

## Supplementary material

Ruszkowski J, Heleniak Z, Król E, et al. Associations between symptoms of constipation and sleep quality in patients with nondialysis chronic kidney disease: a cross-sectional study. *Pol Arch Intern Med.* 2021; 131: 512-519. doi:10.20452/pamw.15974

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**Table S1. Pharmacotherapy in total study population and according to estimated glomerular filtration rate tercile**

	All (n=100)	High eGFR tercile	Medium eGFR tercile	Low eGFR tercile	P value
Beta blockers, n (%)	68	18 (54.5)	24 (72.7)	26 (76.5)	0.12
Calcium channel blockers, n (%)	52	10 (30.3)	19 (57.6)	23 (67.6)	0.007
Diuretics, n (%)	54	15 (45.5)	21 (63.6)	18 (52.9)	0.33
Lactulose, n (%)	3	0	2 (6.1)	1 (2.9)	0.54*
NSAIDs, n (%)	22	6 (18.2)	9 (27.3)	7 (20.6)	0.65
Paracetamol, n (%)	12	1 (3.0)	5 (15.2)	6 (17.6)	0.14*
Calcium supplements, n (%)	18	3 (9.1)	5 (15.2)	10 (29.4)	0.08
Vitamin D, n (%)	30	9 (27.3)	9 (27.3)	12 (35.3)	0.71
Iron, n (%)	7	1 (3.0)	2 (6.1)	4 (11.8)	0.50*
Hypnotics, n (%)	6	1 (3.0)	1 (3.0)	4 (11.8)	0.36*

\* Since the assumptions of  $\chi^2$ -test were violated, Fisher exact probability test was used.

Abbreviations: eGFR: estimated glomerular filtration rate tercile; NSAIDs: nonsteroidal anti-inflammatory drugs

**Description S1. Selection of gastrointestinal symptoms significantly associated with altered prevalence ratio of decreased Sleep Quality.**

1. Gastrointestinal disorders ( $P < 0.05$ ):

Functional constipation, Frequency of defecation ( $< 7/\text{week}$ ;  $7/\text{week}$ ;  $> 7/\text{week}$ ).

2. Symptoms treated as binary variables (symptom present or not) ( $P < 0.05$ ):

2.1. Items of the Abdominal Scale:

- abdominal discomfort ( $\geq 1$  point at PAC-SYM Scale);
- abdominal pain ( $\geq 1$  point at PAC-SYM Scale);
- stomach cramps ( $\geq 1$  point at PAC-SYM Scale)

2.2. Items of the Rectal Scale:

- painful bowel movements ( $\geq 1$  point at PAC-SYM Scale);

2.3. Items of the Stool Scale:

- too hard BMs ( $\geq 1$  point at PAC-SYM Scale);
- too small BMs ( $\geq 1$  point at PAC-SYM Scale);
- straining or squeezing ( $\geq 1$  point at PAC-SYM Scale).

3. Symptoms associated with decreased Sleep Quality (2.2.) treated as tri-level variable (Absent / Mild / at least moderate) (at each level  $P < 0.05$ ):

3.1. Items of the Abdominal Scale: abdominal discomfort; abdominal pain;

3.2. Items of the Rectal Scale: painful bowel movements;

3.3. Items of the Stool Scale: too small BMs.

Gastrointestinal disorders and symptoms selected above (section 1. and section 3.) were shown in Table S2.

**Table S2. Univariable analyses assessing prevalence ratio of decrease Sleep Quality according to gastrointestinal symptoms and disorders**

Variable	Univariable analyses (each row represents separate model)		
	Prevalence ratio	95% CI	<i>P</i> value
Abdominal discomfort*	5.86	2.09-16.49	0.001
Abdominal discomfort			
- Lack	reference	-	-
- Mild	4.31	1.29-14.37	0.02
- Moderate/severe	7.34	2.54-21.19	< 0.001
Abdominal pain*	5.33	2.22- 12.79	< 0.001
Abdominal pain:			
- Lack	reference	-	-
- Mild	4.24	1.56-11.52	0.004
- At least medium	7.20	2.87-18.03	< 0.001
Too small BMs*	5.19	2.28-11.85	< 0.001
Too small BMs:			
- Lack	reference	-	-
- Mild	3.34	1.14-9.82	0.03
- At least medium	7.60	3.37-17.16	< 0.001
Painful BMs*	3.86	1.81-8.27	< 0.001
Painful BMs:			
- Lack	reference	-	-
- Mild	3.86	1.69-8.86	0.001
- Moderate/severe	3.86	1.26-11.89	0.02
Defecation frequency			
- 7 times a week	reference	-	-
- < 7 times a week	7.23	1.74-30.12	0.007
- > 7 times a week	2.93	0.53-16.19	0.22
Functional constipation	2.71	1.21-6.07	0.02

