

# Structure of dysphagia rehabilitation provision in community settings: A nationwide analysis of medical and dental services using open claims data in Japan

**Kaori Kojima**

National Center for Geriatrics and Gerontology

**Tomoya Myojin**

`t-myojin@hama-med.ac.jp`

Hamamatsu University School of Medicine

**Yoshikazu Kobayashi**

Fujita Health University

**Toshiyuki Ojima**

Hamamatsu University School of Medicine

**Naoki Takashi**

National Center for Geriatrics and Gerontology

**Shosuke Ohtera**

National Center for Geriatrics and Gerontology

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## Research Article

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# Abstract

## Background

Japan is experiencing an unprecedented demographic shift toward a ‘super-aged’ society, and aspiration pneumonia prevention has become a critical public health priority. Although dysphagia rehabilitation is essential to maintain oral intake in older adults, the regional structure of its delivery across Japan remains unclear. We aimed to investigate nationwide patterns of outpatient dysphagia rehabilitation provided by the medical and dental sectors using the National Database of Health Insurance Claims (NDB) Open Data and to explore the association of outpatient dysphagia rehabilitation with dental home-visit services.

## Methods

This ecological cross-sectional study analyzed NDB Open Data and public statistics (fiscal year 2023). The number of outpatient dysphagia rehabilitation and dental home-visit claims per 100,000 population aged  $\geq 65$  years were calculated by prefecture. Regional disparities were evaluated using the coefficient of variation and maximum-to-minimum ratio. The association between dental dysphagia rehabilitation and dental home-visit services was assessed using Pearson's correlation coefficient.

## Results

The mean number of national outpatient claims per 100,000 population aged  $\geq 65$  years was substantially higher in the dental sector (647.9) than that in the medical sector (121.1). In contrast, inpatient rehabilitation was overwhelmingly dominated by the medical sector, revealing a two-tier delivery structure. Marked regional disparities were observed in dental dysphagia rehabilitation (coefficient of variation = 1.00; maximum-to-minimum ratio = 151.4). A moderate positive correlation was found between the volume of dental home-visit services and dental dysphagia rehabilitation claims ( $r = 0.58$ , 95% confidence interval: 0.35–0.74,  $p < 0.001$ ). Prefectures with higher medical sector claims tended to have relatively fewer dental claims, suggesting a structural divergence in service delivery by region.

## Conclusions

Outpatient dysphagia rehabilitation in Japan appears to be primarily delivered by the dental sector, and a moderate association was observed with the local dental home-visit infrastructure. The substantial regional imbalances identified in this study suggest a potential structural dependency on local dental resources. To improve equitable access to dysphagia care regardless of residence, strengthening dental

home-visit systems and promoting multidisciplinary collaboration between the medical and dental sectors within the framework of community-based integrated care would be desirable.

## Background

Japan is experiencing an unprecedented transition to a 'super-aged' society. Nationally, pneumonia, including aspiration pneumonia, is one of the leading causes of death in older adults [1]. Approximately 50% of the older adults in Japan have some degree of swallowing dysfunction [2]. Thus, the prevention and management of dysphagia represents a critical clinical challenge in community care.

Dental care in Japan is integrated into the universal health insurance system. The system covers a wide range of treatments from dental caries and periodontal management and prosthetic fabrication to oral surgery. Patient copayment rates are set at 30% for working-age adults and 10% for those aged 75 years and older (20–30% for higher-income individuals), enabling continuous dental management with limited financial barriers [3]

Dysphagia rehabilitation is widely implemented as an important intervention for patients with swallowing disorders. In Japan, a multidisciplinary team approach involving physicians, dentists, and speech-language-hearing therapists is recommended [4]. In inpatient settings, speech-language-hearing therapists play a central role under physician supervision [5]. The importance of swallowing assessment in dental home care has been emphasized in outpatient and home-based settings [6], and continued provision of oral care and dysphagia rehabilitation has been associated with improved oral status and intake in community-dwelling older adults [7, 8]. Furthermore, dysphagia rehabilitation delivered in home-care settings has been shown to result in the maintenance or improvement of Functional Oral Intake Scale (FOIS) scores at the one-year follow-up in most patients [9]. Similar outcomes have been reported in outpatient settings, with 75.3% of patients maintaining or improving FOIS scores at the one-year follow-up [10].

