

## INTRODUCTION

- Sleep apnea (SA) can be divided into central sleep apnea, and obstructive sleep apnea [1].
- Chronic kidney disease (CKD) is prevalent in the global population (8-16%), and its incidence is increasing as people are increasingly diagnosed with diabetes, hypertension, and atherosclerotic diseases [2].
- An association between SA and CKD has been proposed, as several small cohort studies have reported a positive risk prediction of SA toward CKD development [3-5].
- However, interpretations should be performed with caution, given certain limitations, such as 1) the diagnosis of SA was mainly through a self-reported questionnaire without confirmation by polysomnography, 2) dialysis patients were excluded, and 3) sleep-related breathing disorders, other than sleep apnea were inclusively reported.

## METHODS

- Eligible references were searched through Ovid MEDLINE, EMBASE, and the Cochrane Library from database inception until March 2020.
- The inclusion criteria were clinical trials or observational studies that enrolled patients age  $\geq 18$  years who were diagnosed with CKD, end-stage kidney disease (ESKD) or SA.
- Studies in which SA was diagnosed using a questionnaire or a wrist-worn portable device were excluded.
- Studies reporting heart failure-related or stroke-related SA were excluded.
- Included studies were divided into two cohorts: 1) a cohort of CKD or ESKD patients reporting the prevalence of SA or odds ratio (OR) for SA (**CKD cohort**) and 2) a cohort of SA patients reporting the prevalence of CKD, ESKD or OR for CKD or ESKD (**SA cohort**).

Figure 1. Forest plot of all meta-analyses.

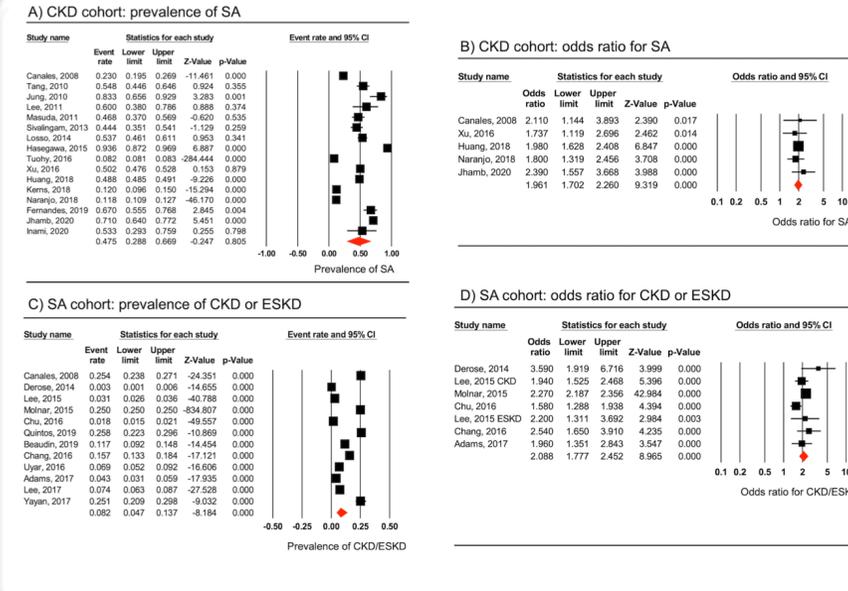
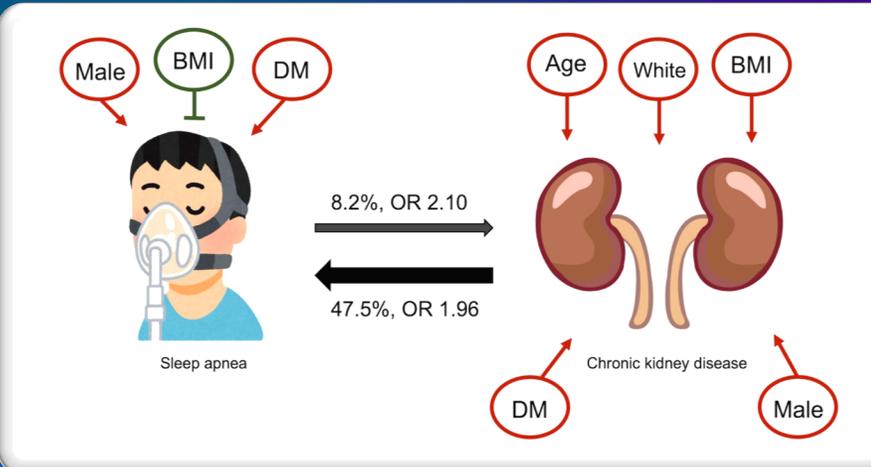


Figure 2. Infographic demonstrating the bidirectional association between SA and CKD along with potential risk factors.



## RESULTS

- A total of 16 studies (n = 340,587) consisting of 97.8% ESKD and 2.2% CKD were included.
- The studies dated from 2008 to 2020.
- Most studies were prospective in design (75.0%).
- All subjects were non-transplant patients.
- Up to 50.5% and 43.0% were male and white, respectively.
- Only 6.1% had history of tobacco use, and 29.1% had diabetes.
- The mean age of included patients was  $66.6 \pm 11.4$  years.
- The mean BMI was  $26.3 \pm 1.9$  kg/m<sup>2</sup>.
- The pooled estimated prevalence of SA among CKD/ESKD patients was 47.5% (95% CI, 28.8-66.9; I<sup>2</sup> 98.9%; Figure 1A).
- The pooled adjusted OR for SA was 1.961 (95% CI, 1.702-2.260; I<sup>2</sup> 0%; Figure 1B) among CKD/ESKD patients.
- The pooled prevalence of CKD/ESKD among patients with SA was 8.2% (95% CI, 4.7-13.7; I<sup>2</sup> 99.6%; Figure 1C).
- The pooled adjusted OR for CKD/ESKD among patients with SA was 2.088 (95% CI, 1.777-2.452; I<sup>2</sup> 62.7%; Figure 1D).
- The results of meta-regression analyses are depicted in Figure 2.

## CONCLUSIONS

The prevalence and OR of SA in CKD/ESKD patients was 47.5% and 1.96, respectively. Similarly, the prevalence and OR of CKD/ESKD in SA patients was 8.2% and 2.10, respectively. Age, BMI, male sex, white race, and diabetes were associated with CKD/ESKD in SA patients. Meanwhile, male sex, a history of diabetes, and lower BMI were associated with a higher prevalence of SA in CKD/ESKD patients.

## REFERENCES

- Foldvary-Schaefer NR, Waters TE (2017) Sleep-Disordered Breathing. Continuum (Minneapolis) 23 (4, Sleep Neurology):1093-1116.
- Jha V, et al. (2013) Chronic kidney disease: global dimension and perspectives. Lancet 382 (9888):260-272.
- Lee YC, et al. (2015) Sleep apnea and the risk of chronic kidney disease: A nationwide population-based cohort study. Sleep 38 (2):213-221A.
- Molnar MZ, et al. (2015) Association of incident obstructive sleep apnea with outcomes in a large cohort of US veterans. Thorax 70 (9):888-895.
- Chu H, et al. (2016) Association of sleep apnea with chronic kidney disease in a large cohort from Taiwan. Respirology 21 (4):754-760.