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Research Article

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Low-cost, high-volume healthcare services contribute the most to low-value care spending in Japan

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Abstract

Introduction: High-income countries face the urgent task of reducing healthcare spending incurred by low-value care. However, evidence is limited as to whether high-cost or low-cost low-value care services contribute more to total unnecessary healthcare spending, especially outside the United States.

Methods: Using a claims database covering all age groups in Japan from April 2022 to March 2023 (approximately 2 million beneficiaries, or 2% of the total population), we examined 52 low-value care services using two versions of claims-based measures with different sensitivities and specificities (narrower and broader definitions).

Results: We identified 3.1 million (narrower) to 3.7 million (broader) episodes of low-value care services, accounting for 42.6-67.2 million USD, or 0.7%-1.0% of total healthcare spending. In the narrower definition, lower-cost services (<80 USD per service) contributed to virtually all episodes of low-value care and 67% of total unnecessary healthcare spending—far exceeding the 33% attributed to the higher-cost services (≥80 USD).

Conclusion: This finding suggests that compared with focusing solely on higher-cost low-value care services, targeting the reduction of frequently performed, lower-cost low-value care services may be a more effective and efficient strategy for reducing wasteful spending.

Key words: low-value care; no-value care; quality of care; healthcare cost; overuse; healthcare waste.

Key points

- In a cross-sectional study of nearly two million beneficiaries examining 52 low-value care services in Japan, we identified more than 3 million episodes of such care during a 1-year period, with over one-third of individuals receiving at least one, accounting for 0.7%-1.0% of total healthcare spending.
- Lower-cost services (<80 USD per service) contributed to virtually all episodes of low-value care and over two-thirds of unnecessary spending due to low-value care, exceeding spending from the higher-cost services (≥80 USD per service).
- Focusing on frequently performed, lower-cost services may better reduce wasteful healthcare spending than targeting only high-cost services.

Introduction

As healthcare spending growth continues to outpace inflation, many high-income countries are facing the urgent task of curbing unsustainable spending growth. Reducing low-value care (LVC)—services that provide little or no net clinical benefit in specific scenarios[1-3]—is appealing to policymakers because it can eliminate wasteful spending without compromising the quality of care and patients' health outcomes. Reducing spending on LVC services has the potential to directly curb unnecessary healthcare spending, improve care quality and patient safety by minimizing over diagnosis and overtreatment, and lead to better population health outcomes by reallocating healthcare resources toward high-value services.[4]

Despite the publication of numerous guidelines, a global Choosing Wisely campaign, and decades of attention to this issue, spending on LVC services remains persistent.[5-8] Several

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studies have reported problems due to the use of high-cost LVC services[9,10]—such as knee arthroscopy among patients with osteoarthritis—and their associated spending.[11-13] However, existing research has also shown that even low-cost LVC can amount to considerable unnecessary healthcare spending when provided at scale.[14,15] High- and low-cost services may differ in several respects, including the setting in which care is delivered (hospitals vs clinics), the specialty of the physician providing the service (specialists vs generalists), and the characteristics of the patient populations they target (eg, individuals with severe vs minor illnesses). Identifying whether high-cost or low-cost LVC services contribute more to total unnecessary healthcare spending is essential for prioritizing effective and efficient strategies to reduce their use.

However, evidence is limited regarding the relative contributions of high-cost and low-cost services to unnecessary healthcare spending. While existing research on this topic suggests that spending on low-cost LVC services exceeds that of high-cost LVC services,[16-18] these studies are confined to the United States (US), and it is unclear whether this finding can be generalized to countries with different healthcare systems, access to physician services, and payment models.

LVC represents a critical public health issue in Japan, as it does in the US. Japan faces the dual challenge of maintaining fiscal sustainability while ensuring patient safety amid a rapidly aging population. The widespread coverage of numerous LVC services under social insurance plans,[7,19] combined with limited perceptions of LVC provision among physicians,[20] can lead to higher healthcare spending and an increased risk of patient exposure to its adverse effects. Therefore, using a nationwide health insurance claims database in Japan, we examined how high-cost and low-cost LVC services contribute to unnecessary healthcare spending.

