Association Between Subjective Sleep Quality and Quality of Life (QOL) Linked with Claims Data in the DeSC Database in Japan

Junya Sado[1], Minako Izutsu[1], Akiko Hatakama[1], Ataru Igarashi[2]

[1] DeSC Healthcare, Inc., Tokyo, Japan; [2] Tokyo University, Tokyo, Japan

Poster No. PCR27

Background

- **Limitations of Traditional Databases:** Conventional claims databases lack Patient-Reported Outcomes (PROs), which limits their capability to capture a comprehensive view of treatment effectiveness.
- **Importance of PROs in Real-World Research:** The integration of PROs is essential in real-world research, especially in fields such as sleep disorders where Quality of Life (QOL) is a primary concern.
- **Research Gap:** While the relationship between sleep quality and QOL has been suggested, there has been a lack of longitudinal investigation using large-scale, real-world clinical data.

Objectives

- The purpose of this study is to quantitatively evaluate the magnitude of the association between sleep quality and QOL in a Japanese population using real-world data.

Methods

Data Source and Study Design

- The DeSC database (DB) includes anonymized data collected from medical claims, annual health checkups, and enrollment information. In addition, data such as daily step counts are collected and surveys are distributed biannually through the smartphone application kencom®(a total of 13 times since 2019). This database enables us to link anonymized claims data with Patient-Reported Outcomes (PROs).
- Among the several health insurances available in Japan, DeSC covers Employee Health Insurance (EHI), National Health Insurance (NHI), and the Late-Stage Elderly Healthcare System (LSEHS). The PROs in the DeSC DB includes survey respondents who are covered by the EHI and NHI plans.
- The study design combined a cross-sectional analysis at two survey points (December 2021 and December 2022) with a longitudinal analysis of participants who responded to both surveys.

Patient Selection Flowchart

Individuals in the database (enrolled between Dec 2020 and Jan 2024) n = 1,142,081
Required 6-month continuous enrollment prior to the survey and age between 18 and 74 2021: n = 939,104, 2022: n = 728,909
kencom® Registrants 2021: n = 136,759, 2022: n = 157,876
PSQI and QOL Respondents 2021: n = 19,366, 2022: n = 25,176, 2021 & 2022: n = 12,638

Measures

- **Sleep Quality:** Assessed using the Japanese version of the Pittsburgh Sleep Quality Index (PSQI). The total score (0-21) was used as a continuous variable, and a PSQI score > 5 was used to define the "poor sleep quality" group.
- **Health-Related QOL:** The utility score from the Japanese version of the five-level version of the EuroQol five-dimensional questionnaire (EQ-5D-5L), calculated using the Japanese value set, was used as the indicator for QOL.

Statistical Analysis

- A multiple regression analysis was used to evaluate the association between the PSQI score (independent variable) and the EQ-5D-5L score (dependent variable).
- Covariates: Age Group (categorical), Sex (categorical), Survey year (2021/2022), and the following variables were assessed for the 6 months prior to the survey:
  - Severity of comorbidities (Charlson Comorbidity Index score)
  - Medical costs (outpatient and inpatient)
  - Number of days of medical care (outpatient and inpatient)
- All statistical analyses were performed using R version 4.2.2.