\* ≥1 point at PAC-SYM Scale

Abbreviations: BMs: bowel movements; PAC-SYM: the Patient Assessment of Constipation-Symptoms questionnaire

**Table S3. Univariable analyses assessing prevalence ratio of decrease Sleep Quality [T Score < 40]**

Variable	Univariable analyses (each row represents separate model)		
	Prevalence ratio	95% CI	<i>P</i> value
Gender:			
- male	reference	-	-
- female	1.59	0.69-3.69	0.28
Age $\geq 65$	1.66	0.64-4.30	0.29
eGFR tercile			
- high	reference	-	-
- medium	4.00	0.92-17.44	0.07
- low	3.88	0.89-16.95	0.07
Depression	4.80	2.31-9.98	< 0.001
Use of beta-blockers	1.65	0.59-4.61	0.34
Use of CCBs	3.23	1.14-9.13	0.03
Use of diuretics	2.21	0.85-5.75	0.10
Use of hypnotics	1.96	0.58- 6.61	0.28
Use of NSAIDs	1.77	0.75-4.18	0.19

Variables with Vovk-Sellke maximum *P*-ratio > 1.0, i.e.  $P < 0.37$ , were shown.

Abbreviations: CCBs: calcium channel blockers; NSAIDs: nonsteroidal anti-inflammatory drugs

**Description S2. Selection of optimal set of variables at each domain based on minimal Akaike information criterion (AIC).**

Variables shown in Table S3 were categorized based on the domain. Then, optimal set of variables (1-item set were permitted) at each domain were selected based on the minimum value of the Akaike information criterion. Below, the results were shown:

- Anthropometric and demographic data: age  $\geq 65$
- Disease: depression (AIC 97.41)
- Drugs: Ca channel blockers and diuretics (AIC 96.59)

**Table S4. Log-Poisson regression models of decreased Sleep Quality Score prevalence ratio according to defecation frequency adjusted for key clinical data**

Variable	Model adjusted for age		Model adjusted for age, depression		Model adjusted for age, depression and drugs	
	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value
Defecation frequency						
- 7 times a week	reference	-	Reference	-	Reference	-
- < 7 times a week	7.43 (1.82-30.32)	0.005	6.46 (1.55-26.83)	0.01	4.64 (1.13-18.97)	0.03
- > 7 times a week	3.21 (0.59-17.247)	0.17	2.55 (0.47-13.90)	0.28	2.30 (0.43-12.41)	0.33
Age ≥ 65	2.12 (0.80-5.66)	0.13	2.24 (0.937-5.35)	0.07	1.99 (0.86-4.61)	0.11
Depression	-	-	3.83 (1.67-8.78)	0.002	3.11 (1.32-7.31)	0.009
Use of CCBs	-	-	-	-	1.92 (0.68-5.40)	0.22
Use of diuretics	-	-	-	-	1.66 (0.60-4.64)	0.33

Abbreviations: CCBs: calcium channel blockers; PR: prevalence ratio.

**Table S5. Log-Poisson regression models of decreased Sleep Quality Score prevalence ratio according to abdominal discomfort adjusted for key clinical data**

Variable	Model adjusted for age		Model adjusted for age, depression		Model adjusted for age, depression and drugs	
	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value
Abdominal discomfort						
- Lack	reference	-	reference	-	reference	-
- Mild	4.49 (1.39-14.52)	0.01	3.62 (1.07-12.29)	0.04	3.60 (1.19-10.83)	0.02
- Moderate/severe	7.55 (2.60-21.92)	< 0.001	6.83 (2.34-19.95)	< 0.001	7.42 (2.50-21.99)	< 0.001
Age ≥ 65	1.86 (0.79-4.39)	0.16	2.08 (0.93-4.64)	0.08	2.03 (0.96-4.26)	0.06
Depression	-	-	2.72 (1.22-6.07)	0.02	2.02 (1.12-3.64)	0.02
Use of CCBs	-	-	-	-	3.10 (1.15-8.37)	0.03
Use of diuretics	-	-	-	-	1.76 (0.86-3.59)	0.12

Abbreviations: CCBs: calcium channel blockers; PR: prevalence ratio.

**Table S6. Log-Poisson regression models of decreased Sleep Quality Score prevalence ratio according to abdominal pain adjusted for key clinical data**

Variable	Model adjusted for age		Model adjusted for age, depression		Model adjusted for age, depression and drugs	
	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value
Abdominal pain:						
- Lack	Reference	-	reference	-	Reference	-
- Mild	4.17 (1.57-11.09)	0.004	3.52 (1.34-9.30)	0.01	2.91 (1.19-7.15)	0.02
- At least medium	8.47 (3.39-21.14)	< 0.001	7.98 (3.21-19.85)	< 0.001	11.04 (4.82-25.26)	< 0.001
Age ≥ 65	2.14 (1.00-4.60)	0.05	2.51 (1.26-4.98)	0.009	2.87 (1.31-6.25)	0.008
Depression	-	-	3.18 (1.70-5.93)	< 0.001	1.93 (0.85-4.42)	0.12
Use of CCBs	-	-	-	-	2.86 (1.07-7.67)	0.04
Use of diuretics	-	-	-	-	2.17 (0.91-5.16)	0.08

Abbreviations: CCBs: calcium channel blockers; PR: prevalence ratio.

