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ORIGINAL RESEARCH

The Impact of Obesity on Readmission and Healthcare Costs in Patients with Skin and Subcutaneous Tissue Infections

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Purpose: Obesity is a global public health issue linked to worsened skin and subcutaneous tissue infections (SSTIs), complicating clinical management and increasing healthcare costs. This study aimed to evaluate obesity's influence on hospitalization duration, readmission rates, and healthcare costs among patients with SSTIs, with an emphasis on sex-specific patterns.

Patients and Methods: This retrospective cohort study analyzed data from South Korea's national healthcare database. The study population comprised adults hospitalized with SSTIs between 2015 and 2020. Obesity measures included body mass index (BMI) and waist circumference (WC), categorized by standard thresholds. Statistical analyses included Cox proportional hazards models for hospitalization duration, while multivariable logistic regression evaluated readmission risks. Healthcare costs were analyzed using generalized linear models, with sex-stratified analysis to examine clinical and economic outcome disparities.

Results: Male patients demonstrated an inverse relationship between BMI and hospitalization duration and costs, with minimal WC influence. Conversely, female patients exhibited positive associations between both obesity measures and hospitalization outcomes. SSTI-related readmissions within two years increased with rising BMI and WC across both sexes ($p < 0.001$). Estimated readmission costs showed significant sex-specific variations, increasing 55% among males with WC $\geq$ 100 cm versus < 80 cm and 132% among females with WC $\geq$ 95 cm versus < 75 cm.

Conclusion: Obesity substantially impacts SSTI clinical severity and economic costs, with distinct sex-specific disparities. Implementing tailored antimicrobial regimens, weight management strategies, and sex-specific treatment protocols is essential for outcome optimization and cost reduction. Future research should prioritize sex-specific interventions and resource allocation strategies in SSTI management.

Keywords: obesity, skin and soft tissue infections, hospital readmission, healthcare costs, body mass index, waist circumference

Introduction

Obesity has emerged as one of the most pressing global public health challenges, with its prevalence nearly tripling since 1975. As of 2022, obesity affected more than 890 million adults worldwide, while 37 million children under 5 years old and over 390 million children and adolescents aged 5–19 years were classified as overweight or obese.[1] These statistics highlight the substantial burden that obesity places on healthcare systems globally.[2] Beyond its established associations with chronic conditions such as diabetes and cardiovascular disease, obesity increases susceptibility to infections. This heightened risk stems from altered immune function, impaired wound healing, and a chronic proinflammatory state, which collectively render individuals with obesity particularly vulnerable to infections, including skin and subcutaneous tissue infections (SSTIs). SSTIs, which encompass a spectrum of conditions ranging from mild cellulitis to life-threatening necrotizing fasciitis, impose significant clinical and economic burdens through prolonged hospitalizations, recurrent readmissions, and intensive care requirements for severe cases.[3]

From an economic perspective, the impact of obesity is substantial. Recent estimates indicate that the global economic burden of overweight and obesity accounts for approximately 2–3% of the global gross domestic product

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(GDP), with healthcare expenditures markedly higher among individuals with obesity compared to those with normal weight.[1,4] Studies demonstrate that adults with obesity incur significantly higher annual medical care costs, reflecting the extensive resources required to manage obesity-related complications.[5] This cost disparity is particularly evident in conditions such as SSTIs, where obesity exacerbates clinical severity and complicates management through mechanisms including impaired immune defenses and delayed wound healing.[3,6] These factors contribute to increased hospitalization duration, elevated readmission rates, and higher healthcare costs, highlighting the urgent need to address obesity as a modifiable risk factor. Recent population-based studies have further substantiated the link between elevated body mass index and infection-related hospitalizations, reinforcing the necessity of integrating obesity into infection risk assessments and clinical protocols.[7]

Despite increasing recognition of obesity's impact on SSTIs, research remains limited, particularly regarding its influence on clinical and economic outcomes across diverse populations. Furthermore, emerging evidence suggests potential sex-specific differences in SSTI outcomes among patients with obesity, yet comprehensive studies exploring these disparities are sparse.[3,6] Cohort studies from European populations have reported similar obesity-associated infection risks in both sexes, though differential susceptibility by sex remains an area requiring further investigation.[8] Large-scale, population-based research is critically needed to elucidate the full extent of obesity's impact on SSTIs and inform the development of effective interventions.