Results

	Overall Population		kencom® Registrants		PSQI Registrants		
	2021	2022	2021	2022	2021	2022	2times
n	939,104	728,909	136,759	157,876	19,366	25,176	12,638
sex(n, %)							
Female	461,147(49.1)	349,843(48.0)	55,498(40.6)	63,136(40.0)	6,039(31.2)	8,525(33.9)	3,739(29.6)
Male	477,957(50.9)	379,066(52.0)	81,261(59.4)	94,740(60.0)	13,327(68.8)	16,651(66.1)	8,899(70.4)
age(mean, sd)	52.1(15.7)	50.4(15.6)	46.1(11.4)	46.4(11.9)	48.7(10.4)	49.8(10.7)	49.4(10.0)
age_groups, %							
18_24	59,296(6.3)	51,491(7.1)	3,862(2.8)	4,824(3.1)	224(1.2)	240(1.0)	84(0.7)
25_29	43,474(4.6)	39,488(5.4)	9,967(7.3)	12,153(7.7)	743(3.8)	920(3.7)	378(3.0)
30_34	52,174(5.6)	45,013(6.2)	11,701(8.6)	13,309(8.4)	1,200(6.2)	1,402(5.6)	733(5.8)
35_39	63,863(6.8)	54,498(7.5)	14,213(10.4)	15,867(10.1)	1,649(8.5)	1,953(7.8)	1,020(8.1)
40_44	73,988(7.9)	62,079(8.5)	16,378(12.0)	18,126(11.5)	2,293(11.8)	2,669(10.6)	1,444(11.4)
45_49	93,893(10.0)	76,795(10.5)	21,845(16.0)	23,295(14.8)	3,291(17.0)	3,908(15.5)	2,127(16.8)
50_54	101,935(10.9)	85,555(11.7)	24,898(18.2)	26,702(16.9)	4,117(21.3)	5,101(20.3)	2,849(22.5)
55_59	86,435(9.2)	76,105(10.4)	18,851(13.8)	23,298(14.8)	3,182(16.4)	4,533(18.0)	2,175(17.2)
60_64	85,564(9.1)	64,331(8.8)	8,909(6.5)	12,104(7.7)	1,672(8.6)	2,710(10.8)	1,150(9.1)
65_69	125,055(13.3)	75,168(10.3)	4,547(3.3)	5,583(3.5)	718(3.7)	1,173(4.7)	504(4.0)
70_74	153,427(16.3)	98,386(13.5)	1,586(1.2)	2,615(1.7)	277(1.4)	567(2.3)	174(1.4)
Insurer Type							
NHI	478,817(51.0)	470,142(64.5)	133,840(97.9)	153,431(97.2)	18,609(96.1)	23,715(94.2)	12,231(96.8)
EHI	460,287(49.0)	258,767(35.5)	2,919(2.1)	4,445(2.8)	757(3.9)	1,461(5.8)	407(3.2)
PSQI score(mean, sd)						4.6(2.5)	4.5(2.6)	4.6(2.5)

Table1. Background of the population, kencom® registrants, and PSQI respondents:
The kencom® registrants/PSQI respondents were younger, predominantly male, and mostly EHI members (vs. overall population). Participation increased, but demographics and mean PSQI remained stable.

Adjusted for covariates	Crude β (95% CI)	p-value	Adjusted β (95% CI)*	p-value
Association between PSQI and QOL Scores by Survey				
2021	-0.0161 (-0.0166, -0.0156)	< 0.001	-0.0153 (-0.0158, -0.0148)	< 0.001
2022	-0.0160 (-0.0165, -0.0156)	< 0.001	-0.0151 (-0.0155, -0.0146)	< 0.001
Association between Changes in PSQI and QOL Scores				
Change (2021-2022)	-0.0079 (-0.0088, -0.0071)	< 0.001	-0.0105 (-0.0116, -0.0093)	< 0.001