**Table S7. Log-Poisson regression models of decreased Sleep Quality Score prevalence ratio according to too small bowel movement adjusted for key clinical data**

Variable	Model adjusted for age		Model adjusted for age, depression		Model adjusted for age, depression and drugs	
	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value
Too small BMs:						
- Lack	Reference	-	Reference	-	Reference	-
- Mild	3.36 (1.15-9.85)	0.03	3.12 (1.09-8.96)	0.03	2.97 (1.11-7.94)	0.03
- At least medium	7.25 (3.11-16.89)	< 0.001	6.22 (2.51-15.43)	< 0.001	5.24 (2.17-12.63)	< 0.001
Age ≥ 65	1.16 (0.46-2.97)	0.75	1.24 (0.48-3.21)	0.65	1.02 (0.40-2.57)	0.97
Depression	-	-	2.98 (1.23-7.24)	0.02	2.36 (0.98-5.67)	0.05
Use of CCBs	-	-	-	-	2.06 (0.74-5.70)	0.17
Use of diuretics	-	-	-	-	1.83 (0.86-3.88)	0.12

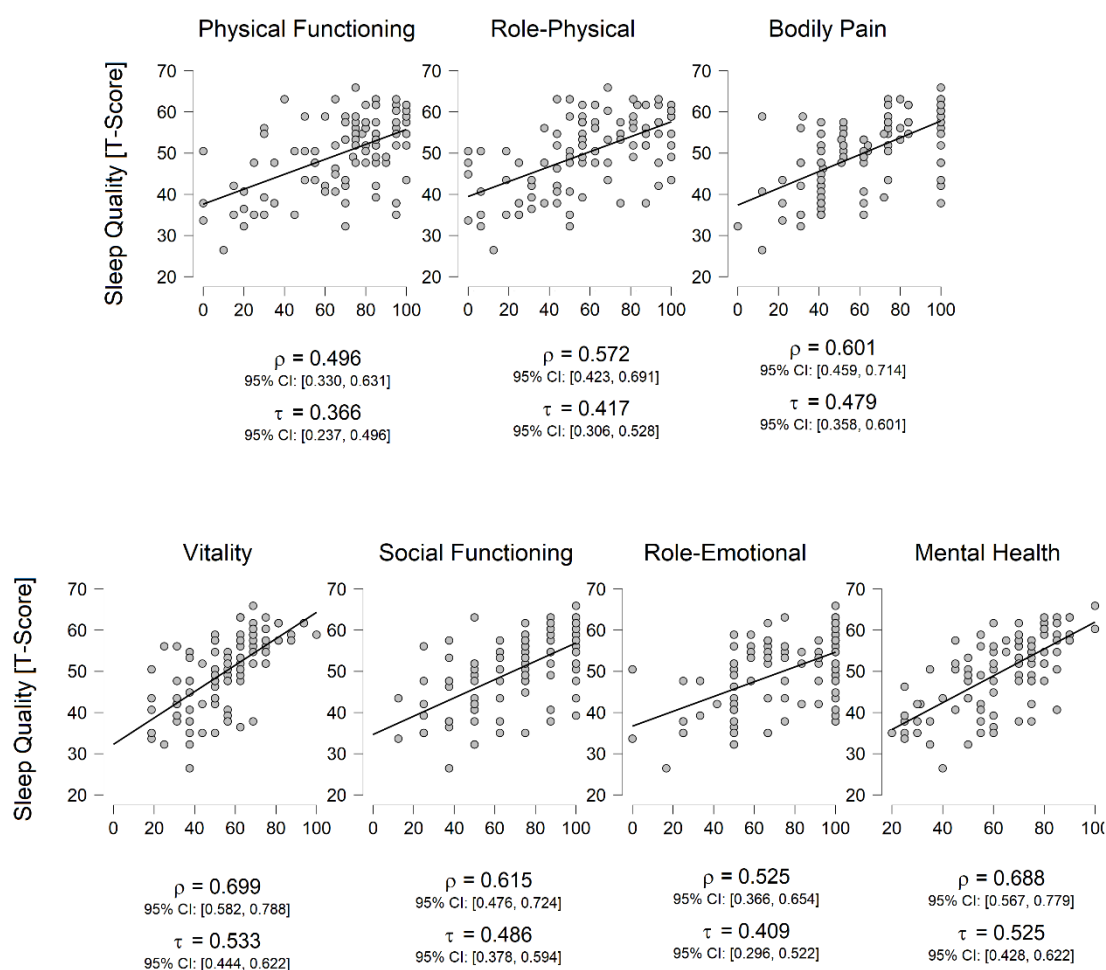
Abbreviations: BMs: bowel movements; CCBs: calcium channel blockers; PR: prevalence ratio.