Although evidence supporting the clinical effectiveness of dysphagia rehabilitation continues to accumulate, the extent of the implementation of such interventions at the community level remains unclear. In Japan, dysphagia rehabilitation is reimbursed under the billing code "feeding function therapy," which is divided into medical feeding function therapy—performed by physicians—and dental feeding function therapy—performed by dentists. Both are covered under national health insurance [11]. The implementation of dysphagia rehabilitation may vary considerably depending on the local healthcare resources and context.

In particular, dental home-visit services may play an important role in providing continuous dysphagia support to community-dwelling older adults. Previous reports have shown that oral care and dysphagia rehabilitation are among the most frequently provided interventions in home-visit dental practice [8]. However, how the availability of dental home-visit care is associated with the overall provision of dysphagia rehabilitation at the community level or what differences exist between the medical and dental sectors in their contributions to outpatient dysphagia rehabilitation remain unclear.

Many countries have established claims databases to characterize the current state of healthcare delivery. Examples include the Research Data Assistance Center in the United States and L'Assurance Maladie in France [12, 13]. Similarly, Japan maintains a comprehensive national healthcare database—the National Database of Health Insurance Claims and Specific Health Checkups (NDB). The NDB encompasses patients receiving outpatient and home-visit care. Analyzing these billing records is valuable for identifying the actual provision and demand for dysphagia rehabilitation at the community level and for informing effective healthcare planning.

Therefore, in this study we investigated the nationwide trends in outpatient dysphagia rehabilitation provided by the medical and dental sectors using the NDB Open Data. In addition, we analyzed the association of the provision of outpatient services with dental home-visit services and clarified regional disparities in the provisional structure of dysphagia rehabilitation across Japan.

## Methods

### Study Design

This was a nationwide ecological cross-sectional study. Using the NDB Open Data and public statistics for the fiscal year 2023, we assessed the provision of outpatient “feeding function therapy” in the medical and dental sectors by prefecture and analyzed its association with dental home-visit services. As this study focused on the structure of community-based dysphagia rehabilitation delivery, inpatient claims were excluded, and only outpatient claims were analyzed.

## Data Sources

### NDB Open Data

In Japan, under the universal health insurance system, virtually all medical and dental services are electronically claimed, and anonymized claims data are stored in the NDB by the Ministry of Health, Labour, and Welfare. A portion of the aggregated information in the NDB Open Data is publicly available by medical procedure and prefecture and has been widely used to characterize the actual state of healthcare delivery. For this study, we obtained the claims data for “feeding function therapy” and dental home-visit services from the NDB Open Data for the fiscal year 2023 (published by the Ministry of Health, Labour and Welfare).

For prefectural claims, the counts of medical feeding function therapy and dental feeding function therapy session duration categories ( $\geq 30$  minutes and  $< 30$  minutes) were not distinguished; rather, aggregated totals were used.

For dental home-visit services, prefectural claims counts for dental home visits 1, 2, and 3 (clinics and hospitals) were extracted from the “dental home-visit related items” category and aggregated to

comprehensively capture the home dental-care infrastructure in each region.

## Population Statistics

For population standardization, the information about the population aged  $\geq 65$  years by prefecture for the fiscal year 2023 was obtained from the public statistics of the Statistics Bureau of the Ministry of Internal Affairs and Communications.

## Variables and Indicators

The primary indicators used in this study were as follows.