Table2. Association between PSQI and QOL Scores（2021、2022、and change (2021-2022)：
Poorer sleep quality (PSQI) was significantly associated with lower quality of life (QOL) in both cross-sectional (2021, 2022) and longitudinal (2021-2022 changes) analyses.
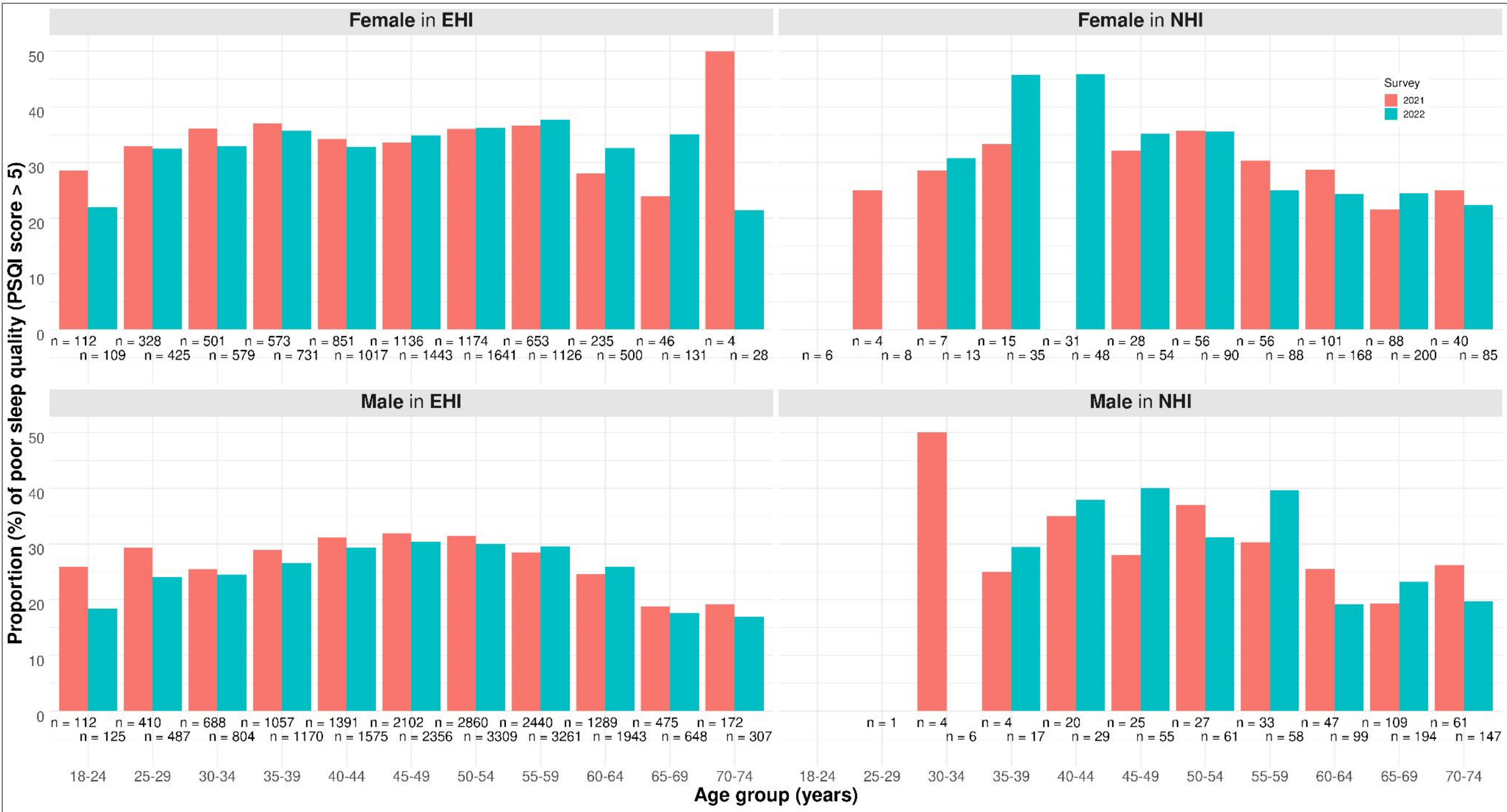

