Supplementary Appendix. Pittsburgh sleep quality index (PSQI)

Instructions:

The following questions relate to your usual sleep habits during the past month *only*. Your answers should indicate the most accurate reply for the *majority* of days and nights in the past month. Please answer all questions.

1. During the past month, when have you usually gone to bed at night?
   USUAL BED TIME (_____)

2. During the past month, how long (in minutes) has it usually take you to fall asleep each night?
   NUMBER OF MINUTES (_____)

3. During the past month, when have you usually gotten up in the morning?
   USUAL GETTING UP TIME (_____)

4. During the past month, how many hours of *actual sleep* did you get at night? (This may be different than the number of hours you spend in bed.)
   HOURS OF SLEEP PER NIGHT (_____)

For each of the remaining questions, check the one best response. Please answer *all* questions.

5. During the past month, how often have you had trouble sleeping because you...

   (a) Cannot get to sleep within 30 minutes

   | Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

   (b) Wake up in the middle of the night or early morning

   | Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

   (c) Have to get up to use the bathroom

   | Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

   (d) Cannot breathe comfortably

   | Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(e) Cough or snore loudly

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(f) Feel too cold

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(g) Feel too hot

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(h) Had bad dreams

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(i) Have pain

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

(j) Other reason(s), please describe (_____)

| Not during the past month (__)* | Less than once a week (__)* | Once or twice a week (__)* | Three or more times a week (__)* |

6. During the past month, how would you rate your sleep quality overall?

(__) Very good

(__) Fairly good

(__) Fairly bad

(__) Very bad

7. During the past month, how often have you taken medicine (prescribed or "over the counter") to help you sleep?

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

8. During the past month, how often have you had trouble staying awake while driving, eating meals, or engaging in social activity?

| Not during the past month (__) | Less than once a week (__) | Once or twice a week (__) | Three or more times a week (__) |

9. During the past month, how much of a problem has it been for you to keep up enough enthusiasm to get things done?

(__) No problem at all

(__) Only a very slight problem

(__) Somewhat of a problem

(__) A very big problem

*Not available in CKD-JAC study

Scoring instructions for PSQI

The Pittsburgh Sleep Quality Index (PSQI) contains 19 self-rated questions and 5 questions rated by the bed partner or roommate (if one is available). Only self-rated questions are included in the scoring. The 19 self-rated items are combined to form seven "component" scores, each of which has a range of 0–3 points. In all cases, a score of "0" indicates no difficulty, while a score of "3" indicates severe difficulty. The seven component scores are then added to yield one "global" score, with a range of 0–21 points,

"0" indicating no difficulty and "21" indicating severe difficulties in all areas. Scoring

proceeds as follows:

Component 1: subjective sleep quality

Examine question #6, and assign scores as follows:

Response	Component 1 sore
"Very good"	0
"Fairly good"	1
"Fairly bad"	2
"Very bad"	3

Component 2: Sleep latency

1. Examine question #2, and assign scores as follows:

Response	Score
≤15 minutes	0
16–30 minutes	1
31–60 minutes	2
>60 minutes	3

2. Examine question #5a, and assign scores as follows:

Response	Score
Not during the past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

3. Add #2 score and #5a score as follows:

Sum of #2 and #5a	Component 2 score
0	0
1–2	1
3–4	2
5–6	3

Component 3: sleep duration

Examine question #4, and assign scores as follows:

Response	Component 3 score
>7 hours	0
6–7 hours	1
5–6 hours	2
<5 hours	3

Component 4: Habitual sleep efficiency

1. Calculate the number of hours spent in bed:

   Getting up time (question #3) - Bedtime (question #1)

2. Calculate habitual sleep efficiency (%) as follows:

   Number of hours slept (question #4) / Number of hours in bed X 100

3. Assign component 4 scores as follows:

Habitual sleep efficiency (%)	Component 4 score
>85%	0
75–84%	1
65–74%	2
<65%	3

Component 5: Sleep disturbance[†]

1. Examine questions #5b–5j, and assign scores for *each* question as follows:

Response	Score
Not during the past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

2. Add the scores of questions #5b–5j

3. Assign component 5 score as follows:

Sum of #5b–5j	Component 5 score
0	0

1–9	1
10–18	2
19–27	3

Component 6: Use of sleeping medication

Examine question #7 and assign scores as follows:

Response	Component 6 score
Not during the past month	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

Component 7: Day time dysfunction

1. Examine question #8, and assign scores as follows:

Response	Score
Never	0
Less than once a week	1
Once or twice a week	2
Three or more times a week	3

2. Examine question #9, and assign scores as follows:

Response	Score
No problem as all	0
Only a very slight problem	1
Somewhat of a problem	2
A very big problem	3

3. Add the scores for questions #8 and #9

4. Assign component 7 score as follows:

Sum of #8 and #9	Component 7 score
0	0
1–2	1
3–4	2
5–6	3

Global PSQI score: sum of component 1–7

Supplementary Table 1. Baseline clinical characteristics of included and excluded patients with missing data.