Study data and methods

Health systems in Japan

Japan's health system is characterized by predominantly private clinics and hospitals financed by a combination of social health insurance and cost-sharing from patients. Japanese citizens are required by law to enroll in one of the social health insurance plans (eg, either employment-based or residence-based insurance for those aged <75 years), except for individuals receiving public assistance, who represent approximately 1.6% of the population and are not required to enroll. Regardless of the plan, beneficiaries are covered under standardized benefits, such as the uniform fee schedules, the same co-insurance rates (10%-30%, varying by age categories), out-of-pocket maximum (covered by the catastrophic health insurance program), and freedom to choose any hospital or clinic (similar to Preferred Provider Organization plans in the US, although some tertiary hospitals charge an additional "first visit fee" for patients without a referral letter from a primary care physician). Insurance benefits are also standardized and include all healthcare services except for preventive services (which are financed using general tax revenues) and long-term care (covered under long-term care insurance). The majority of outpatient services are reimbursed through the fee-for-service model. The majority of inpatient care at large acute care hospitals is paid through a bundled payment called the Diagnosis Procedure Combination, which is a per diem payment system based on diagnosis and procedures (a modified version of the diagnosis-related group in the US). While these features ensure broad access to care, they may also create incentives for clinics or hospitals to increase the volume of physician visits and diagnostic tests.[21] In turn, this may facilitate the widespread provision of LVC especially in outpatient settings and influence the cost distribution of services that may explain unnecessary spending.

Data sources

We used data obtained from the DeSC claims database, a nationwide health insurance claims database compiled and maintained by DeSC Healthcare, Inc. (Tokyo, Japan).[22,23] The dataset, extracted in September 2024, included approximately 2.3 million insured individuals as of April 2023, representing about 2% of the total Japanese population. The database includes all age groups and comprises individuals from diverse socioeconomic backgrounds. It includes beneficiaries in several major social health insurance schemes in Japan: the National Health Insurance program (covering unemployed, self-employed, and retired individuals and their dependents aged <75 years); corporate health insurance societies (covering employed individuals and their dependents aged <75 years); and the Late-Stage Medical Care System (covering all individuals aged ≥75 years). Individuals from households receiving public assistance were not included in this database. Although the age distribution in the database is slightly older than that of the total Japanese population, the prevalence of major comorbidities is comparable to estimates from a national survey.[24]

The DeSC database includes the beneficiary registry, medical claims, and dispensing claims. The beneficiary registry contains an encrypted personal identifier and beneficiaries' demographics, insurance type, and region, enabling longitudinal tracking of individuals across multiple health care settings. Medical claims provide detailed information on both outpatient and inpatient care (service dates, diagnosis codes, and corresponding start and end dates). Dispensing claims document prescriptions, specifying drug names, quantities, and prescription/dispensing dates. In Japan, almost all medical claims are electronically managed through computerized systems in which all services provided to each patient are recorded on a daily basis.[25] The database we used was derived from these electronically managed claims data, allowing us to identify the information on the date of services provided. Diagnosis codes are recorded using the *International Classification of Diseases, 10th Revision* (ICD-10); drug agents are categorized according to the World Health Organization's *Anatomical Therapeutic Chemical* classification system; and tests and procedures are recorded using the *Japanese Medical Practice Codes*, a collection of standardized codes representing medical procedures, supplies, products, and services used in Japan.

Study population

We included all beneficiaries continuously enrolled in the DeSC database from April 1, 2022, through March 31, 2023 (fiscal year 2022). We required continuous enrollment over a lookback period of 1 year preceding the fiscal year 2022 and over subsequent cascade periods of one month, as some LVC services required information on medical history from the preceding year and preoperative status within one month.

LVC measurement

We identified 52 LVC services through a review of published clinical literature (Tables S1 and S2). We began with 31 LVC services detected in a previous study conducted in acute care hospital settings in Japan.[7] Next, to conduct a more comprehensive assessment; we updated this list by assembling a panel of physicians from 19 specialties. Each specialist was asked to list services within their specialty that are definitively low-value—defined as having evidence of no clinical benefit, supported by meta-analyses or multiple studies (including randomized controlled trials) showing no efficacy with minimal variability in outcomes—together with the relevant clinical evidence. Two independent physicians on the research team (A.M. and Y.K.), who are experienced in claims-based analysis, reviewed the provided clinical evidence and selected services consistently categorized as "definitely low-value" by both the specialists and the independent reviewers. They then assessed whether each service was measurable using Japanese claims data, excluding those with insufficient information or not covered by the public health insurance system (Table S3). This process resulted in the identification of 24 measurable LVC services. Finally, we combined these 24 newly validated services with the original 31 services, and after removing three duplicates, we established a final set of 52 LVC services. Details of these processes are provided in Method S1. Each service and its operational definition are presented in Table S1, with corresponding codes provided in Table S2.