### Outpatient Indicators (Primary Analysis)

1. The prefectural claim counts included medical feeding function therapy, dental feeding function therapy, and dental home-visit services.
2. Population-standardized indicators of the number of claims per 100,000 population aged  $\geq 65$  years were calculated for each indicator to adjust for differences in age composition across the prefectures.
3. The medical-to-dental ratio was used to compare the provisional structure of outpatient medical and dental feeding function therapies. The medical (billing code H004)/dental (billing code H001) ratio was calculated by prefecture, and the distributions of both indicators were compared.
4. The total supply indicator per 100,000 population claim counts for medical and dental feeding function therapies was determined to evaluate the total volume of dysphagia rehabilitation provided in each region.

## Inpatient Indicators (Supplementary Analysis)

The mean, standard deviation (SD), coefficient of variation (CV), and maximum-to-minimum ratio (max/min ratio) of inpatient dysphagia rehabilitation claims by prefecture were calculated separately for the medical and dental sectors.

## Statistical Analysis

The association between dental feeding function therapy claims per 100,000 population aged  $\geq 65$  years and dental home-visit claims by prefecture was assessed using Pearson's correlation coefficient. To evaluate the magnitude of regional disparities, the CV and max/min ratio were calculated for each indicator. The relationship between medical and dental feeding function therapy claims was descriptively compared by prefecture to identify the structural imbalances in regional provisional patterns. All statistical analyses were performed using R software (version 4.5.2; R Foundation for Statistical Computing, Vienna, Austria).

# Results

Table 1 presents the national totals for fiscal year 2023. Total outpatient medical dysphagia rehabilitation (H004) claims were 46,184, and dental dysphagia rehabilitation claims were 366,294, with the dental sector accounting for approximately 89% of all outpatient dysphagia rehabilitation claims. Total dental home-visit claims were 10,055,990, covering a population of 36,226,000 aged ≥ 65 years nationwide (Table. 1).

Table 1  
National volume of dysphagia rehabilitation and dental home visit services in Japan

| Item                                                                       | Value      |
|----------------------------------------------------------------------------|------------|
| Total medical dysphagia rehabilitation claims                              | 46,184     |
| Total dental dysphagia rehabilitation claims                               | 366,294    |
| Total dental home visit claims                                             | 10,055,990 |
| Population aged ≥ 65 years                                                 | 36,226,    |
| Dysphagia rehabilitation claims per per 100,000 population aged ≥ 65 years | 1,011.14   |
| Dental home visit claims per per 100,000 population aged ≥ 65 years        | 27,759.04  |

## Outpatient Provision of Medical and Dental Feeding Function Therapies

The national mean number of outpatient “feeding function therapy” claims per 100,000 population aged ≥ 65 years in the fiscal year 2023 was 647.9 for dental feeding function therapy, and 121.1 for medical feeding function therapy, with the dental sector providing substantially more services than the medical sector.

The medical-to-dental ratio (H004/H001) for outpatient services indicated that the dental sector was the primary provider of “feeding function therapy” in most of the prefectures (Fig. 1).

## Regional Disparities

The CV for dental feeding function therapy claims per 100,000 population aged ≥ 65 years was extremely high at 1.00, indicating large disparities across the prefectures. The CV for medical feeding function therapy was 0.70, indicating that although the CV was less extreme than that in the dental sector, marked regional variation was also present in the medical sector.

The CV for the total combined supply of medical and dental feeding function therapies was 0.85, confirming substantial regional disparities in the overall provision of dysphagia rehabilitation.

The max/min ratio was 151.4 for dental feeding function therapy and 37.8 for medical feeding function therapy, demonstrating considerable inequity in the access to dysphagia rehabilitation across the

regions (Table 2).

Table 2  
Regional variation in dysphagia rehabilitation services across prefectures

| Service category                 | Mean  | SD    | Coefficient of variation (CV) | Max/Min ratio |
|----------------------------------|-------|-------|-------------------------------|---------------|
| Dental dysphagia rehabilitation  | 647.9 | 649.7 | 1.00                          | 151.4         |
| Medical dysphagia rehabilitation | 121.4 | 85.9  | 0.70                          | 37.8          |
| Total (Medical + Dental)         | 769.3 | 655.5 | 0.85                          | 35.6          |

Mean, standard deviation (SD), coefficient of variation (CV), and maximum-to-minimum (max/min) ratios of dysphagia rehabilitation claims per 100,000 population aged ≥ 65 years are shown for dental, medical, and total services.

