

# Analysis of the Relationship between Physician Density and Healthcare Expenditure in Japan:

## Using Large-Scale Real-World Data of Employment-Based Health Insurance Claims (the Wellness-Star☆ Database)

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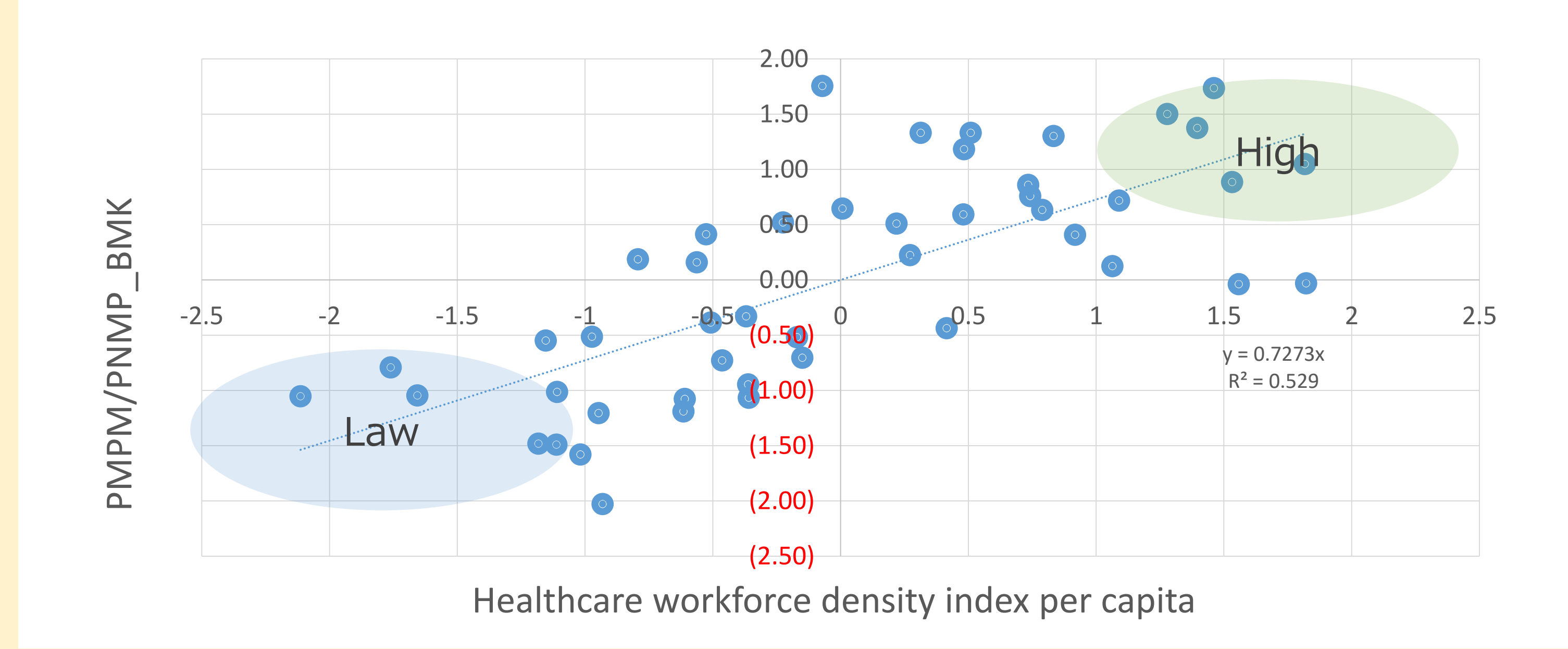
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### Backgrounds

- Japan has adopted a universal health insurance system, under which nearly all citizens have access to medical services through public health insurance.
- Additionally, medical fees in Japan are set uniformly nationwide based on the fee schedule established by the Ministry of Health, Labour and Welfare.

### Objectives

- Physician-induced demand (PID) refers to the provision or recommendation of medical services by physicians that exceed what patients would choose if fully informed. In Japan, physician density is positively associated with healthcare expenditure.