To address the inherent uncertainty in quantifying LVC services using administrative claims data, we specified two versions of each LVC measure following previous studies:[1,7] a broader (more sensitive) definition and a narrower (more specific) definition. First, we created the broader definition to include all LVC, which runs the risk of misclassifying appropriate care as low-value. By adding some criteria to this broader definition, we next created the narrower definition to minimize the misclassification of appropriate care; conversely, this runs the risk of missing some LVC. For example, the prescription of antibiotics for patients diagnosed with an acute respiratory infection was classified as low-value under the broader definition. Under the narrower definition, antibiotics were considered low-value only if there was no accompanying diagnosis for which antibiotics may be appropriate. We adopted operational definitions from previous research in Japan,[7] using a consensus-based approach, with minor modifications for compatibility with the DeSC claims database. For the newly added services, definitions were established through a consensus method involving three physicians experienced in analyzing healthcare administrative data (A.M., Y.K., and Y.T.).

Spending calculations

To quantify spending associated with each LVC service, we calculated the total amount paid to healthcare providers (including patients' out-of-pocket costs) using government-set prices for each service, legally standardized across geography, clinical settings, and insurers. For 42 of 52 measures, the spending was defined as costs of the detected LVC service itself to avoid overestimation of the spending on LVC. It should be noted that although inpatient services at large hospitals in Japan are reimbursed under a per diem payment system, we followed a previous study[7] and calculated spending of detected services on a fee-for-service basis, per the Guideline for Healthcare Spending-Effectiveness Evaluation issued by the Japan Central Social Insurance Council.[26] For the remaining 10 measures, which were all procedural/surgical services, it was not possible to comprehensively specify the many codes that could be relevant to the service. Therefore, for three services often performed in the outpatient setting (eg, spinal injection for low back pain), all costs incurred during the same day of service were included in the spending estimates to capture all related costs within the same episode of care (eg, in the case of spinal injections, we included the costs of the physician's effort [examinations and procedures] as well as infusion of the drug[6]). For seven services occurring nearly exclusively in the inpatient setting (eg, carotid endarterectomy), the total cost of the hospitalization was considered as the spending estimates to capture all related costs within the same episode, given that the hospitalization occurred because of the LVC service. Details are provided in Table S2.

Statistical analysis

First, we described beneficiaries' characteristics. Second, we examined the total volume of identified LVC services and the proportion of beneficiaries who received at least one LVC from April 2022 to March 2023. As in prior research,[16,27] we primarily presented the narrower set of LVC measures to minimize the risk of misclassifying high-value care services as LVC services, even at the cost of potentially underestimating the prevalence of LVC. We also reported the associated unnecessary healthcare spending. We analyzed the total LVC volume and associated spending by age group (<18, 18-64, 65-74, and ≥75 years). We also presented estimates of national volume and spending on LVC by extrapolating the age-, sex-, and region-specific per capita volume and spending to the national population (see Method S2 for details).

Third, we examined how different service price categories (eg, low-cost vs high-cost services) contributed to the total volume and spending of LVC. Service price categories were determined based on their average per-service spending as very low (<1000 Japanese yen [JPY] or 8 US dollars [USD]; 125 JPY = 1 USD in 2022), low (1000-9999 JPY [8-80 USD]), medium (10 000–99 999 JPY [80-800 USD]), or high (≥100 000 JPY [800 USD]). Average per-service spending was calculated based on the calculated volume and associated spending for each LVC service in the total sample. Furthermore, we identified the top ten LVC services contributing to unnecessary spending in the sample and reported average per-service spending, LVC volume and associated spending, and percentage in grand total LVC spending.

Sensitivity analyses

We conducted several sensitivity analyses. First, we quantified the LVC volume and spending by using the broader set of more sensitive and less specific LVC measures instead of the narrower one. Second, we repeated the analyses using alternative price category cutoffs by classifying LVC services into quartiles based on service price. Finally, we reanalyzed the price distribution of LVC based on age-, sex-, and region-adjusted national extrapolations.

Stratified analyses

To examine how the price category distribution of LVC services varied by beneficiaries' age, we examined the proportion

Table 1. Volume and cost of low-value care services during April 2022 to March 2023, overall and by age group.