## Association with Dental Home-Visit Services

A moderate positive correlation was found between dental feeding function therapy claims per 100,000 population aged ≥ 65 years and dental home-visit claims by prefecture (Pearson  $r = 0.58$ , 95% confidence interval [CI]: 0.35–0.74,  $p < 0.001$ ) (Fig. 2).

## Structural Divergence Between Medical and Dental Provision

When medical and dental feeding function therapy claims were compared by prefecture, regions with more medical claims tended to have fewer dental claims (Additional file Fig. 1). These findings suggest that the provisional structure of dysphagia rehabilitation may be skewed toward either the medical or dental sectors, depending on the region.

## Regional Disparities in Inpatient Dysphagia Rehabilitation

The regional disparities in inpatient dysphagia rehabilitation are presented in Appendix Table 1.

The mean number of medical inpatient rehabilitation claims per 100,000 population aged ≥ 65 years was 187,647.6 (standard deviation [SD]: 174,530.6), with a CV of 0.93. The max/min ratio was 30.55, indicating a marked regional variation in medical inpatient provision.

In contrast, the mean for dental inpatient rehabilitation was extremely low at 317.2 (SD: 522.3) with a very high CV of 1.65. The max/min ratio reached 190.73, reflecting the extremely large regional disparities in the provision of dental inpatient dysphagia rehabilitation.

## Setting-Specific Differences in the Medical and Dental Provisional Structure

A clear difference in the primary providers of dysphagia rehabilitation was observed between the inpatient and outpatient settings.

Provision by the medical sector was overwhelmingly dominant in the inpatient settings, with a mean of 187,648 medical inpatient rehabilitation claims, compared to 317 for the dental sector.

In the outpatient settings, dental feeding function therapy was the predominant modality, with 647.9 dental claims per 100,000 population aged  $\geq 65$  years compared to 121.1 for the medical sector.

Collectively, these findings demonstrate the existence of a nationwide two-tiered delivery structure in which the medical sector dominates inpatient settings, whereas the dental sector plays a central role in outpatient care.

## Discussion

Using the NDB Open Data, we compared the nationwide provision of outpatient feeding function therapy between the medical and dental sectors and analyzed its association with dental home-visit services, revealing a structure in which outpatient feeding function therapy is concentrated in the regions with stronger dental home-visit infrastructure. Although “feeding function therapy” can be claimed by both sectors, by design, its delivery appears to be operationally linked to the dental home-visit system. This suggests that the maturity of the local dental healthcare infrastructure may structurally determine the volume of outpatient feeding function therapy services provided in each region.

## Association Between Dental Home-Visit Infrastructure and Dental Feeding Function Therapy

This study revealed a moderate positive correlation between the volume of dental home-visit services and dental feeding function therapy claims ( $r = 0.58$ , 95% CI: 0.35–0.74,  $p < 0.001$ ). This finding suggests that regions with more developed home dental-care infrastructure tend to provide greater volumes of dental dysphagia rehabilitation. Previous studies have highlighted the importance of swallowing assessment in home dental care [6] and have shown that the continued provision of oral care and dysphagia rehabilitation for older adults receiving home medical care is associated with improvements in oral status and intake function [7, 8]. Oral care and dysphagia rehabilitation are among the most frequently provided interventions in home-visit dental practice, underscoring the important role of home-visit dental services in managing dysphagia [8]. The present findings extend these clinical observations to the national level and are significant in quantitatively demonstrating that dental feeding function therapy can be delivered within the context of home-visit dental care. Although regional disparities in dysphagia rehabilitation volume have been reported [14, 15], the potential contribution of the dental home-visit infrastructure to these disparities warrants further investigation.