- However, it is unclear whether this reflects true PID or lower access costs in high-density areas.
- This study examined the existence of “true” physician-induced demand in Japan using individual-level health insurance claims data.

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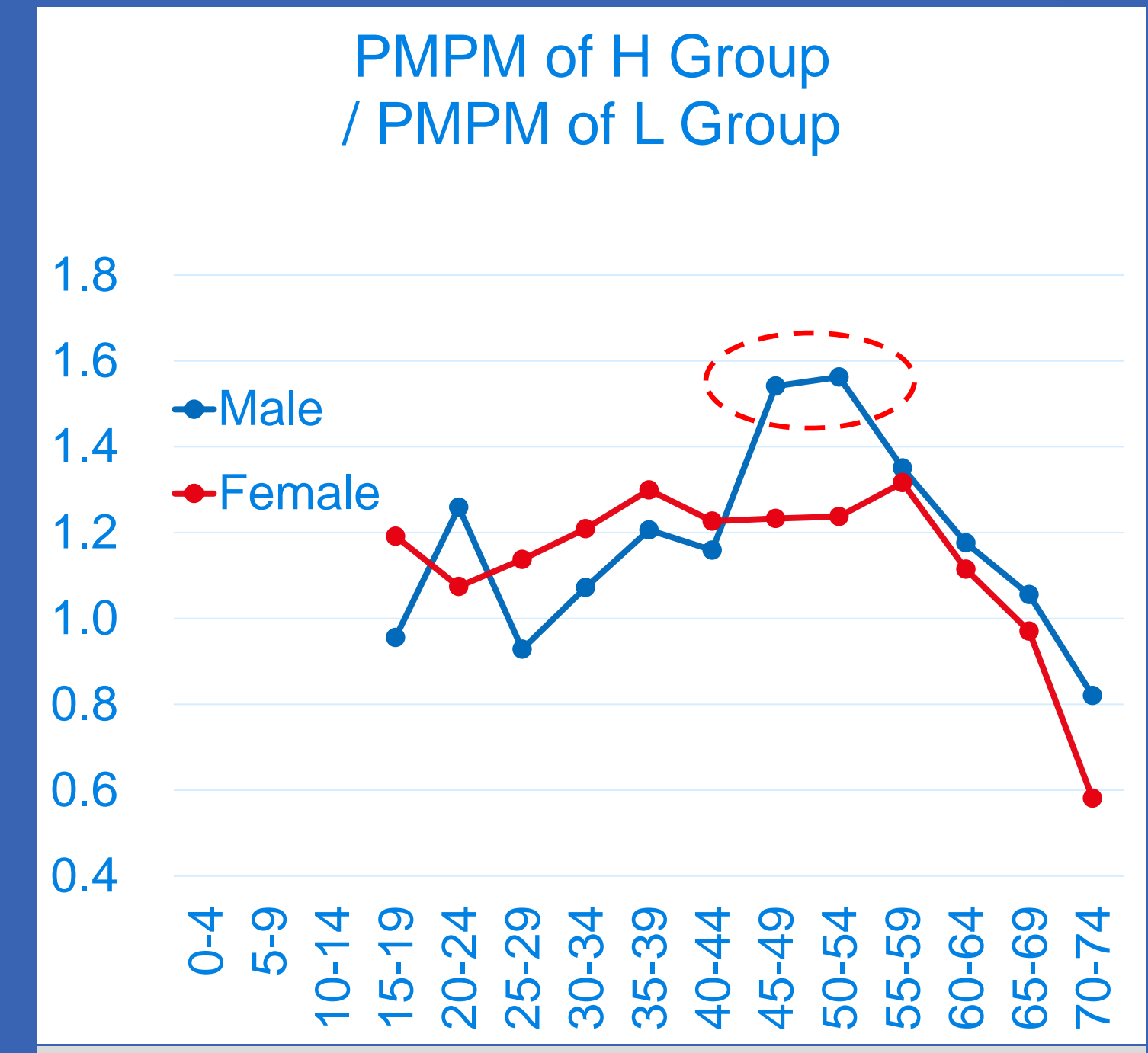
### Methods