Figure 1. Proportion of poor sleep quality (PSQI score > 5) according to PSQI by survey and insurer type:
Contrary to general expectations, **the proportion of poor sleep quality was lower in older adults compared to younger and middle-aged groups**. This trend was consistent across both surveys, with the proportion of poor sleepers peaking in middle age and decreasing after age 60.
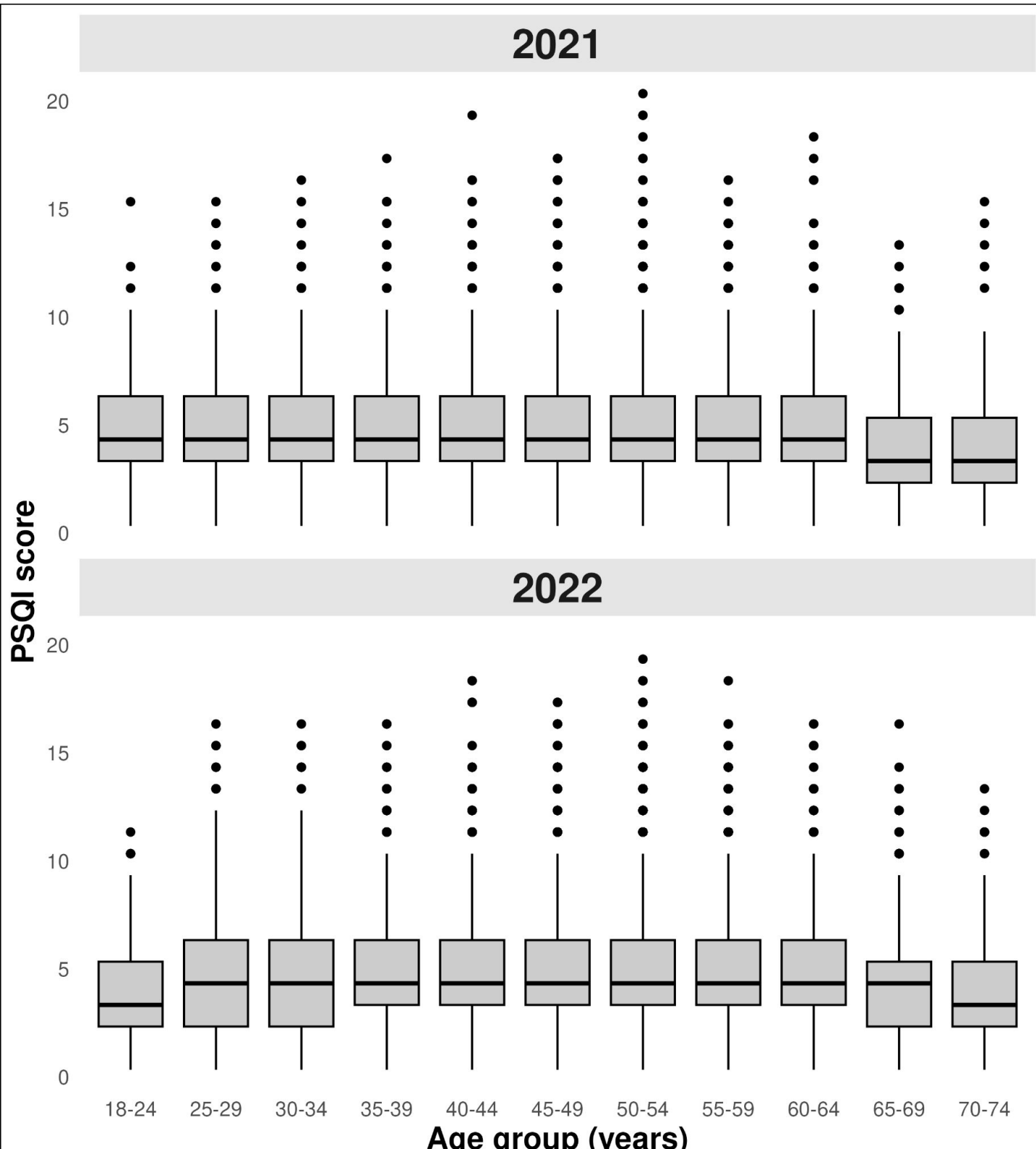