	No. of beneficiaries in our sample	Volume			Spending		
		Total LVC volume, no. of services	LVC volume per 1000 beneficiaries	No. (%) of beneficiaries receiving LVC	Total LVC cost, million JPY	LVC cost per 1000 beneficiaries (million JPY)	% of total healthcare spending within each category[a]
Overall	1 923 484	3 123 618	1623.9	696 190 (36.2)	5329.8	2.78	0.65
Stratified by age category							
<18 years	162 563	228 900	1408.1	75 219 (46.3)	79.6	0.49	0.37
18-64 years	784 945	538 102	685.5	196 337 (25.0)	915.5	1.17	0.51
65-74 years	402 795	617 534	1533.1	140 317 (34.8)	1183.3	2.94	0.56
≥75 years	573 181	1 739 082	3034.1	284 317 (49.6)	3151.4	5.50	0.77

Source: Authors' analysis of data from DeSC claims data, 2022-2023.
[a]Total healthcare spendings in our sample (denominators) were 823.7 billion, 21.5 billion, 180.9 billion, 209.8 billion, and 411.6 billion JPY for the analytic sample overall, aged <18 years, aged 18-64 years, 65-74 years, and ≥75 years.

of total LVC volume and spending in each of the price categories for different age categories (<18 years, 18-64 years, 65-74 years, and ≥75 years).

The Ethics Committee of the University of Tokyo approved this study and waived written informed consent because we retrospectively analyzed deidentified data. This manuscript follows the STROBE reporting guidelines for observational studies. This study was previously posted as a preprint on medRxiv.[28]

Study results

Volume of and spending on LVC services

The analytic sample included 1 923 484 beneficiaries (mean [SD] age, 58.6 [23.5] years; 52.7% female) (Table S4). For these beneficiaries, LVC services defined by 52 LVC measures were provided a total of 3 123 618 times from April 2022 to March 2023, corresponding to 1623.9 times per 1000 beneficiaries (Table 1). We found that 36.2% of beneficiaries (696 190 individuals) received at least one LVC services annually. In this cohort, unnecessary spending on LVC services totaled 5.3 billion JPY (42.6 million USD), corresponding to 2.78 million JPY (22.2 thousand USD) per 1000 beneficiaries. This accounted for 0.65% of the overall healthcare spending of 823.7 billion JPY (6.6 billion USD) in this cohort. Age-stratified analyses revealed that the LVC spending per 1000 beneficiaries increased with beneficiary age, from 0.49 million JPY (3920 USD) among those aged <18 years to 5.50 million JPY (44.0 thousand USD) among those aged ≥75 years. After extrapolating to the national population with age-, sex-, and region-adjustments, we calculated that the annual national volume and spending on LVC in Japan were 138.8 million services and 207.2 billion JPY (1.7 billion USD), respectively.

Cost distribution for LVC volume and spending

Price categories of very-low-cost, low-cost, medium-cost, and high-cost services consisted of 15, 18, 9, and 10 services, respectively. Among the 3 123 618 LVC services, 3 095 563 were very low cost and low cost (99.1%), compared with only 28 055 such services that were medium cost or high-cost (0.9%) (Figure 1). The total spending of very-low-cost or low-cost services in our sample (67.3% of unnecessary healthcare spending, or 3.6 billion JPY [28.7 million USD]) exceeded the total spending of medium or high-cost services (32.7% of unnecessary healthcare spending, or 1.7 billion JPY [13.9 million USD]).

Five of the top 10 LVC services contributing to unnecessary spending were derived from very-low-cost or low-cost services (Table 2). Especially, three services—including topical salicylates or long-term topical nonsteroidal anti-inflammatory drugs (NSAIDs) for chronic pain (very low cost), early imaging for acute low back pain (low cost), and injection for low back pain (low cost)—accounted for approximately half of the grand total LVC spending. All 52 measures are presented in Table S5, along with age-, sex-, and region-adjusted national extrapolations.

Sensitivity analyses

When using the broader set of LVC definitions (Table S6), a total of 3 714 442 LVC services (1931.1 per 1000 beneficiaries) were provided in 2022-2023, with 39.5% of patients receiving at least one LVC service. The associated spending in this cohort amounted to 8.4 billion JPY (67.2 million USD), representing 1.02% of total healthcare spending. National spending on LVC in Japan, adjusted for age, sex, and region and based on the broader definition, was estimated at 330.5 billion JPY (2.6 billion USD) (Table S7). The findings of the price category distribution were qualitatively unchanged when applying the broader definitions of LVC (Figure S1).

The findings of the price category distribution were also qualitatively unchanged by using alternative cutoffs based on the average spending per service (Figure S2) and when reanalyzed based on national estimates of LVC volume and spending (Figure S3).

