**Appendix**

**Association between particulate matter air pollution and risk of suicide and depression: a systematic review and meta-analysis**

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**Table S1.** Detailed search strategy

|  |  |
| --- | --- |
| **Database** | **Search strategy** |
| **Pubmed** | #1 ("Air Pollution"[Mesh]) OR ("Particulate Matter"[Mesh]) OR "Air Pollution" OR "Air pollutant\*" OR "Particulate Matter" OR "PM2.5" OR "PM10"  #2 ("Depression"[Mesh]) OR ("Depressive Disorder"[Mesh]) OR ("Suicide"[Mesh]) OR "Depression" OR "Depressive Disorder\*" OR "Suicide" OR "depressive symptom\*" OR "depressed mood"  #3 #1 AND #2 |
| **Medline** | #1 (MH "Air Pollution") OR (MH "Air Pollutants") OR (MH "Particulate Matter") OR "Air Pollution" OR "air pollutant\*" OR "Particulate Matter" OR "PM2.5" OR "PM10"  #2 (MH "Depression") OR (MH "Depressive Disorder") OR (MH "Suicide") OR "Depression" OR "Depressive Disorder\*" OR "Suicide" OR "depressive symptom\*" OR "depressed mood"  #3 #1 AND #2 |
| **Embase** | #1 'air pollution'/exp/mj OR 'air pollutant\*'/mj OR 'particulate matter'/exp/mj OR 'PM2.5'/mj OR 'PM10'/mj  #2 'depression'/exp/mj OR 'suicide'/exp/mj OR 'depressive symptom\*'/mj OR 'depressive disorder'/mj OR 'depressed mood'/mj  #3 #1 AND #2 |
| **OVID** | ((air pollution or air pollutant\* or particulate matter or PM2 5 or PM10) and (depression or depressive symptom\* or depressive disorder or depressed mood or suicide)).ti,ab,kw. |
| **Web of science** | （"air pollution" or "air pollutant\*" or "particulate matter" or "PM2.5" or "PM10"） and ("depression" or "depressive symptom\*" or "depressive disorder" or "depressed mood" or "suicide") |
| **SIGLE** | (depression or depressive or suicide) and (air pollution or air pollutant or particulate matter or PM2.5 or PM10) |
| **Social Care Online** | (depression or depressive or suicide) and (air pollution or air pollutant or particulate matter or PM2.5 or PM10) |
| **British National Bibliography for Report Literature** | (depression or depressive or suicide) and (air pollution or air pollutant or particulate matter or PM2.5 or PM10) |
| **NITS** | (depression or depressive or suicide) and (air pollution or air pollutant or particulate matter or PM2.5 or PM10) |

**Table S2.** Quality assessment using Newcastle-Ottawa Scale (NOS) for (A) case-crossover and (B) cohort studies

|  |  |  |  |  |  |  |  |  |  |  |  |  |
| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **(A) Case-crossover Study** | **Outcome** | **Selection** | | | | **Comparability** | | **Exposure** | | | **Total** | **Grading** |
| **Case definition** | **Representa-tiveness** | **Selection of controls** | **Definition of controls** | **Adjusted for demographic characteristic** | **Adjusted for meteorological variables** | **Ascertainment** | **Consistent method** | **Non-response rate** |
| Kim, et al. (2010) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Bakian, et al. (2015) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Lin, et al. (2016) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Casas, et al. (2017) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Li, et al. (2018) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Kim, et al. (2018) | Suicide | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Cho, et al. (2014) | Depression | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Szyszkowicz, et al. (2016) | Depression | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |
| Wang, et al. (2018) | Depression | 0 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 1 | 8 | High |