- We analyzed the monthly expenditures for each individual, aggregated from claim data in the Wellness Star database owned by Nippon Life Insurance, comprising 251 million beneficiary-months from more than 200 employment-based health insurance societies.
- The analysis focused on fiscal year 2022.
- Industry groups with similar demographic-adjusted per-member-per-month (PMPM) expenditures were selected.

- Within these groups, we identified insurers in prefectures with high physician density (H group) and low physician density (L group), based on Ministry of Health, Labour, and Welfare statistics.
- Disease-specific prevalence, expenditure per-patient-per-month (PPPM), PMPM expenditure per insured person, and service frequencies were compared.

| Prefecture | Cost Index | physician density | Group |
|------------|------------|-------------------|-------|
| Ibaraki    | 0.83       | 0.713             | L     |
| Shizuoka   | 0.86       | 0.815             | L     |
| Gifu       | 0.77       | 0.827             | L     |
| Mie        | 0.95       | 0.856             | L     |
| ⋮          | ⋮          | ⋮                 | ⋮     |
| Wakayama   | 0.93       | 1.184             | H     |
| Okayama    | 1.01       | 1.214             | H     |
| Kochi      | 0.96       | 1.268             | H     |
| Fukuoka    | 0.95       | 1.280             | H     |
| Tokushima  | 0.99       | 1.342             | H     |

**Table 1: Cost Index and Physician Density by Prefectures Selected**  
Physician density: Ratio of physicians per 100,000 population compared with the national average  
**Cost Index:** Ratio of PMPM compared with the national average  
**PMPM:** Cost Per Member Per Month