Figure 2. PSQI score distribution by survey:
The data distributions look consistent across all age groups, with several outliers identified. Furthermore, no major differences were found between the two survey periods.
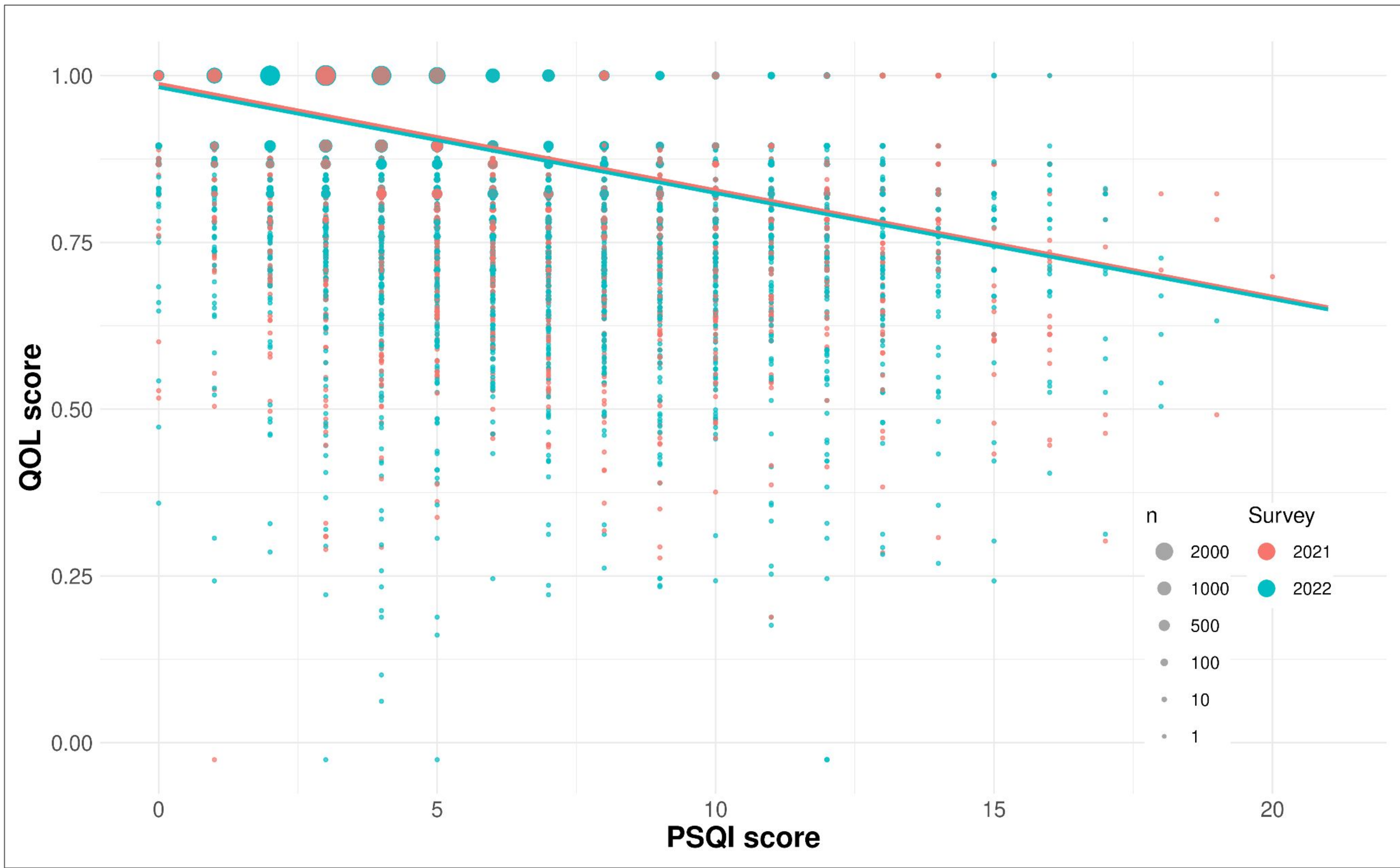