Stratified analyses by beneficiaries' age

Very-low-cost or low-cost services accounted for most (> 99%) of the volume of LVC services across beneficiaries' age categories (Figure 2). Furthermore, total spending on very-low-cost or low-cost services exceeded that on medium- or high-cost services across all age groups.

Discussion

Using a nationwide claims database in Japan, we examined 52 LVC services and found that more than one-third of

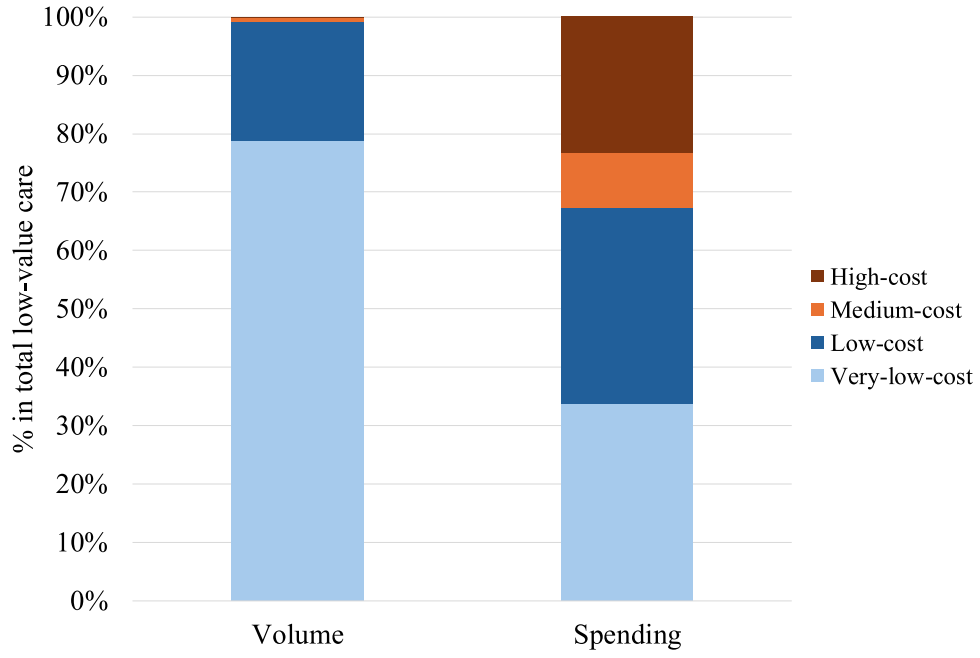

Figure 1. Proportion of total low-value care volume and spending by price category. Source: Authors' analysis of data from DeSC claims data, 2022-2023. Notes: Low-value care services were classified into four price categories according to average spending per service: very low (<1000 Japanese yen [JPY] or 8 US dollars [USD]; 125 JPY = 1 USD in 2022), low (1000-9999 JPY [8-80 USD]), medium (10 000–99 999 JPY [80-800 USD]), or high (≥100 000 JPY [800 USD]). Categories of very-low-cost, low-cost, medium-cost, and high-cost consisted of 15, 18, 9, and 10 services, respectively.

Table 2. The 10 most costly low-value care (LVC) in the total sample.

LVC service	Price (thousand JPY)[a]	Price category[a]	Sample LVC volume	Ranking by volume	Sample LVC spending (million JPY)	% in grand total LVC spending[b]
Topical salicylate or long-term topical nonsteroidal anti-inflammatory drug therapy for chronic pain	0.9	Very low	1 738 631	1	1532.3	28.7
Early imaging for acute low back pain	3.3	Low	211 914	3	693.7	13.0
Vertebroplasty for osteoporotic vertebral fractures	1463.8	High	410	31	600.2	11.3
Injection for low back pain	6.0	Low	74 125	9	444.0	8.3
Imaging for uncomplicated headache	15.4	Medium	19 477	13	299.9	5.6
Percutaneous coronary intervention for stable coronary disease	1022.6	High	242	34	247.5	4.6
Bone mineral density testing at frequent intervals	1.5	Low	148 452	5	221.9	4.2
Spinal fusion for lumber stenosis	243.6	High	644	28	156.9	2.9
Pregabalin for low back pain	1.7	Low	84 701	8	140.6	2.6
Preoperative stress testing or stress testing for stable coronary disease	31.6	Medium	4253	20	134.6	2.5

