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References

Go to:

1. Kapur V, Strohl KP, Redline S, et al. . Underdiagnosis of sleep apnea syndrome in U.S. communities. Sleep Breath 2002;6:049–54. 10.1055/s-2002-32318 [PubMed] [CrossRef] [Google Scholar]

2. Wang X, Bi Y, Zhang Q, et al. . Obstructive sleep apnoea and the risk of type 2 diabetes: a meta-analysis of prospective cohort studies. Respirology 2013;18:140–6. 10.1111/j.1440-1843.2012.02267.x [PubMed] [CrossRef] [Google Scholar]

3. Gottlieb DJ, Yenokyan G, Newman AB, et al. . Prospective study of obstructive sleep apnea and incident coronary heart disease and heart failure: the sleep heart health study. Circulation 2010;122:352–60. 10.1161/CIRCULATIONAHA.109.901801 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

4. Kales A, Bixler EO, Cadieux RJ, et al. . Sleep apnoea in a hypertensive population. Lancet 1984;2:1005–8. [PubMed] [Google Scholar]

5. Lavie P, Ben-Yosef R, Rubin AE. Prevalence of sleep apnea syndrome among patients with essential hypertension. Am Heart J 1984;108:373–6. 10.1016/0002-8703(84)90628-8 [PubMed] [CrossRef] [Google Scholar]

6. Kent BD, Grote L, Ryan S, et al. . Diabetes mellitus prevalence and control in sleep-disordered breathing: the European Sleep Apnea Cohort (ESADA) study. Chest 2014;146:982–90. 10.1378/chest.13-2403 [PubMed] [CrossRef] [Google Scholar]

7. Varvarigou V, Dahabreh IJ, Malhotra A, et al. . A review of genetic association studies of obstructive sleep apnea: field synopsis and meta-analysis. Sleep 2011;34:1461–8. 10.5665/sleep.1376 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

8. Young T, Finn L, Peppard PE, et al. . Sleep disordered breathing and mortality: eighteen-year follow-up of the Wisconsin sleep cohort. Sleep 2008;31:1071–8. [PMC free article] [PubMed] [Google Scholar]

9. Peker Y, Hedner J, Norum J, et al. . Increased incidence of cardiovascular disease in middle-aged men with obstructive sleep apnea: a 7-year follow-up. Am J Respir Crit Care Med 2002;166:159–65. 10.1164/rccm.2105124 [PubMed] [CrossRef] [Google Scholar]

10. MARIN J, CARRIZO S, Vicente E, et al. . Long-term cardiovascular outcomes in men with obstructive sleep apnoea-hypopnoea with or without treatment with continuous positive airway pressure: an observational study. The Lancet 2005;365:1046–53. 10.1016/S0140-6736(05)74229-X [PubMed] [CrossRef] [Google Scholar]

11. Beck MK, Westergaard D, Jensen AB, et al. . Temporal order of disease pairs affects subsequent disease trajectories: the case of diabetes and sleep apnea. Pac Symp Biocomput 2017;22:380–9. 10.1142/9789813207813_0036 [PubMed] [CrossRef] [Google Scholar]

12. Botros N, Concato J, Mohsenin V, et al. . Obstructive sleep apnea as a risk factor for type 2 diabetes. Am J Med 2009;122:1122–7. 10.1016/j.amjmed.2009.04.026 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

13. Ronksley PE, Hemmelgarn BR, Heitman SJ, et al. . Obstructive sleep apnoea is associated with diabetes in sleepy subjects. Thorax 2009;64:834–9. 10.1136/thx.2009.115105 [PubMed] [CrossRef] [Google Scholar]

14. Kendzerska T, Gershon AS, Hawker G, et al. . Obstructive sleep apnea and incident diabetes. A historical cohort study. Am J Respir Crit Care Med 2014;190:218–25. 10.1164/rccm.201312-2209OC [PubMed] [CrossRef] [Google Scholar]

15. Reichmuth KJ, Austin D, Skatrud JB, et al. . Association of sleep apnea and type II diabetes: a population-based study. Am J Respir Crit Care Med 2005;172:1590–5. 10.1164/rccm.200504-637OC [PMC free article] [PubMed] [CrossRef] [Google Scholar]

16. Ozol D, Carlıoğlu A, Karamanlı H, et al. . Influence of snoring on microalbuminuria in diabetic patients. Sleep Breath 2011;15:295–300. 10.1007/s11325-010-0380-1 [PubMed] [CrossRef] [Google Scholar]

