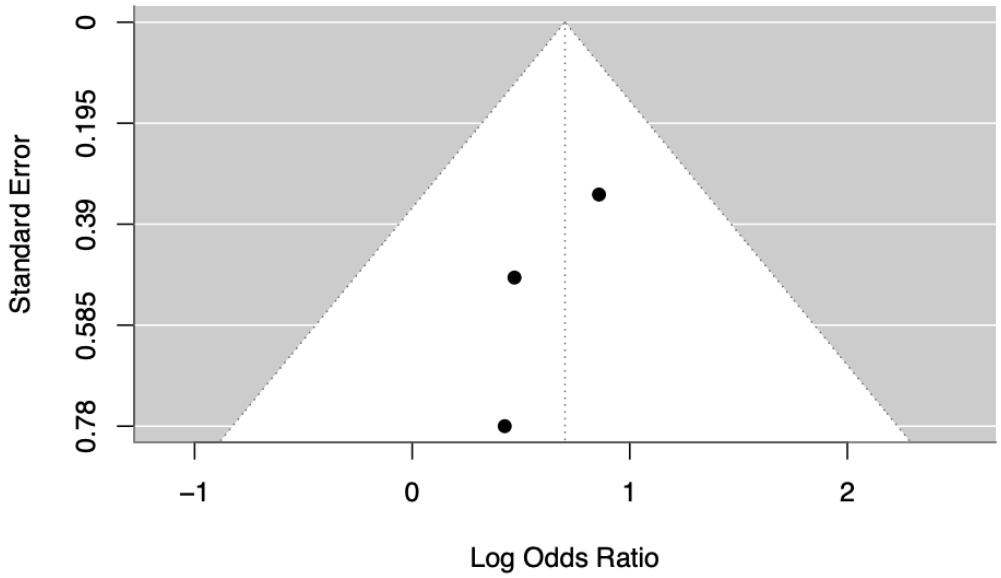
Analysis – Melanoma Prognosis (Tumor thickness and Vitamin D Deficiency):

Test for Funnel Plot Asymmetry: p = 0.74



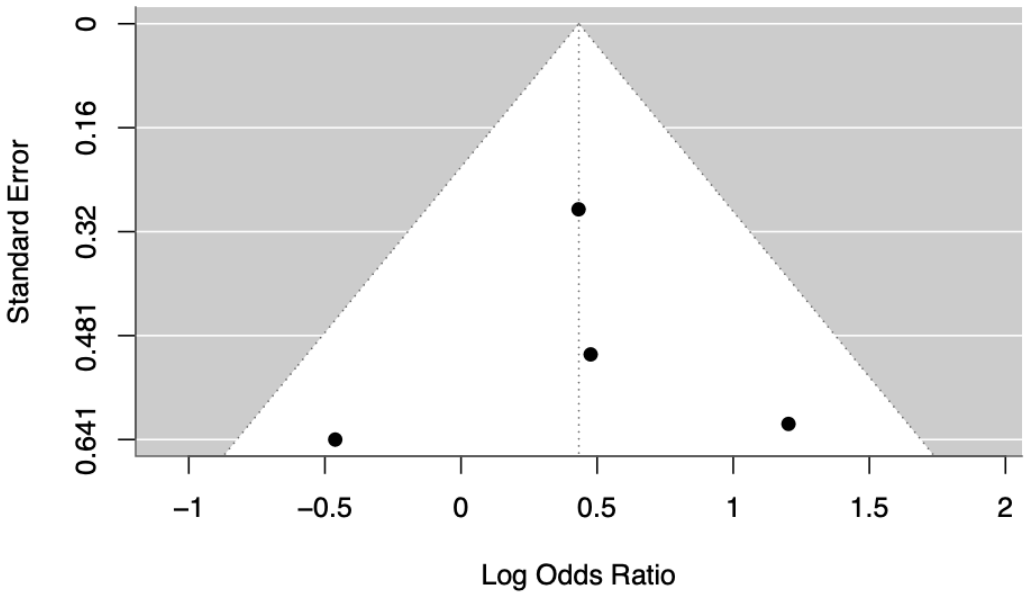
Analysis – Melanoma Prognosis (Mitotic Rate and Vitamin D Deficiency):