Source: Authors' analysis of data from DeSC claims data, 2022-2023.
[a]LVC services were classified into four price categories according to average spending per service: very low (< 1000 Japanese yen [JPY] or 8 US dollars [USD]; 125 JPY = 1 USD in 2022), low (1000-9999 JPY [8-80 USD]), medium (10 000–99 999 JPY [80-800 USD]), or high (≥100 000 JPY [800 USD]).
[b]Grand total LVC cost was the sum of the cost of all 52 low-value care services analyzed in our sample. See Table S5 for the volume and cost of all 52 low-value care services analyzed.

beneficiaries received at least one LVC service in 2022-2023. The spending for these 52 services alone accounted for 0.7%-1.0% of total healthcare spending, corresponding to 207-331 billion JPY (1.7-2.6 billion USD) when extrapolated to the national population with age-, sex-, and region-adjustment. Over 99% of LVC episodes were classified as very-low-cost or low-cost services, and the associated spending on these LVC services exceeded spending for medium-cost or high-cost LVC services. This pattern was consistent across all age groups, including older adults, who often require costly services due to multiple coexisting conditions. These findings suggest that frequently provided low-cost LVC services can cumulatively impose a substantial financial burden on the healthcare system, and represent an important opportunity to identify and reduce wasteful spending.

Interventions to reduce LVC may target policy, medical institutional, physician, and patient levels.[29] Macro-level approaches include redesigning supply-side interventions (eg, payment reforms through global budgets programs[30] or insurer restrictions[31]) and demand-side strategies (eg, increasing patient cost-sharing). It is important to note that increasing cost-sharing has a higher risk of the unintended consequences of curbing medically necessary care due to patients' difficulties in choosing care based on value.[32] At micro levels, data-driven