Figure 3. Relationship between PSQI and QOL scores by survey:
A significant negative correlation was found between PSQI and QOL scores, **indicating that poorer sleep quality is associated with a lower QOL.** This relationship remained consistent and highly significant across both the 2021 and 2022 surveys.
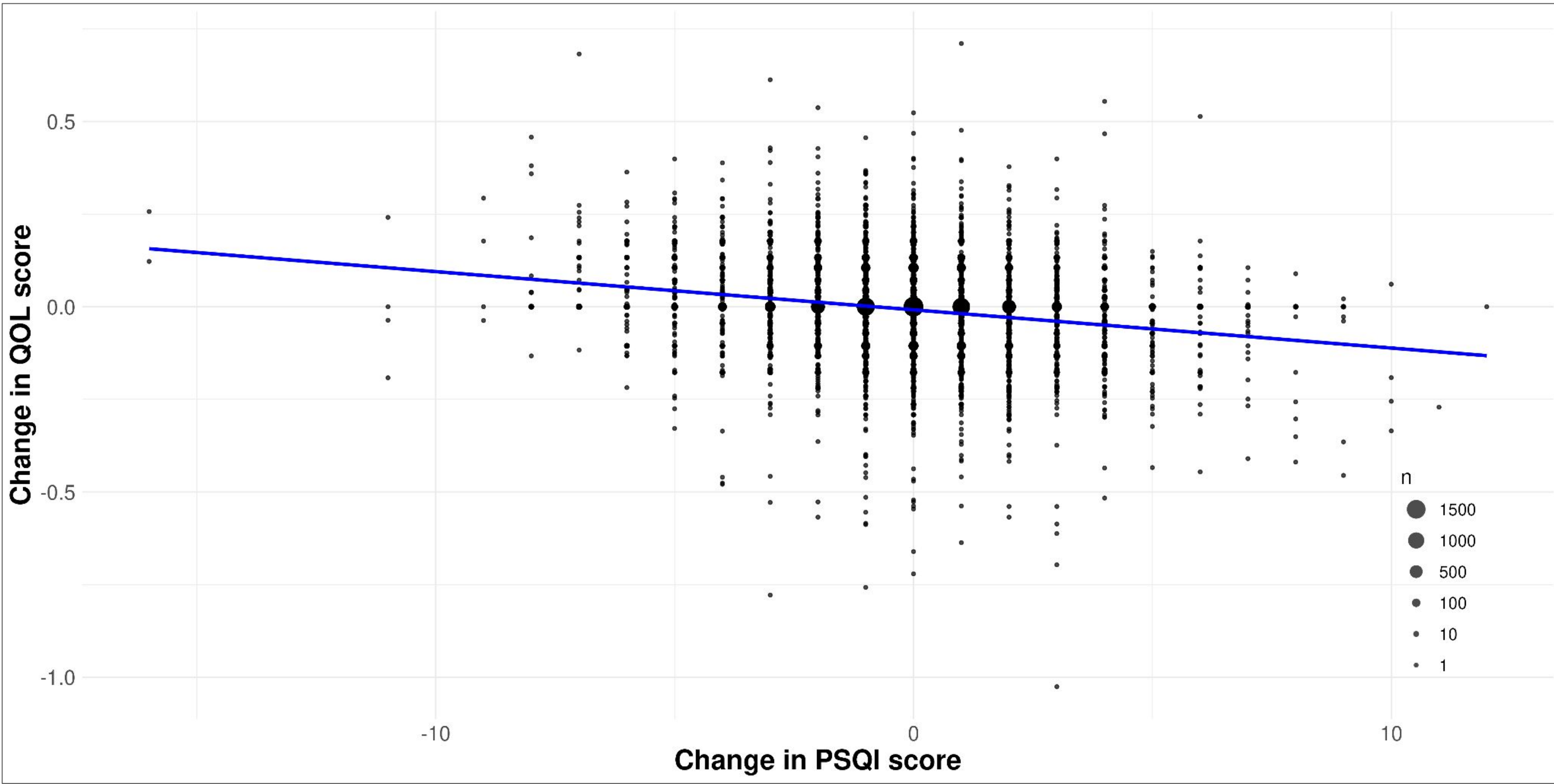

Figure 4. Relationship between Change in PSQI and QOL Scores:
A significant negative correlation was observed between the change in PSQI scores and the change in QOL scores. **This indicates that an improvement in sleep quality (a decrease in PSQI score) is strongly associated with an improvement in Quality of Life (an increase in QOL score).**

Discussion

- Non-elderly adults showed a higher proportion of poor sleep (high PSQI) compared to elderly adults. **A Japanese national survey shows a similar trend** as well.
- **Strengths:** Innovative Data Linkage: The study linked large-scale PRO data (from tens of thousands of users) with administrative claims data.
- **Limitations:** Selection Bias: The study population was limited to users of the kencom® app, which may affect the generalizability of the results.

Conclusions

- **PROs Visualize the Patient's Reality:** PRO data collected via smartphone apps visualize subjective health states not captured by claims data alone, demonstrating for the first time on a large scale the close link between sleep quality and QOL.
- **Poor Sleep is a Sign of Low QOL:** Temporal changes in sleep quality were linked to changes in QOL, suggesting that early detection of and intervention for poor sleep are crucial for maintaining and improving patient QOL.

Conflict of Interest

- Sado, Izutsu, and Hatakama are employed by DeSC Healthcare.
- Igarashi has received a joint research grant from DeSC Healthcare