## Structural Divergence Between Medical and Dental Provision

The national mean medical-to-dental ratio for outpatient feeding function therapy was as low as 0.12 in our study, indicating that most of the outpatient provision was delivered by the dental sector. However, the regional analysis revealed that the prefectures with higher medical claims tended to have relatively fewer dental inpatient rehabilitation and dental home-visit claims, suggesting structural differences in provisions between the two sectors across regions. Large regional disparities were observed in both medical and dental inpatient settings. However, the disparities in dental inpatient rehabilitation was notable because of its very low overall volume and extremely large regional variation. These findings suggest that the primary provider of outpatient dysphagia rehabilitation differs by region, with a structure emerging in which the responsible sector varies across prefectures [16]. Historically, dysphagia rehabilitation has developed primarily in the medical field, and the systematic integration of dysphagia management into dental education and practice is a relatively recent development [17]. These historical factors, combined with the regional differences in healthcare resource allocation, may reflect the structural divergence observed in outpatient care provision. Furthermore, given that inadequate physician–dentist collaboration has been identified as a concern in aspiration pneumonia prevention [18], the regional disparities revealed in this study may also reflect differences in the degree of medical–dental collaboration and distribution of local healthcare resources. Our findings also clarified a setting-specific role-sharing structure in which the medical sector dominates inpatient settings and the dental sector plays a central role in outpatient care. Although inpatient services are organized around acute and convalescent care delivery systems, local dental healthcare resources appear to dominate the provision of “feeding function therapy” in outpatient settings.

## **Magnitude of Regional Disparities and Structural Challenges**

This study revealed a high CV (1.00) for dental feeding function therapy, with substantial regional variations observed in medical feeding function therapy and the total combined supply. This indicates that the nationwide provision of dysphagia rehabilitation is not uniform and is strongly dependent on the local home dental-care infrastructure and distribution of qualified professionals. “Feeding function therapy” and dental home visits differ in their billing rules and delivery formats, resulting in fundamentally different per-capita scales. Dental home visits are billed per visit, whereas “feeding function therapy” involves specialized rehabilitation with a limited number of capable/qualified providers. Although some degree of regional disparity is inherent in these structural characteristics, the magnitude of differences observed in this study was considerable. These disparities may reflect not only the variation in the number of professional types but also the maturity of the local home-care infrastructure and multidisciplinary collaboration systems [19]. In resource-limited regions, the development of support models centered on existing dental home-visit systems is an important priority.

Several factors may explain these observed regional disparities. First, with respect to professional distribution, the uneven geographic distribution of dental clinics capable of addressing dysphagia may constrain service supply capacity. Second, regarding the reimbursement structure, a billing framework based on dental home-visit services may facilitate the provision of “feeding function therapy” in regions

with established home-visit systems. Third, with respect to the maturity of home-care infrastructure, regions with well-developed multidisciplinary collaborations and community-based integrated care systems may more readily incorporate swallowing assessments and interventions into their care pathways. Although these factors cannot be directly verified from the data in this study, they collectively suggest that regional disparities in outpatient feeding function therapy are shaped not only by differences in demand, but also by structural factors on the supply side. The large differences in the provision volume existing across the regions, despite both sectors being eligible to bill for “feeding function therapy”, suggests that the distribution of healthcare resources and the development of dental home-visit systems are likely contributing factors.

Given that approximately half of the older adult population exhibits swallowing dysfunction [2], the prevention of aspiration pneumonia remains a critical public health priority. To our knowledge, this is the first study to quantitatively demonstrate that community-based dysphagia rehabilitation provisions may be structurally dependent on the dental home-visit system.

However, dysphagia is a multifaceted condition, and dental approaches alone have inherent limitations. From a risk management perspective, strengthening multidisciplinary collaborations among physicians, nurses, speech-language-hearing therapists, and registered dietitians is essential [20]. Therefore, from a policy standpoint, redefining the role of dental home-visit services within the community-based integrated care framework and promoting the development of an implementable collaborative network that enables seamless coordination among the medical, dental, and long-term care sectors are important.