Test for Funnel Plot Asymmetry: *p* = 0.52



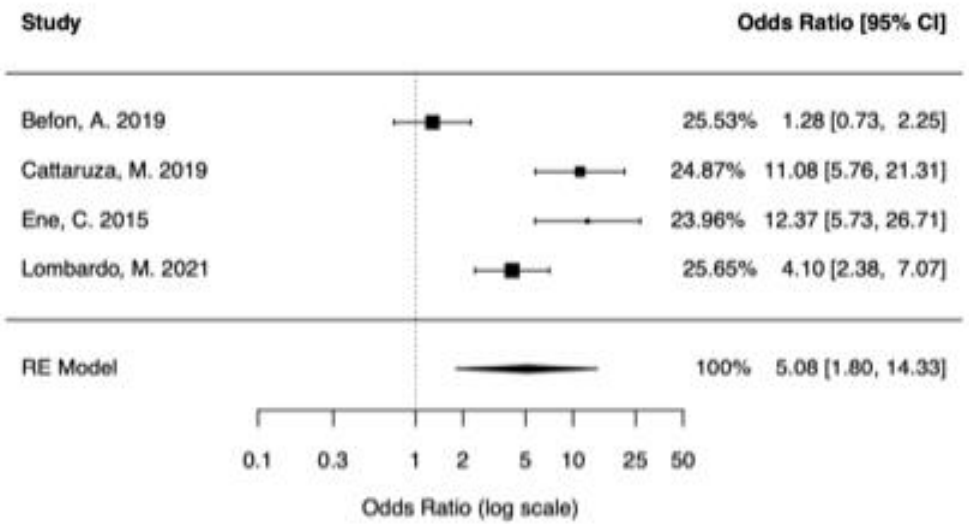
Analysis – Melanoma Prognosis (Tumor stage and Vitamin D Deficiency):

Test for Funnel Plot Asymmetry: p = 0.91



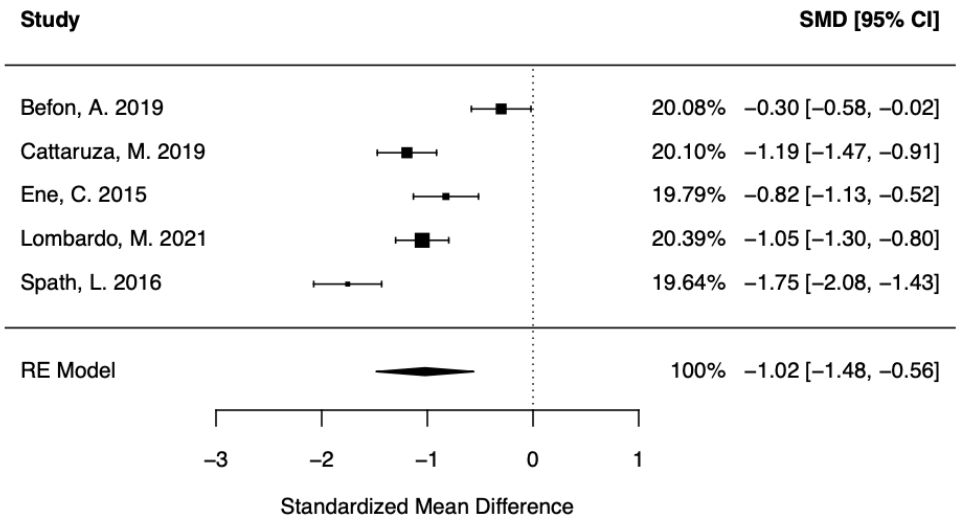
3) Sensitivity Analyses:

Melanoma Risk (Odds Ratio):
Moderator Analyses for geographic region (moderator) was significant (p= 0.03).