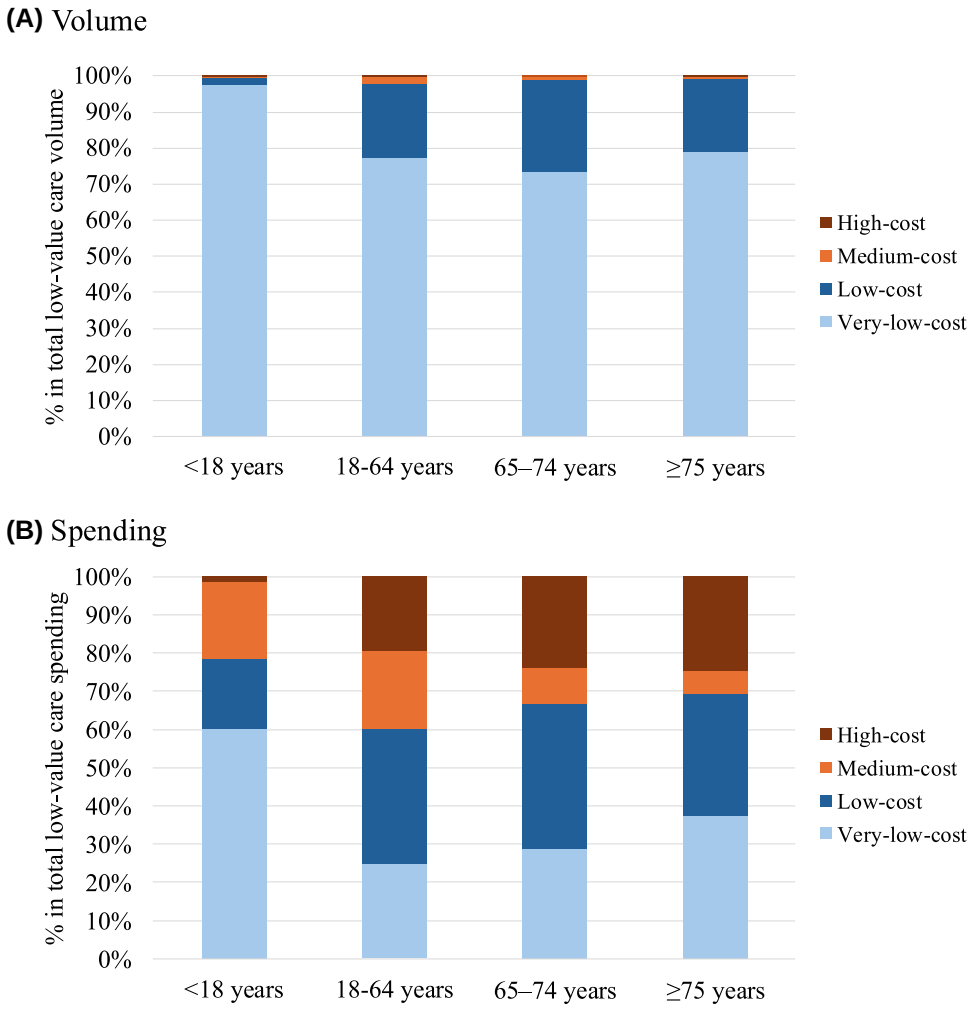

Figure 2. Proportion of total low-value care volume and spending by price category, by beneficiaries' age group. Source: Authors' analysis of data from DeSC claims data, 2022-2023. Notes: Low-value care services were classified into four price categories according to an average spending per service: very low (<1000 Japanese yen [JPY] or 8 US dollars [USD]; 125 JPY = 1 USD in 2022), low (1000-9999 JPY [8-80 USD]), medium (10 000–99 999 JPY [80-800 USD]), or high (≥100 000 JPY [800 USD]). Proportions of low-value care volume (panel A) and spending (panel B) in each price category are shown.

and non-judgmental dialogue with specialists[33] and nudging interventions using electronic health records[34] have been reported as effective. Enhancing patient education may also be effective.[35] Ultimately, multi-modal strategies combining these approaches may be most promising.[35]

While high-cost services have frequently been discussed as drivers of rising healthcare spending,[9-13] our findings suggest that even modest reductions in very-low-cost or low-cost LVC across broad patient populations can cumulatively lead to substantial reduction in unnecessary healthcare spending. Efforts to reduce high-cost services may decrease revenue for specific clinical specialties, potentially leading to political opposition from these sectors. In contrast, low-cost LVC reduction efforts are less likely to provoke such specialty-specific resistance, although the cumulative revenue reduction for an individual provider can still be substantial. Designing cost-effective interventions for reducing frequently delivered, low-cost LVC services remains a critical challenge.[36] For example, broad interventions, such as claims audits targeting all physicians, may not be efficient as de-implementation costs could exceed the low cost of the services. Furthermore, even if reduction of low-cost LVC is socially optimal in aggregate, individual physicians may have limited incentives to reduce such care. However, prior studies have shown that a large proportion of low-cost LVC is concentrated among a small portion of physicians,[37] suggesting that targeted interventions focusing on physicians providing high-volume, low-cost services may offer an efficient strategy for maximizing the impact of limited resources.[38] Another strategy may be to engage provider stakeholder organizations, such as medical associations and professional societies, to promote collective action through the development of guidelines or quality indicators aimed at avoiding LVC.

Among the top 10 LVC services contributing the most to unnecessary spending, low-cost LVC services for low back pain management were prominent. As low back pain is a leading cause of disability worldwide, including in Japan, reducing LVC in this area is a public health priority.[39] The widespread use of LVC services highlights the need to educate physicians on guidelines-based care and promote high-value, multimodal alternatives, like exercise programs, physical therapy, yoga, and cognitive behavioral therapy.[40]

Our findings on the price category distribution of unnecessary spending are consistent with previous studies in the US,

where low-cost services contributed more to total LVC spending than high-cost services.[16-18] The estimated spending due to LVC accounted for 0.65% of total healthcare spending when applying the narrower LVC definition in our study, which is similar to studies in the US that quantified 28 services for the Medicare or commercially insured population.[1,41] The frequency of LVC (approximately 1.6 per beneficiary per year) in our study was higher than in these US studies. This suggests that Japan's healthcare system is structurally prone to the provision of low-cost, high-volume LVC. In Japan, outpatient services are primarily reimbursed via a fee-for-service model. This system can create incentives for physicians to frequently provide LVC in outpatient settings. This tendency may also be influenced by the characteristics of Japan's health system, including low patient cost-sharing (particularly for those aged 75 and older, who pay only 10% unless their annual income exceeds 2 million JPY [16 000 USD], if they are the sole 75-year-old in the household) and freedom to seek healthcare from any hospital or clinic (no gatekeeping function). In contrast, inpatient care in large acute care hospitals is primarily reimbursed through the DPC system, a per diem bundled payment system based on patients' diagnosis and procedures (developed based on DRG in the US). Because payments are bundled on a per-diem basis—except for certain high-cost services that are reimbursed according on a fee-for-service basis (eg, surgeries, radiation therapy, anesthesia, and expensive drugs)—providing additional healthcare services for inpatients does not increase hospitals' reimbursement. Instead, it increases their expenditures and may consequently reduce their profits. This mechanism may function as a lever to lower utilization of healthcare services, including high-cost LVC that are often delivered in the inpatient setting.