**Table S8. Log-Poisson regression models of decreased Sleep Quality Score prevalence ratio according to painful bowel movement adjusted for key clinical data**

Variable	Model adjusted for age		Model adjusted for age, depression		Model adjusted for age, depression and drugs	
	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value	PR (95% CI)	<i>P</i> value
Painful BMs						
- Lack	Reference	-	Reference	-	Reference	-
- Mild	3.68 (1.53-8.89)	0.004	2.91 (1.13-7.47)	0.03	2.09 (0.84-5.18)	0.11
- Moderate/severe	4.84 (1.32-17.75)	0.02	3.87 (1.11-13.48)	0.03	3.28 (0.89-12.02)	0.07
Age ≥ 65	1.84 (0.77-4.43)	0.17	2.03 (0.86-4.75)	0.11	1.96 (0.75-5.14)	0.17
Depression	-	-	2.63 (1.15-6.00)	0.02	2.31 (0.97-5.53)	0.06
Use of CCBs	-	-	-	-	2.38 (0.79-7.13)	0.12
Use of diuretics	-	-	-	-	1.54 (0.62-3.86)	0.35

Abbreviations: BMs: bowel movements; CCBs: calcium channel blockers; PR: prevalence ratio.

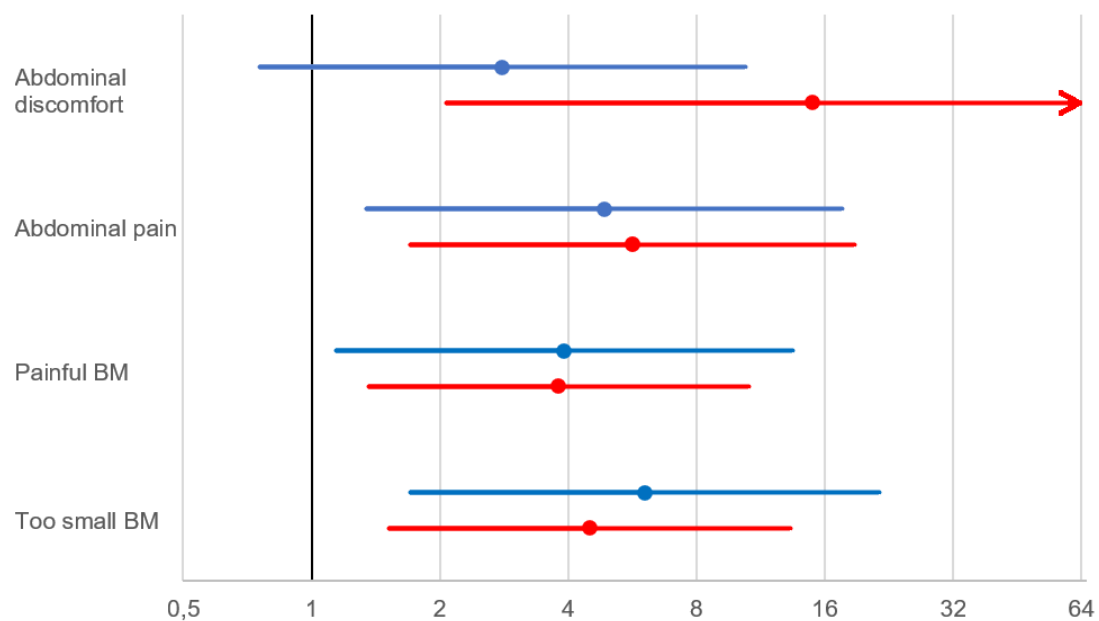
**Figure S1. Correlations between Sleep Quality T Score and SF-36v2 domains**



Below each scatter plot, Spearman's  $\rho$  and Kendall's  $\tau$ -B with 95% confidence intervals were shown.



**Figure S2. Prevalence ratio of deteriorated Sleep Quality in patients with according to gastrointestinal symptoms and estimated glomerular filtration rate**



Dots: estimated prevalence ratio (PR).

Lines: 95% confidence interval (CI).

Blue: patients with eGFR  $\geq$  median (38 ml/min/1.73m<sup>2</sup>);

Red: patients with eGFR < median (38 ml/min/1.73m<sup>2</sup>).

Upper range of 95% CI for patients with abdominal discomfort and eGFR < median was not shown (= 108.81)