This study aims to address these knowledge gaps by examining the relationship between obesity and SSTI-related outcomes using a national healthcare database in South Korea. Specifically, it analyzes the impact of obesity on hospitalization duration, readmission rates, and healthcare costs, with a focus on sex-specific trends. By providing robust evidence, this research seeks to inform clinical decision-making and policy development to enhance outcomes for patients with SSTIs.

Materials and Methods

Study Design and Data Source

This study employed a retrospective cohort design utilizing data from the National Health Insurance Service (NHIS) database in South Korea. The dataset comprised medical claims data from adult patients hospitalized for SSTIs in 2018, encompassing medical diagnoses, treatment protocols, and prescription records reported by healthcare providers. The database also incorporated demographic and socioeconomic parameters, along with health examination results, including body mass index (BMI) and waist circumference (WC) measurements, obtained through the NHIS. This comprehensive dataset was constructed using the NHIS Customized Research Database, facilitating detailed analyses of patient characteristics and clinical outcomes.

Study Population

The study population included patients who were hospitalized and met all of the following criteria: (i) primary or secondary diagnosis of SSTIs (L00-L08) in 2018, as classified by the International Classification of Diseases, 10th Revision (ICD-10); (ii) treatment with systemic anti-infectives according to the World Health Organization (WHO) Anatomical Therapeutic Chemical (ATC) classification system; and (iii) availability of BMI and WC measurements from health examinations conducted by the National Health Insurance Service between 2017 and 2018. Patients with conditions that could potentially confound the relationship between obesity and clinical indicators or costs were excluded, including malignant neoplasms, organ transplantation, hemophilia, and pregnancy- or childbirth-related cases. The final study population comprised 53,655 adult patients hospitalized for SSTIs, consisting of 28,904 males (53.9%) and 24,751 females (46.1%).

Obesity Classification

The BMI classification in this study followed standards established by the WHO for the Asian population and clinical guidelines from the Korean Society for the Study of Obesity.[9,10] Study participants were stratified into six BMI groups:

underweight (< 18.5 kg/m²), normal weight (18.5–22.9 kg/m²), and overweight (23.0–24.9 kg/m²), Class I obesity (25.0–29.9 kg/m²), Class II obesity (30.0–34.9 kg/m²), and Class III obesity (≥ 35.0 kg/m²).

The WC categorization followed clinical guidelines from the Korean Society for the Study of Obesity, which defines abdominal obesity as a WC ≥ 90 cm in males and ≥ 85 cm in females. WC measurements were stratified into six sex-specific categories.[9,11] Female categories were defined as: Category 1 (< 75 cm), Category 2 (75.0–79.9 cm), Category 3 (80.0–84.9 cm), Category 4 (85.0–89.9 cm), Category 5 (90.0–94.9 cm), and Category 6 (≥ 95.0 cm). Meanwhile, male WC categories comprised: Category 1 (< 80 cm), Category 2 (80.0–84.9 cm), Category 3 (85.0–89.9 cm), Category 4 (90.0–94.9 cm), Category 5 (95.0–99.9 cm), and Category 6 (≥ 100.0 cm).

Variables and Measurements

The analytical framework incorporated three categories of independent variables: obesity indicators, patient characteristics, and antibacterial use patterns. Obesity indicators comprised BMI and WC measurements obtained during routine health examinations to assess patients' weight status and abdominal fat distribution. Patient characteristics encompassed demographic and health-related parameters, including age, sex, and the Charlson Comorbidity Index (CCI)—which quantifies comorbid conditions affecting patient outcomes, income level, residential area classification (metropolitan or nonmetropolitan), and treatment facility type.[12] Antibacterial agents were categorized according to the WHO ATC classification system (third level).

Outcome variables comprised four key metrics capturing clinical and economic dimensions of patient care: hospitalization duration (length of hospital stay), hospitalization costs, readmission rates, and readmission costs. Length of stay, measured in days from admission to discharge, quantified the duration of inpatient treatment and recovery. Hospitalization costs, calculated in US dollars (USD), represented total expenditures associated with the inpatient episode, offering a financial perspective on the treatment's impact and resource utilization.

The analysis of readmission rates examined SSTI-related readmissions within a two-year postdischarge period, serving as a key indicator of treatment efficacy and recovery outcomes, as higher readmission rates could suggest challenges in long-term management or recovery from SSTIs. Readmission costs were estimated using a two-part model to account for cost variability. Bootstrapping methods were applied to enhance estimate precision and provide a comprehensive assessment of readmission-associated economic burden.