	Included patients	Excluded patients	Missing (N [%])
Number	1601	1241	
Baseline characteristics			
Age (year)*	61 (54–69)	64 (55–70)	0 (0)
Male (N [%])*	1031 (64)	734 (59)	0 (0)
Smoking status (N [%])*			421 (15)
Non-smokers	853 (53)	488 (60)	
Past smokers	481 (30)	193 (24)	
Current smokers	267 (17)	139 (17)	
Diabetes (N [%])*	558 (35)	507 (41)	0 (0)
Cardiovascular disease (N [%])*	333 (21)	313 (25)	0 (0)
Body mass index (kg/m^2)	23.5±3.8	23.6±3.9	279 (10)
Systolic blood pressure (mmHg)	132±18	132±19	37 (1)
Diastolic blood pressure (mmHg)*	77±11	76±12	40 (1)
Serum creatinine (mg/dL)	1.8 (1.4–2.5)	1.8 (1.4–2.5)	0 (0)
eGFR (mL/min/1.73m^2)	29 (20–38)	29 (20–38)	0 (0)
45–59 (N [%])	154 (10)	125 (10)	
30–44	620 (39)	455 (37)	
15–29	635 (40)	509 (41)	
10–14	192 (12)	152 (12)	
Urinary albumin excretion (g/gCr)	0.48 (0.12–1.26)	0.48 (0.01–1.32)	273 (10)
C-reactive protein (mg/dL)*	0.1 (0.0–0.2)	0.1 (0.0–0.2)	659 (23)
Medications (N [%])			
RAS blockade	1324 (83)	1010 (81)	0 (0)
Hypnotics*, none	1362 (85)	666 (81.1)	413 (15)
≤2 times/week	75 (2)	44 (2)	
≥3 times/week	164 (10)	118 (14)	
Beck depression inventory score	7 (4–12)	7 (3–13)	383 (13)
≥11 (N [%])	524 (33)	299 (35)	
Sleep duration (hour)	7.0±1.3	6.9±1.3	424 (15)
PSQI global score	4 (3–7)	5 (3–7)	875 (31)

≥ 6 (N [%])	588 (37)	148 (40)	
Follow-up period and ESKD			
Follow-up period (year)	4.0 (2.6–4.3)	3.9 (2.3–4.3)	0 (0)
ESKD (N [%])	282 (18)	241 (19)	0 (0)
Incidence rate (per person-year)	0.051	0.059	0 (0)

Mean±standard deviation; Median (interquartile range)

Cr, creatinine; eGFR, estimated glomerular filtration rate; ESKD, end-stage kidney disease; PSQI, Pittsburgh sleep quality index; RAS, renin-angiotensin system

*P < 0.05

Supplementary Table 2. Sleep duration and incidence of ESKD in 1223 patients with baseline C-reactive protein available.

	Sleep duration (hour)				
	≤5.0	5.1–6.0	6.1–7.0	7.1–8.0	≥8.0
Number	113	232	415	314	149
Incidence of ESKD (N [%])	23 (20)	36 (16)	62 (15)	58 (18)	35 (23)
Incidence rate (per person-year)	0.061	0.044	0.043	0.054	0.072
Adjusted hazard ratio (95% CI)					
Model 1	1.39 (0.86, 2.24)	1.07 (0.71, 1.61)	1.00 (reference)	1.23 (0.85, 1.76)	1.71 (1.12, 2.60)
Model 2	2.04 (1.26, 3.31)*	1.18 (0.77, 1.80)	1.00 (reference)	1.06 (0.74, 1.52)	1.49 (0.97, 2.27)
Model 3	2.00 (1.23, 3.36)*	1.19 (0.78, 1.82)	1.00 (reference)	1.07 (0.75, 1.55)	1.46 (0.95, 2.24)
Model 4	1.84 (1.11, 3.07)*	1.15 (0.75, 1.76)	1.00 (reference)	1.07 (0.74, 1.54)	1.37 (0.88, 2.12)
Model 5	1.82 (1.09, 3.04)*	1.15 (0.75, 1.77)	1.00 (reference)	1.08 (0.75, 1.55)	1.37 (0.88, 2.12)

CI, confidence interval; ESKD, end-stage kidney disease

*$P<0.05$

Model 1, Adjusted for age (year) and gender.

Model 2, Adjusted for the covariates in model 1, eGFR (ml/min/1.73 m^2) and urinary albumin excretion (Log g/gCr).

Model 3, Adjusted for the covariates in model 2, smoking status (non-, past, and current smokers), body mass index (kg/m^2), history of diabetes mellitus and cardiovascular disease, systolic blood pressure (mmHg), and blockade of renin-angiotensin system

Model 4, Adjusted for the covariates in model 3 and Beck depression inventory score (≤10 and >10) and use of hypnotics (none, 1–2 times, or ≥3 times per week).

Model 5, Adjusted for the covariates in model 4 and C-reactive protein (Log [mg/dl + 0.01])

Supplementary Table 3. Sleep duration and incidence of ESKD in 1223 patients with baseline C-reactive protein available.

	PSQI global score	
	≤5	≥6
Number	762	461
Incidence of ESKD (N [%])	126 (17)	88 (19)
Incidence rate (per person-year)	0.047	0.057
Adjusted hazard ratio (95% CI)		
Model 1	1.00 (reference)	1.24 (0.95, 1.63)
Model 2	1.00 (reference)	1.56 (1.18, 2.06)*
Model 3	1.00 (reference)	1.56 (1.17, 2.08)*
Model 4	1.00 (reference)	1.47 (1.10, 1.97)*
Model 5	1.00 (reference)	1.47 (1.09, 1.97)*

CI, confidence interval; ESKD, end-stage kidney disease; PSQI, Pittsburgh sleep quality index

*P < 0.05

Model 1, Adjusted for age (year) and gender.

Model 2, Adjusted for the covariates in model 1, eGFR (ml/min/1.73 m^2) and urinary albumin excretion (Log g/gCr).

Model 3, Adjusted for the covariates in model 2, smoking status (non-, past, and current smokers), body mass index (kg/m^2), history of diabetes mellitus and cardiovascular disease, systolic blood pressure (mmHg), and blockade of renin-angiotensin system

Model 4, Adjusted for the covariates in model 3 and Beck depression inventory score (≤10 and >10).

Model 5, Adjusted for the covariates in model 4 and C-reactive protein (Log [mg/dl + 0.01])