**Figure 1: Ratio of PMPM of L Group with H Group by demographics**  
PMPM: Cost Per Member Per Month

| disease categories                    | PREV  |       | PPPM     |          | PMPM    |        | H/L  |      |      | H-L   |        |        | RANK |
|---------------------------------------|-------|-------|----------|----------|---------|--------|------|------|------|-------|--------|--------|------|
|                                       | H     | L     | H        | L        | H       | L      | PREV | PPPM | PMPM | PREV  | PPPM   | PMPM   |      |
| Other diseases of digestive           | 65.3% | 62.6% | ¥20,423  | ¥12,910  | ¥13,374 | ¥8,105 | 1.0  | 1.6  | 1.7  | ¥447  | ¥4,823 | ¥6,270 | 2    |
| Other diseases of the musculoskeletal | 27.8% | 23.8% | ¥30,800  | ¥18,315  | ¥8,560  | ¥4,364 | 1.2  | 1.7  | 2.0  | ¥995  | ¥3,200 | ¥4,195 | 3    |
| Diseases of the skin                  | 22.8% | 20.5% | ¥33,916  | ¥18,383  | ¥7,807  | ¥3,789 | 1.1  | 1.8  | 2.1  | ¥613  | ¥3,405 | ¥4,019 | 4    |
| Infectious and parasitic diseases     | 17.4% | 15.0% | ¥36,500  | ¥20,283  | ¥6,394  | ¥3,054 | 1.2  | 1.8  | 2.1  | ¥678  | ¥2,661 | ¥3,340 | 5    |
| Other diseases of the respiratory     | 42.7% | 42.1% | ¥21,813  | ¥14,334  | ¥9,374  | ¥6,054 | 1.0  | 1.5  | 1.5  | ¥124  | ¥3,196 | ¥3,320 | 6    |
| Hypertensive diseases                 | 22.1% | 19.7% | ¥33,958  | ¥22,269  | ¥7,484  | ¥4,390 | 1.1  | 1.5  | 1.7  | ¥681  | ¥2,413 | ¥3,094 | 7    |
| Other diseases of the circulatory     | 7.7%  | 7.4%  | ¥69,855  | ¥31,822  | ¥5,349  | ¥2,342 | 1.0  | 2.2  | 2.3  | ¥145  | ¥2,861 | ¥3,007 | 8    |
| Other metabolic diseases              | 6.6%  | 5.5%  | ¥75,480  | ¥39,289  | ¥4,975  | ¥2,176 | 1.2  | 1.9  | 2.3  | ¥614  | ¥2,184 | ¥2,798 | 9    |
| Diabetes mellitus                     | 12.9% | 10.4% | ¥42,925  | ¥28,646  | ¥5,515  | ¥2,978 | 1.2  | 1.5  | 1.9  | ¥889  | ¥1,649 | ¥2,537 | 10   |
| Other diseases of the eye/ear         | 32.9% | 32.4% | ¥21,498  | ¥14,177  | ¥7,116  | ¥4,632 | 1.0  | 1.5  | 1.5  | ¥77   | ¥2,406 | ¥2,484 | 11   |
| Dyslipidemia                          | 21.0% | 19.8% | ¥30,850  | ¥20,144  | ¥6,462  | ¥4,006 | 1.1  | 1.5  | 1.6  | ¥302  | ¥2,155 | ¥2,457 | 12   |
| Other mental disorders                | 15.6% | 14.3% | ¥36,468  | ¥23,380  | ¥5,656  | ¥3,343 | 1.1  | 1.6  | 1.7  | ¥404  | ¥1,909 | ¥2,313 | 13   |
| Other diseases of the genitourinary   | 9.0%  | 7.8%  | ¥47,996  | ¥26,905  | ¥4,357  | ¥2,094 | 1.2  | 1.8  | 2.1  | ¥470  | ¥1,793 | ¥2,263 | 14   |
| Renal failure                         | 1.7%  | 1.3%  | ¥178,012 | ¥59,874  | ¥2,952  | ¥765   | 1.3  | 3.0  | 3.9  | ¥473  | ¥1,715 | ¥2,187 | 15   |
| Other neoplasms                       | 6.9%  | 5.3%  | ¥49,074  | ¥25,913  | ¥3,399  | ¥1,367 | 1.3  | 1.9  | 2.5  | ¥593  | ¥1,438 | ¥2,032 | 16   |
| Constipation                          | 4.8%  | 4.1%  | ¥81,861  | ¥43,752  | ¥3,819  | ¥1,796 | 1.2  | 1.9  | 2.1  | ¥417  | ¥1,606 | ¥2,023 | 17   |
| Iron deficiency anemia                | 1.2%  | 0.9%  | ¥228,326 | ¥84,307  | ¥2,745  | ¥778   | 1.3  | 2.7  | 3.5  | ¥421  | ¥1,546 | ¥1,967 | 18   |
| Hyperuricemia                         | 10.2% | 8.9%  | ¥37,679  | ¥22,439  | ¥3,813  | ¥1,989 | 1.1  | 1.7  | 1.9  | ¥395  | ¥1,430 | ¥1,824 | 19   |
| Other diseases of the blood           | 2.5%  | 1.8%  | ¥100,138 | ¥44,001  | ¥2,552  | ¥795   | 1.4  | 2.3  | 3.2  | ¥543  | ¥1,215 | ¥1,757 | 20   |