Statistical Analysis

This study employed multiple statistical methods to examine obesity's influence on clinical and economic outcomes. Initial analyses utilized descriptive statistics to compare patient characteristics by sex, with t-tests for continuous variables and chi-square tests for categorical variables, identifying significant sex-specific differences in demographic and clinical parameters. The length of hospital stay and hospitalization costs were analyzed across BMI and WC levels to elucidate the relationship between obesity indicators and clinical and economic outcomes.

Cox proportional hazard models generated hazard ratios (HRs) for SSTI-related readmissions within two years, stratified by BMI and WC levels. The models incorporated adjustments for potential confounding variables, including sex, age, CCI score, and metropolitan residence, to assess the likelihood of readmission while accounting for demographic and clinical variability.

Per-patient readmission costs were estimated using two-part models.[13] The first step employed logistic regression to calculate SSTI-related readmission probabilities, stratified by BMI and WC levels, with sex, age, CCI score, and metropolitan residence as explanatory variables. The second step utilized a generalized linear model with a gamma distribution and log link function to model readmission costs among readmitted patients. The combined model results generated expected readmission costs for each BMI and WC category. Bootstrap resampling with 1000 iterations provided robust cost estimates, with the mean of resampled estimates serving as the final expected cost.

Results

Analysis revealed significant sex differences in baseline characteristics. Male patients were younger (53.5 ± 15.4 years) compared to females (57.6 ± 15.0 years; $p < 0.001$) and exhibited higher BMI (25.4 ± 3.9 kg/m² vs 24.5 ± 3.9 kg/m²; $p < 0.001$) and WC (87.4 ± 9.7 cm vs 80.4 ± 10.1 cm; $p < 0.001$). Additional demographic and clinical characteristics, including income level and CCI score, are presented in Table 1.

Table 1 Characteristics of Patients with SSTIs

	Male	Female	Total	*p*-value[a]
	N (%)	N (%)	N (%)	
N	28,904	24,751	53,655	
Age (year)				
(Mean±SD)	53.5 ± 15.4	57.6 ± 15.0	55.4 ± 15.3	< 0.001
20–49	11,583 (40.1)	6863 (27.7)	18,446 (34.4)	< 0.001
50–64	10,023 (34.7)	9777 (39.5)	19,800 (36.9)	
≥ 65	7298 (25.2)	8111 (32.8)	15,409 (28.7)	
Body mass index (kg/m^2)				
(Mean ± SD)	25.4 ± 3.9	24.5 ± 3.9	25.0 ± 3.9	< 0.001
<18.5	547 (1.9)	816 (3.3)	1363 (2.5)	< 0.001
18.5–22.9	6945 (24.0)	8461 (34.2)	15,406 (28.7)	
23.0–24.9	6567 (22.7)	5460 (22.1)	12,027 (22.4)	
25.0–29.9	11,752 (40.7)	7864 (31.8)	19,616 (36.6)	
30.0–34.9	2485 (8.6)	1786 (7.2)	4271 (8.0)	
≥ 35.0	608 (2.1)	364 (1.5)	972 (1.8)	
Waist circumference				
(Mean ± SD)	87.4 ± 9.7	80.4 ± 10.1	84.2 ± 10.5	< 0.001
Category 1	5562 (19.2)	7328 (29.6)	12,890 (24.0)	< 0.001
Category 2	5984 (20.7)	4766 (19.3)	10,750 (20.0)	
Category 3	6468 (22.4)	4740 (19.2)	11,208 (20.9)	
Category 4	5083 (17.6)	3590 (14.5)	8673 (16.2)	
Category 5	2982 (10.3)	2200 (8.9)	5182 (9.7)	
Category 6	2825 (9.8)	2127 (8.6)	4952 (9.2)	
Charlson Comorbidity Index score				
(Mean ± SD)	1.3 ± 1.6	1.5 ± 1.6	1.4 ± 1.6	< 0.001
0	11,730 (40.6)	8018 (32.4)	19,748 (36.8)	< 0.001
1–2	11,749 (40.6)	11,404 (46.1)	23,153 (43.2)	
≥ 3	5425 (18.8)	5329 (21.5)	10,754 (20.0)	
Income level				
Low	5797 (20.1)	6459 (26.1)	12,256 (22.8)	<0.001
Middle-low	5529 (19.1)	5142 (20.8)	10,671 (19.9)	
Middle-high	7908 (27.4)	5714 (23.1)	13,622 (25.4)	
High	9002 (31.1)	7016 (28.3)	16,018 (29.9)	

(*Continued*)

Table 1 (Continued).