## Limitations

This study had several limitations. First, this was a cross-sectional analysis using data from a single fiscal year from the NDB Open Data. As such, the study represents a secondary analysis of aggregated public statistics. Accordingly, temporal trends and causal relationships cannot be established. A rigorous verification using individual-level data is necessary for a detailed analysis of provider characteristics and causal inferences. Second, this study used the number of reimbursement claims as the primary indicator, and the actual content of the interventions and clinical outcomes were not directly evaluated. Claims data for outpatient services may not adequately capture the intensity or quality of the dysphagia intervention. Third, although “feeding function therapy” can be claimed by both the medical and dental sectors, only one sector can bill a given patient. Regional differences may exist in the interpretation of eligibility criteria and operational practices by local insurers and review bodies, and the possibility that these differences contributed to the regional variations in claim counts cannot be excluded. Finally, this analysis was based on the fiscal year 2023 reimbursement system, and subsequent revisions to the fee schedule have modified the evaluation framework for oral rehabilitation related to oral hypofunction. As such policy changes may affect future billing practices and provisional structures, no projections were made in this study. Therefore, further follow-up studies using post-revision data are warranted.

## Conclusion

Using nationwide public data, this study clarified the provisional structure and regional disparities of outpatient feeding function therapy and demonstrated that the dental home-visit infrastructure may play an important role in community-based dysphagia rehabilitation delivery. As the aging population continues to increase, redefining the role of community dental care, including dental home-visit services, and building an integrated dysphagia support system through coordinated collaboration among medical, dental, and multidisciplinary professionals are essential for sustainable dysphagia management and the prevention of aspiration pneumonia.

## Abbreviations

CI, confidence interval; CV, coefficient of variation; FOIS, Functional Oral Intake Scale; H004, medical feeding function therapy treatment code; H001, dental feeding function therapy treatment code; max/min, maximum-to-minimum (ratio); NDB, National Database of Health Insurance Claims and Specific Health Checkups; SD, standard deviation

## Declarations

### **Ethics approval and consent to participate**

This study used publicly available, fully anonymized, and open data. According to the Ethical Guidelines for Medical and Health Research Involving Human Subjects, institutional review board approval and informed consent were not required as the dataset contained no personal identifiers.

### **Consent for publication**

The requirement for informed consent was waived because personal patient information was not used in this study.

## Competing interests

The authors have no conflicts of interest to declare.

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# Author Contribution

KK conceptualized the study and design, curated the data, performed formal analysis, and drafted the manuscript. TM participated in critical review and revision of the manuscript and provided expert input on clinical practice and health economics. YK participated in critical review and revision of the manuscript and provided expert input in clinical practice and dentistry. TO, NT, and SO participated in critical review and revision of the manuscript. All authors made substantial contributions to this study and approved the final manuscript.

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We thank our colleagues who provided general comments during the development of this study.

# Data Availability

The datasets analyzed in this study are publicly available from the National Database (NDB) Open Data published by the Ministry of Health, Labour and Welfare of Japan. The data can be accessed at: [https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0177221\\_03.html](https://www.mhlw.go.jp/stf/seisakunitsuite/bunya/0177221_03.html)