Our study has limitations. First, as with any study measuring LVC directly,[1,7,16,27] our analysis was subject to the inherent limitations of using administrative claims data. Although claims data reliably indicate whether a procedure was performed, they often lack the detailed clinical context required to determine the appropriateness of that care—information more commonly available in medical records. To address this limitation, we selected definitions of LVC with higher specificity to better capture instances of overuse. Despite these constraints, claims data represent a cost-efficient alternative to medical record review and are particularly valuable for continuous monitoring and the development of payment policies.[1] Second, in administrative claims, physicians may record diagnosis codes for related or more severe conditions than those actually diagnosed clinically in order to avoid the payment denial from the payers. For example, given that the antibiotics prescription would not be reimbursed by the payer if the patient diagnosis is "common cold," physicians may add a diagnosis of pneumonia that enables them to prescribe antibiotics using insurance. Such diagnostic coding pattern, if exists, might lead to an underestimation of the volume and spending of low-value care. Third, although we included 52 LVC services, our measures were limited to those assessable using claims data. For example, because symptoms such as frequent or painful urination cannot be reliably identified in claims data, we could not evaluate bacteriuria screening in asymptomatic patients, which reportedly accounts for about 0.1% (1.2 billion USD) of total Medicare spending in the US.[42] Furthermore, preventive services, like prostate-specific antigen screening for older men, were not covered by public insurance in Japan and thus not captured. However, including these would likely not change our cost distribution findings, as such services are typically low-cost despite frequent use. Fourth, we did not capture downstream costs associated with LVC, such as healthcare spending on adverse events and complications of LVC,[43] which may have resulted in an underestimation of total unnecessary spending. For example, a study demonstrated that including indirect costs from downstream testing/treatments triggered by low-value preoperative electrocardiograms before cataract surgery can increase the associated costs 10-fold.[43] Despite these limitations, our estimates indicate a substantial burden of LVC services in Japan. Finally, our claims data were based on a convenient sample, leading to a slightly older population than Japan's general population. However, findings were qualitatively unchanged when stratified by beneficiaries' age or when using age-sex-region national extrapolations, suggesting generalizability to the entire Japanese population.

Conclusion

This nationwide study in Japan found that low-cost, high-volume services contributed substantially to unnecessary healthcare spending across all age groups. Rather than solely targeting high-cost services, curbing the overuse of frequently performed, lower-cost services may offer a more effective and efficient approach to reducing LVC.

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Author contributions

Dr. Miyawaki had full access to the study data and takes responsibility for the accuracy and integrity of the data and analyses. Study concept and design: Miyawaki, Tsugawa. Acquisition, analysis, or interpretation of data: All authors. Drafting of the manuscript: Miyawaki. Critical revision of the manuscript for important intellectual content: All authors. Statistical analysis: Miyawaki. Administrative, technical, or material support: All authors.

Supplementary material

Supplementary material is available at *Health Affairs Scholar* online.

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Conflicts of interest

Dr. A.M. was supported by the TRiSTAR program (the Strategic Professional Development Program for Young Researchers conducted by the Ministry of Education, Culture, Sports, Science and Technology) during the coduct of this study. He also received funding from the Ministry of Health, Labour and Welfare (23AA2004) and the Japan Society for the Promotion of Science (24K02701) for other work not related to this study; and received consulting fees from M3, Inc. and Datack Inc.; and lecture fees from Janssen Pharma (in the last 36 months). Dr. J.N.M. was supported by a National Institute of Health (NIH)/National Institute on Aging (NIA) Beeson Emerging Leaders in Aging Research Career Development Award (K76AG064392-01A1) during the conduct of this study. He was also supported by an NIH/NIA R01 award (R01AG070017-01) and grants from Arnold Ventures and the Commonwealth Fund for other work not related to this study. Dr. Y.T. received funding from NIH/NIA (R01AG068633 and R01AG082991), NIH/National Institute on Minority Health and Health Disparities (R01MD013913), and GRoW @ Annenberg for other work not related to this study; and serves on the board of directors of M3, Inc. Please see ICMJE form(s) for author conflicts of interest. These have been provided as supplementary materials.

Data availability

The DeSC database is a proprietary database owned by DeSC Healthcare, Inc.; therefore, it cannot be shared. Individuals who are interested in using the DeSC data should contact DeSC Healthcare, Inc. (https://desc-hc.co.jp/en).

Notes

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