	Male	Female	Total	*p*-value[a]
	N (%)	N (%)	N (%)	
Residential area classification				
Metropolitan	11,475 (39.7)	9561 (38.6)	21,036 (39.2)	0.011
Nonmetropolitan	17,429 (60.3)	15,190 (61.4)	32,619 (60.8)	
Treatment facility type				
Tertiary hospital	2394 (8.3)	1718 (6.9)	4112 (7.7)	< 0.001
General hospital	12,795 (44.3)	9916 (40.1)	22,711 (42.3)	
Hospital	9470 (32.8)	8147 (32.9)	17,617 (32.8)	
Clinic	4245 (14.7)	4970 (20.1)	9215 (17.2)	
Antibacterial agents				
J01A: tetracyclines	255 (0.9)	224 (0.9)	479 (0.9)	0.780
J01C: penicillins	3785 (13.1)	2978 (12.0)	6763 (12.6)	< 0.001
J01D: beta-lactamase other than penicillins	26,510 (91.7)	22,315 (90.2)	48,825 (91.0)	< 0.001
J01E: sulfonamides and trimethoprim	166 (0.6)	97 (0.4)	263 (0.5)	0.003
J01F: macrolides, lincosamides and streptogramins	1420 (4.9)	1286 (5.2)	2706 (5.0)	0.136
J01G: aminoglycosides	6955 (24.1)	5583 (22.6)	12,538 (23.4)	< 0.001
J01M: quinolones	3345 (11.6)	2901 (11.7)	6246 (11.6)	0.594
J01X: other antibacterials	2592 (9.0)	1785 (7.2)	4377 (8.2)	< 0.001

Note: [a]Continuous variables were analyzed using *t*-tests, and categorical variables were analyzed using chi-square tests.
Abbreviations: SD, Standard deviation; SSTIs, Skin and Subcutaneous Tissue Infections.

Hospital stay duration and costs demonstrated distinct patterns across BMI and WC levels (Figures 1 and 2). Among males, increasing BMI correlated with shorter hospital stays, with the highest BMI category (Class III obesity, BMI ≥ 35.0 kg/m²) averaging 8.82 days compared to 12.14 days for patients in the underweight category. Hospitalization costs followed a similar trend, with the lowest costs observed in patients with Class I obesity (25 ≤ BMI ≤ 29.9 kg/m²) (USD 1263.75) and the highest costs in underweight patients (USD 1639.45). Conversely, female patients demonstrated positive associations between BMI and both length of stays and costs, with the Class III obesity (BMI ≥35.0 kg/m²) having the longest stays (11.76 days) and highest costs (USD 1528.47), compared to the shortest stays (8.67 days) and lowest costs (USD 1225.83) in the underweight category. WC demonstrated positive associations with both outcomes across sexes, with patients in Category 6 exhibiting the longest stays (males: 9.56 days; females: 11.79 days) and the highest costs (males: USD 1358.97; females: USD 1563.22).

Two-year readmission rates varied significantly by BMI and WC for both sexes (Table 2). Males in the highest BMI category (≥ 35.0 kg/m²) demonstrated the highest readmission rate (96.1 readmissions per 1000 person-years) and a hazard ratio (HR) of 2.030. Females showed a similar trend, with the highest readmission rate in the ≥ 35.0 kg/m² BMI category (82.1 per 1000 person-years) and an HR of 1.463. WC Category 6 was associated with the highest readmission rates in males (73.6 per 1000 person-years; HR=1.559) and females (72.8 per 1000 person-years; HR=1.247).