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Figures

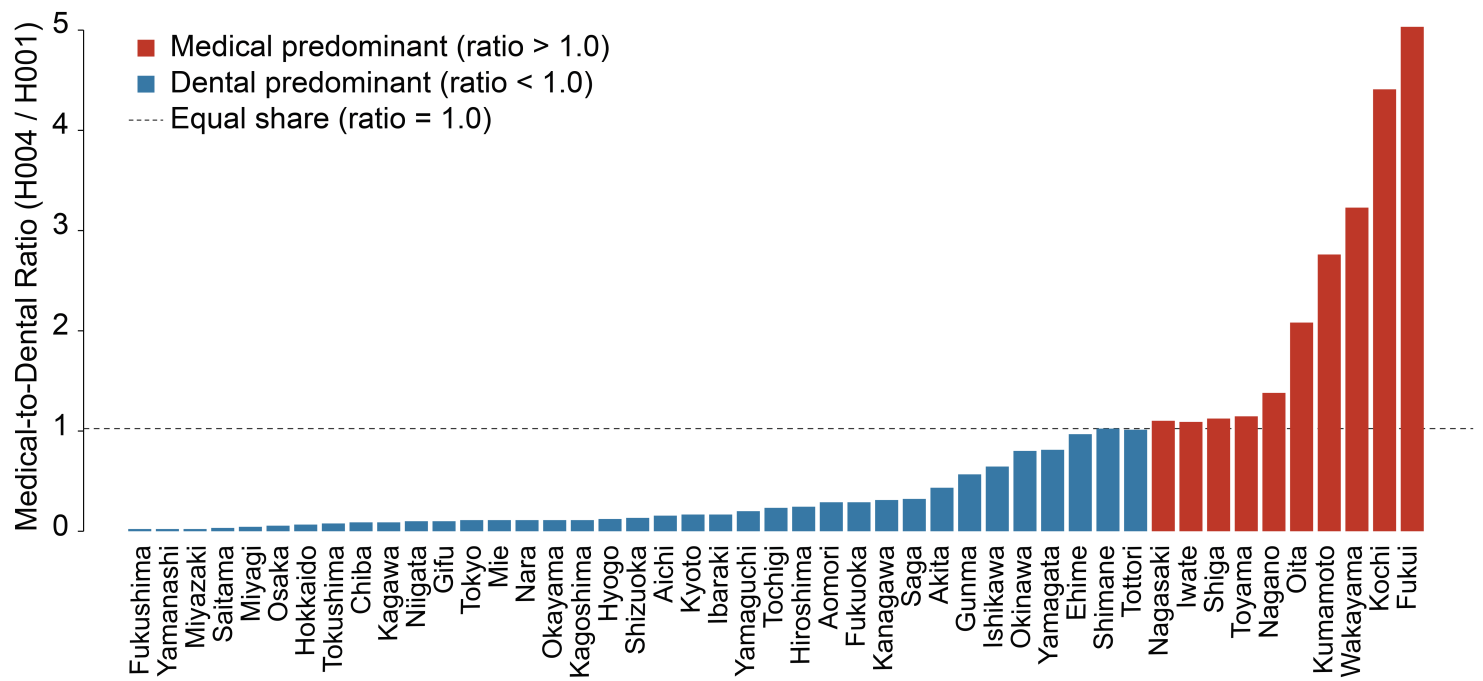


Figure 1

Prefectural variation in outpatient dysphagia rehabilitation services in Japan (fiscal year 2023)

Number of dysphagia rehabilitation claims per 100,000 population aged ≥65 years by prefecture, categorized by medical and dental services.

Ratio of medical to dental claims (H004/H001). The horizontal dashed line indicates a ratio of 1.0, representing an equal distribution. Blue bars indicate prefectures where dental claims were predominant (ratio < 1.0), whereas red bars indicate those where medical claims were predominant (ratio > 1.0).

Metric Definition: The vertical axis represents the ratio of medical claims to dental claims.

Baseline: The dashed line (ratio = 1.0) indicates an equal distribution between medical and dental claims.