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| --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- | --- |
| **(B) Cohort study** | **Outcome** | **Selection** | | | | **Comparability** | | **Outcome** | | | **Total** | **Grading** |
| **Representativeness of the exposed cohort** | **Selection of the non-exposed cohort** | **Ascertainment of exposure** | **Outcome not present at start** | **Adjusted for demographic characteristic** | **Adjusted for meteorological variables** | **Ascertai-nment** | **Enough follow-up** | **Adequacy of follow up of cohort** |
| Min, et.al. (2018) | Suicide | 1 | 1 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 8 | High |
| Kim, et al. (2016) | Depression | 1 | 1 | 1 | 1 | 1 | 0 | 0 | 1 | 1 | 7 | High |
| Zijlema, et al. (2016) | Depression | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 0 | 5 | Medium |
| Kioumourtzoglou, et al. (2017) | Depression | 0 | 1 | 1 | 1 | 1 | 0 | 1 | 1 | 1 | 7 | High |
| Pun, et al. (2017) | Depression | 1 | 1 | 1 | 0 | 1 | 0 | 1 | 0 | 1 | 6 | Medium |

**Table S3.** Results of sensitivity analyses omitting one study each at a time.

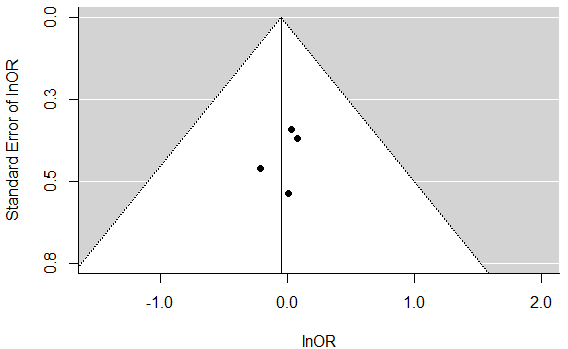
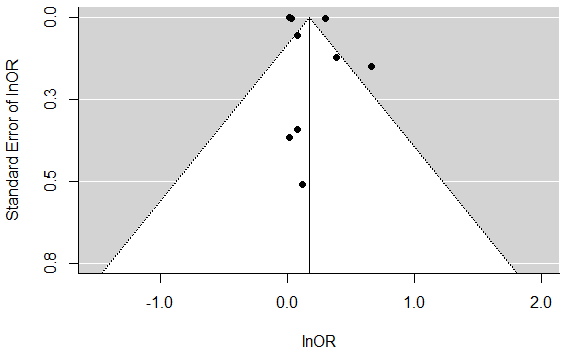
|  |  |  |  |
| --- | --- | --- | --- |
| **Analytic setting** | **OR(95%CI)** | **I-squared value** | **P Value for heterogeneity** |
| **(A) Depression associated with PM2.5** | | |  |
| Omitting Kim, et al.(2016) | 1.16(1.04,1.30) \*\* | 99.92% | <.001 |
| Omitting Zijlema, et al.(2016)-FINRISK | 1.14(1.02,1.28) \* | 99.92% | <.001 |
| Omitting Zijlema, et al.(2016)-KORA | 1.19(1.07,1.33) \*\* | 99.92% | <.001 |
| Omitting Zijlema, et al.(2016)-LifeLines | 1.19(1.07,1.33) \*\* | 99.92% | <.001 |
| Omitting Szyszkowicz, et al.(2016)-male | 1.26(1.05,1.50) \* | 99.91% | <.001 |
| Omitting Szyszkowicz, et al.(2016)-male | 1.26(1.06,1.49) \*\* | 99.89% | <.001 |
| Omitting Kioumourtzoglou, et al.(2017) | 1.21(1.08,1.37) \*\* | 99.92% | <.001 |
| Omitting Pun, et al.(2017) | 1.03(1.01,1.05) \*\* | 87.42% | <.001 |
| Omitting Wang, et al.(2018) | 1.19(1.07,1.33) \*\* | 99.92% | <.001 |
| Overall | 1.19(1.07,1.33) \*\* | 99.91% | <.001 |
| **(B) Depression associated with PM10** | | |  |
| Omitting Cho, et al.(2014) | 0.91(0.55,1.52) | 0 | .817 |
| Omitting Zijlema, et al.(2016)-FINRISK | 0.90(0.55,1.48) | 0 | .834 |
| Omitting Zijlema, et al.(2016)-KORA | 0.99(0.62,1.56) | 0 | .831 |
| Omitting Zijlema, et al.(2016)-LifeLines | 0.99(0.65,1.52) | 0 | .973 |
| Omitting Wang, et al.(2018) | 0.94(0.60,1.47) | 0 | .802 |
| Overall | 0.95(0.63,1.44) | 0 | .908 |
| **(C) Suicide associated with PM2.5** | | |  |
| Omitting Kim, et al.(2010) | 1.05(0.99,1.11) | 95.76% | <.001 |
| Omitting Bakian, et al.(2015) | 1.02(1.00,1.04) \* | 0 | .978 |
| Omitting Li, et al.(2018) | 1.08(1.08,1.09) \*\* | 0 | .820 |
| Omitting Kim, et al.(2018) | 1.05(0.99,1.12) • | 95.73% | <.001 |
| Overall | 1.05(0.99,1.11) • | 93.63% | <.001 |
| **(D) Suicide associated with PM10** | | |  |
| Omitting Kim, et al.(2010) | 1.42(0.70,2.85) | 99.76% | <.001 |
| Omitting Bakian, et al.(2015) | 1.40(0.55,3.58) | 99.75% | <.001 |
| Omitting Lin, et al.(2016) | 1.39(0.71,2.75) | 99.76% | <.001 |
| Omitting Casas, et al.(2017) | 1.41(0.56,3.55) | 99.52% | <.001 |
| Omitting Min, et al.(2018) | 1.01(1.00,1.03) | 0 | .965 |
| Omitting Kim, et al.(2018) | 1.42(0.71,2.87) | 99.76% | <.001 |
| Overall | 1.34(0.71,2.54) | 99.69% | <.001 |