17. Leong WB, Nolen M, Thomas GN, et al. . The impact of hypoxemia on nephropathy in extremely obese patients with type 2 diabetes mellitus. J Clin Sleep Med 2014;10:773–8. 10.5664/jcsm.3870 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

18. Hwu DW, Lin KD, Lin KC, et al. . The association of obstructive sleep apnea and renal outcomes-a systematic review and meta-analysis. BMC Nephrol 2017;18:313–731. 10.1186/s12882-017-0731-2 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

19. Tahrani AA, Ali A, Raymond NT, et al. . Obstructive sleep apnea and diabetic nephropathy: a cohort study. Diabetes Care 2013;36:3718–25. 10.2337/dc13-0450 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

20. Borodulin K, Vartiainen E, Peltonen M, et al. . Forty-year trends in cardiovascular risk factors in Finland. Eur J Public Health 2015;25:539–46. 10.1093/eurpub/cku174 [PubMed] [CrossRef] [Google Scholar]

21. Kattainen A, Salomaa V, Härkänen T, et al. . Coronary heart disease: from a disease of middle-aged men in the late 1970s to a disease of elderly women in the 2000s. Eur Heart J 2006;27:296–301. 10.1093/eurheartj/ehi630 [PubMed] [CrossRef] [Google Scholar]

22. Groop L, Forsblom C, Lehtovirta M, et al. . Metabolic consequences of a family history of NIDDM (the Botnia study): evidence for sex-specific parental effects. Diabetes 1996;45:1585–93. 10.2337/diab.45.11.1585 [PubMed] [CrossRef] [Google Scholar]

23. Isomaa B, Forsén B, Lahti K, et al. . A family history of diabetes is associated with reduced physical fitness in the Prevalence, Prediction and Prevention of Diabetes (PPP)-Botnia study. Diabetologia 2010;53:1709–13. 10.1007/s00125-010-1776-y [PubMed] [CrossRef] [Google Scholar]

24. Tolonen H, Salomaa V, Torppa J, et al. . The validation of the finnish hospital discharge register and causes of death register data on stroke diagnoses. Eur J Cardiovasc Prev Rehabil 2007;14:380–5. 10.1097/01.hjr.0000239466.26132.f2 [PubMed] [CrossRef] [Google Scholar]

25. Pajunen P, Koukkunen H, Ketonen M, et al. . The validity of the Finnish Hospital Discharge Register and Causes of Death Register data on coronary heart disease. Eur J Cardiovasc Prev Rehabil 2005;12:132–7. [PubMed] [Google Scholar]

26. Laitinen LA, Anttalainen U, Pietinalho A, et al. . Sleep apnoea: Finnish National guidelines for prevention and treatment 2002-2012. Respir Med 2003;97:337–65. 10.1053/rmed.2002.1449 [PubMed] [CrossRef] [Google Scholar]

27. Anonymous. https://cran.r-project.org/web/packages/survival/vignettes/timedep.pdf

28. Anothaisintawee T, Reutrakul S, Van Cauter E, et al. . Sleep disturbances compared to traditional risk factors for diabetes development: Systematic review and meta-analysis. Sleep Med Rev 2016;30:11–24. 10.1016/j.smrv.2015.10.002 [PubMed] [CrossRef] [Google Scholar]

29. Abuyassin B, Sharma K, Ayas NT, et al. . Obstructive sleep apnea and kidney disease: a potential bidirectional relationship? J Clin Sleep Med 2015;11:915–24. 10.5664/jcsm.4946 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

30. Tada T, Kusano KF, Ogawa A, et al. . The predictors of central and obstructive sleep apnoea in haemodialysis patients. Nephrol Dial Transplant 2007;22:1190–7. 10.1093/ndt/gfl748 [PubMed] [CrossRef] [Google Scholar]

31. Wolf J, Lewicka J, Narkiewicz K. Obstructive sleep apnea: an update on mechanisms and cardiovascular consequences. Nutr Metab Cardiovasc Dis 2007;17:233–40. 10.1016/j.numecd.2006.12.005 [PubMed] [CrossRef] [Google Scholar]

32. Punjabi NM, Caffo BS, Goodwin JL, et al. . Sleep-disordered breathing and mortality: a prospective cohort study. PLoS Med 2009;6:e1000132 10.1371/journal.pmed.1000132 [PMC free article] [PubMed] [CrossRef] [Google Scholar]

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