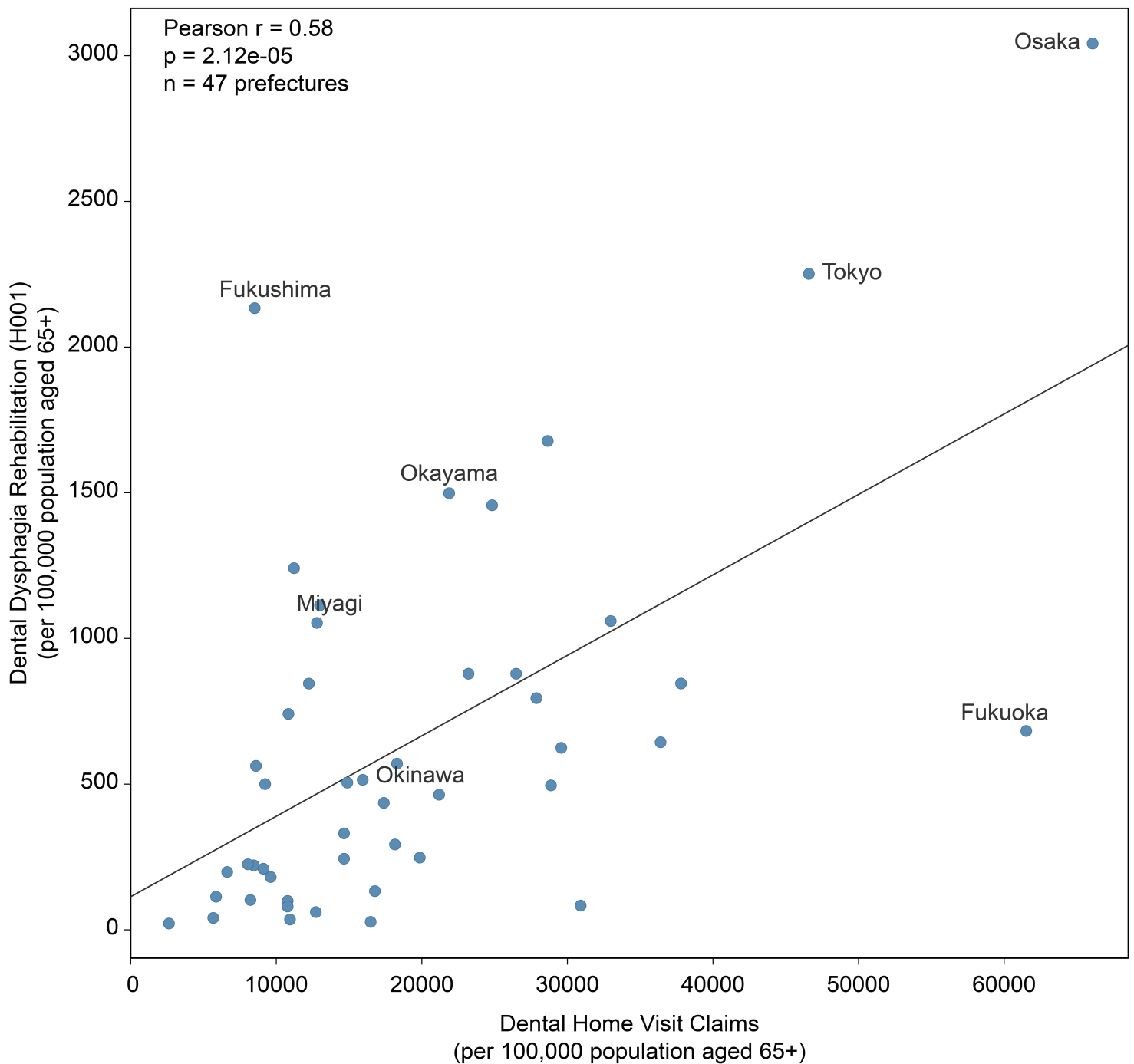


**Figure 2**

**Correlation between dental home-visit claims and dental dysphagia rehabilitation claims by prefecture (fiscal year 2023)**

Prefectures ( $n = 47$ )

Prefectural variation in dental dysphagia rehabilitation claims and dental home-visit claims per 100,000 population aged  $\geq 65$  years is shown. Each point represents one prefecture. Although prefectures with higher volumes of dental home-visit services tended to have higher claim rates, substantial dispersion

was observed, indicating that a strong dental home-care infrastructure does not uniformly translate into a higher provision of dysphagia rehabilitation services.

## Supplementary Files

This is a list of supplementary files associated with this preprint. Click to download.

- [additionalfileltable1.xlsx](#)
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