\*\* 0<P<0.01; \* 0.01<P<0.05; • 0.05<P<0.10.

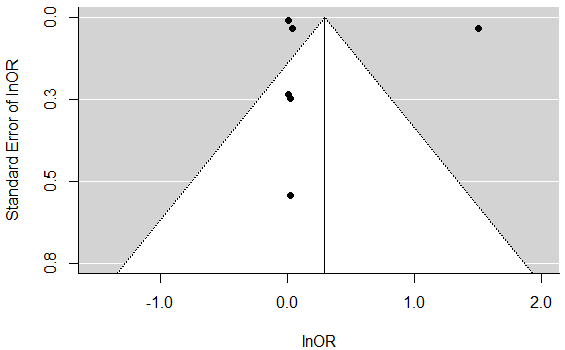
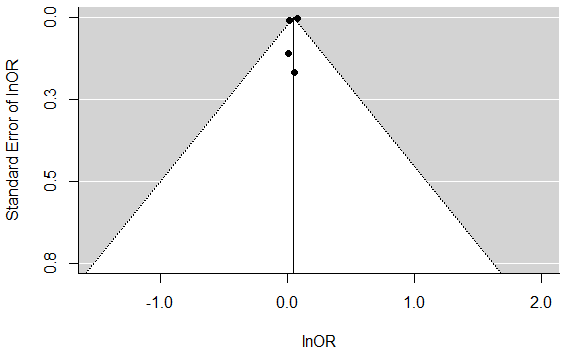
**Table S4.** Results of PM concentration in different study locations.

|  |  |  |
| --- | --- | --- |
| Study Location | PM2.5  Mean/(μg/m3) | PM10 Mean/(μg/m3) |
| North America | 10.76 | 33.21 |
| Europe | 25.00 | 26.50 |
| Asia | 46.75 | 75.57 |

**Figure S1.** Funnel plots of publication bias analyses



**(A) Depression associated with PM2.5 (B) Depression associated with PM10**



**(C) Suicide associated with PM2.5 (D) Suicide associated with PM10**