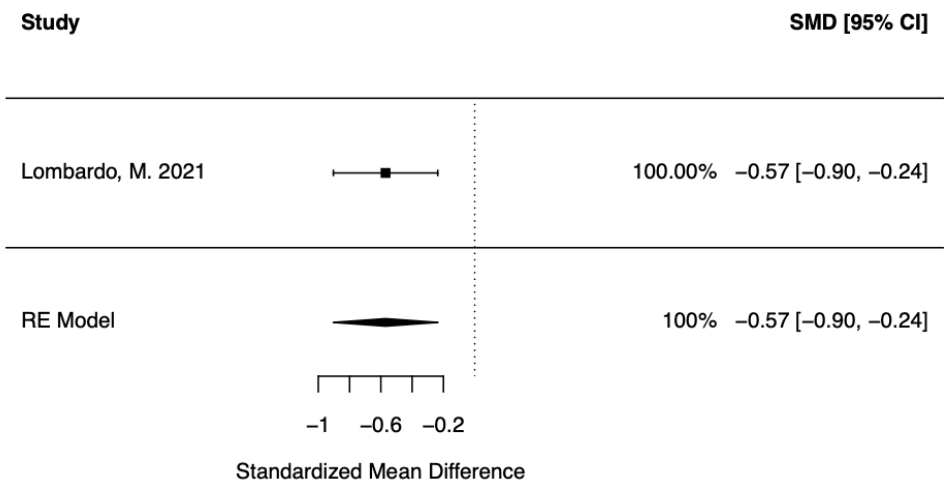
Forest Plot: Melanoma Risk and Vitamin D Deficiency – Subgroup analyses: Southern European studies (p= 0.01), I^2: 91%, Q = 33.12, p <0.0001

Melanoma Risk (standardized mean difference):
Moderator Analyses for geographic region (moderator) was significant (p = 0.001).



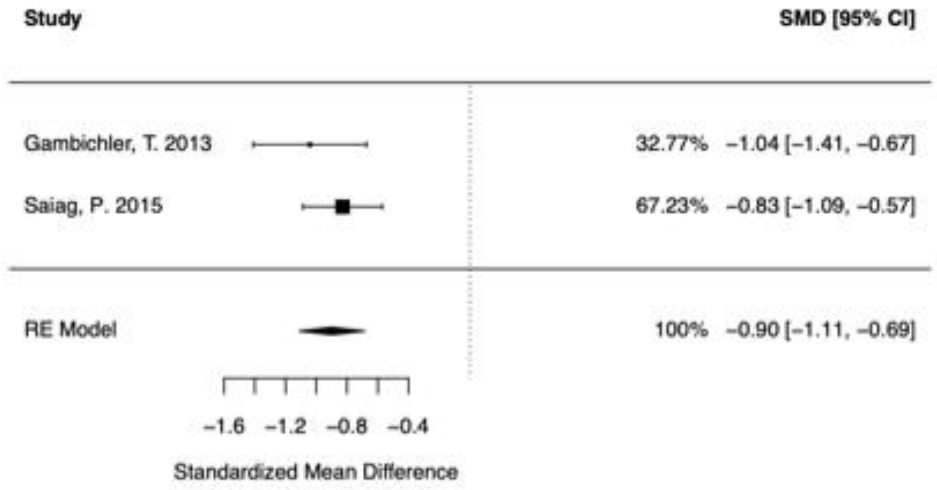
Forest Plot: Melanoma Risk and Vitamin D Deficiency – Subgroup analyses: Southern European studies (p<0.0001), I^2: 92.3%, Q = 48, p <0.0001

Melanoma Prognosis - (standardized mean difference and mitotic rate):
Moderator Analyses for geographic region (moderator) was significant (p = 0.02).



Forest Plot: Melanoma Prognosis (mitotic rate) and Vitamin D levels - Subgroup analyses: Southern European studies (p=0.008), Heterogeneity tests not possible due to n = 1 study.

Melanoma Prognosis - (standardized mean difference and melanoma stage):
Moderator Analyses for geographic region (moderator) was significant (p = 0.001).



Forest Plot: Melanoma Prognosis (melanoma stage) and Vitamin D levels – Subgroup analyses: Central European studies (p = 0.006), I^2: 0%, Q = 0.86, p = 0.35