| Ischemic heart disease                | 3.2%  | 2.5%  | ¥74,144  | ¥33,409  | ¥2,339  | ¥828   | 1.3  | 2.2  | 2.8  | ¥398  | ¥1,114 | ¥1,511 | 21   |
| Sleep disorders                       | 9.5%  | 9.2%  | ¥42,673  | ¥30,508  | ¥3,999  | ¥2,824 | 1.0  | 1.4  | 1.4  | ¥86   | ¥1,088 | ¥1,175 | 22   |
| Glaucoma                              | 7.9%  | 7.9%  | ¥31,724  | ¥17,259  | ¥2,534  | ¥1,377 | 1.0  | 1.8  | 1.8  | ¥-2   | ¥1,160 | ¥1,157 | 23   |
| Osteoporosis                          | 1.0%  | 0.7%  | ¥132,460 | ¥89,930  | ¥1,325  | ¥613   | 1.5  | 1.5  | 2.2  | ¥339  | ¥373   | ¥712   | 24   |
| COPD                                  | 2.1%  | 1.2%  | ¥51,152  | ¥33,283  | ¥1,102  | ¥395   | 1.8  | 1.5  | 2.8  | ¥393  | ¥315   | ¥707   | 25   |
| Lung cancer                           | 0.3%  | 0.2%  | ¥164,462 | ¥16,193  | ¥452    | ¥35    | 1.2  | 10.2 | 12.8 | ¥48   | ¥369   | ¥417   | 26   |
| Schizophrenia                         | 1.5%  | 1.0%  | ¥59,775  | ¥42,232  | ¥771    | ¥435   | 1.4  | 1.4  | 1.8  | ¥220  | ¥116   | ¥336   | 27   |
| inflammatory bowel disease            | 0.8%  | 0.7%  | ¥79,156  | ¥55,174  | ¥628    | ¥376   | 1.2  | 1.4  | 1.7  | ¥90   | ¥163   | ¥252   | 28   |
| Gastric cancer                        | 0.2%  | 0.1%  | ¥140,981 | ¥115,400 | ¥317    | ¥67    | 3.3  | 1.2  | 4.7  | ¥196  | ¥64    | ¥250   | 29   |
| Depression                            | 5.8%  | 6.3%  | ¥32,781  | ¥26,028  | ¥1,850  | ¥1,627 | 0.9  | 1.3  | 1.1  | ¥-141 | ¥365   | ¥223   | 30   |
| Fractures                             | 2.2%  | 2.0%  | ¥36,841  | ¥29,576  | ¥803    | ¥590   | 1.1  | 1.2  | 1.4  | ¥48   | ¥165   | ¥213   | 31   |
| Dementia                              | 0.0%  | 0.1%  | ¥504,066 | ¥33,304  | ¥126    | ¥23    | 0.4  | 15.1 | 5.6  | ¥-115 | ¥219   | ¥103   | 32   |
| Colorectal cancer                     | 0.4%  | 0.4%  | ¥65,649  | ¥47,195  | ¥246    | ¥163   | 1.0  | 1.4  | 1.5  | ¥9    | ¥73    | ¥83    | 33   |
| Cerebrovascular diseases              | 2.6%  | 2.2%  | ¥29,454  | ¥35,819  | ¥785    | ¥805   | 1.2  | 0.8  | 1.0  | ¥124  | ¥-145  | ¥-21   | 34   |
| Gout                                  | 3.2%  | 3.8%  | ¥16,217  | ¥17,965  | ¥516    | ¥679   | 0.8  | 0.9  | 0.8  | ¥-101 | ¥-62   | ¥-163  |      |

**Table 2: Comparison of Prevalence, PPPM, and PMPM of H and L groups, Male, Age 45-55.**  
H group: High physician density group; L group: Low physician density group  
PPPM: Cost Per Patient Per Month; PMPM: Cost Per Member Per Month

### Results

- The L group included 468,920 person-months from Ibaraki, Shizuoka and Gifu, while the H group included 274,624 person-months from Okayama, Kochi, Fukuoka, and Tokushima (Table 1).
- The largest difference was observed among men aged 45-54 years, with PMPM expenditure 1.5 times higher in the H group (Figure 1).
- The difference was most pronounced for other diseases of the digestive system including gastroesophageal reflux disease (H-L PMPM ¥5,270, H/L ratio 1.7).
- Decomposition showed no difference in prevalence but a substantial difference in PPPM (ratio 1.6) (Table 2).

### Conclusions

- Higher physician density was associated with higher healthcare expenditure, driven primarily by higher expenditure per patient.
- These findings may suggest the presence of physician-induced demand.