Readmission costs exhibited distinct patterns by sex and obesity measures (Table 3). Among males, the highest costs occurred in the underweight BMI category (USD 264.9), while the lowest was in the Class I obesity category (USD 126.3). Female patients demonstrated the highest readmission costs in the Class III obesity category (USD 230.9) and the

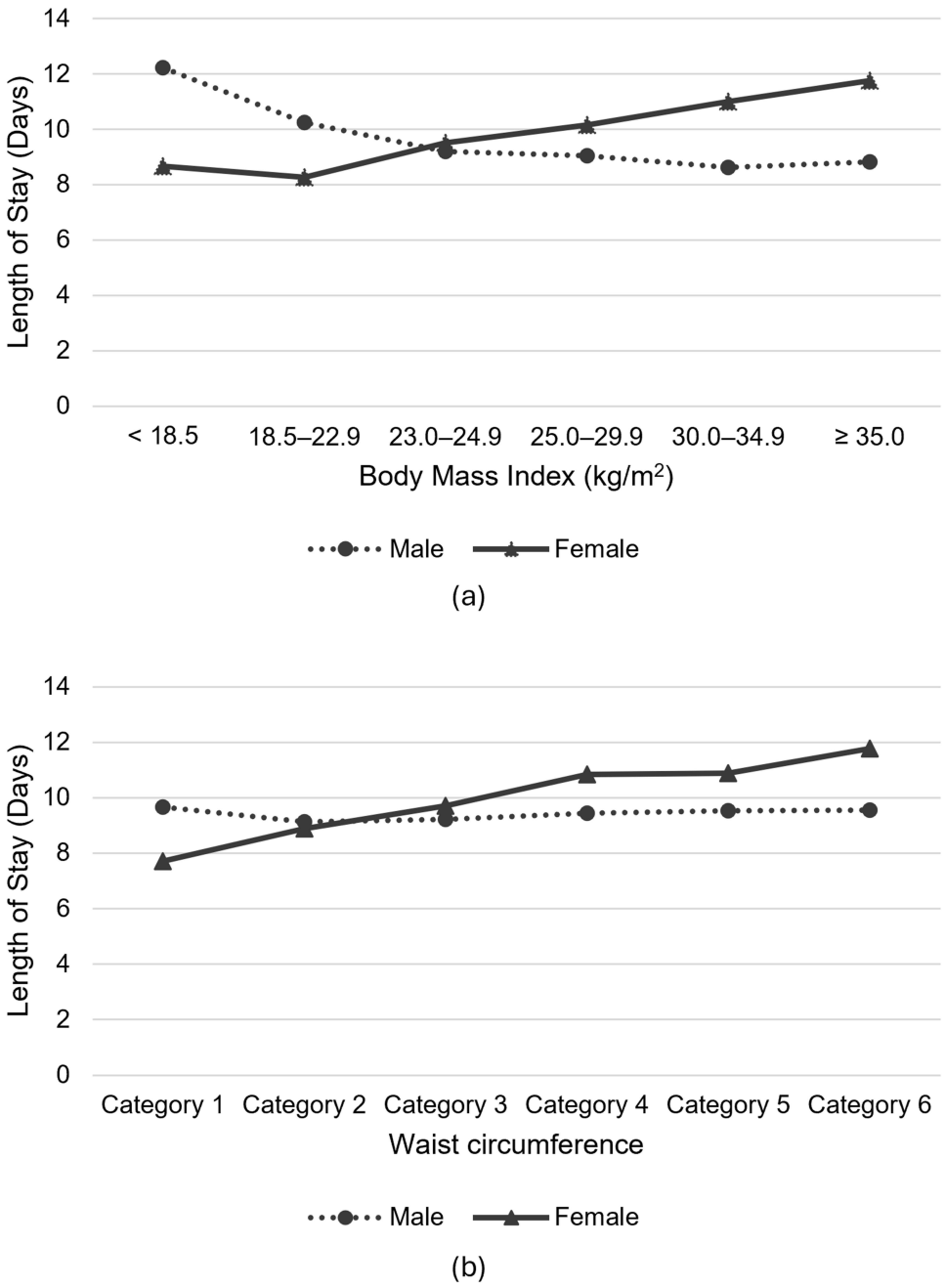

Figure 1 Hospitalization stays by obesity level in patients with SSTI. (**a**) Body Mass Index (**b**) Waist Circumference.

lowest costs in the normal weight category (USD 115.5). WC Category 6 had the highest readmission costs for both sexes (males: USD 189.5; females: USD 205.3), while Category 1 demonstrated the lowest costs among females (USD 88.3).

Discussion

This study demonstrates the significant clinical and economic impact of obesity on patients hospitalized with SSTIs. Analysis of national healthcare data revealed associations between obesity and adverse outcomes, including prolonged hospitalizations, increased costs, and elevated readmission rates. These findings align with existing literature emphasizing obesity's systemic effects on infectious diseases, including its role in increasing infection risk and treatment complexity.[6,14]

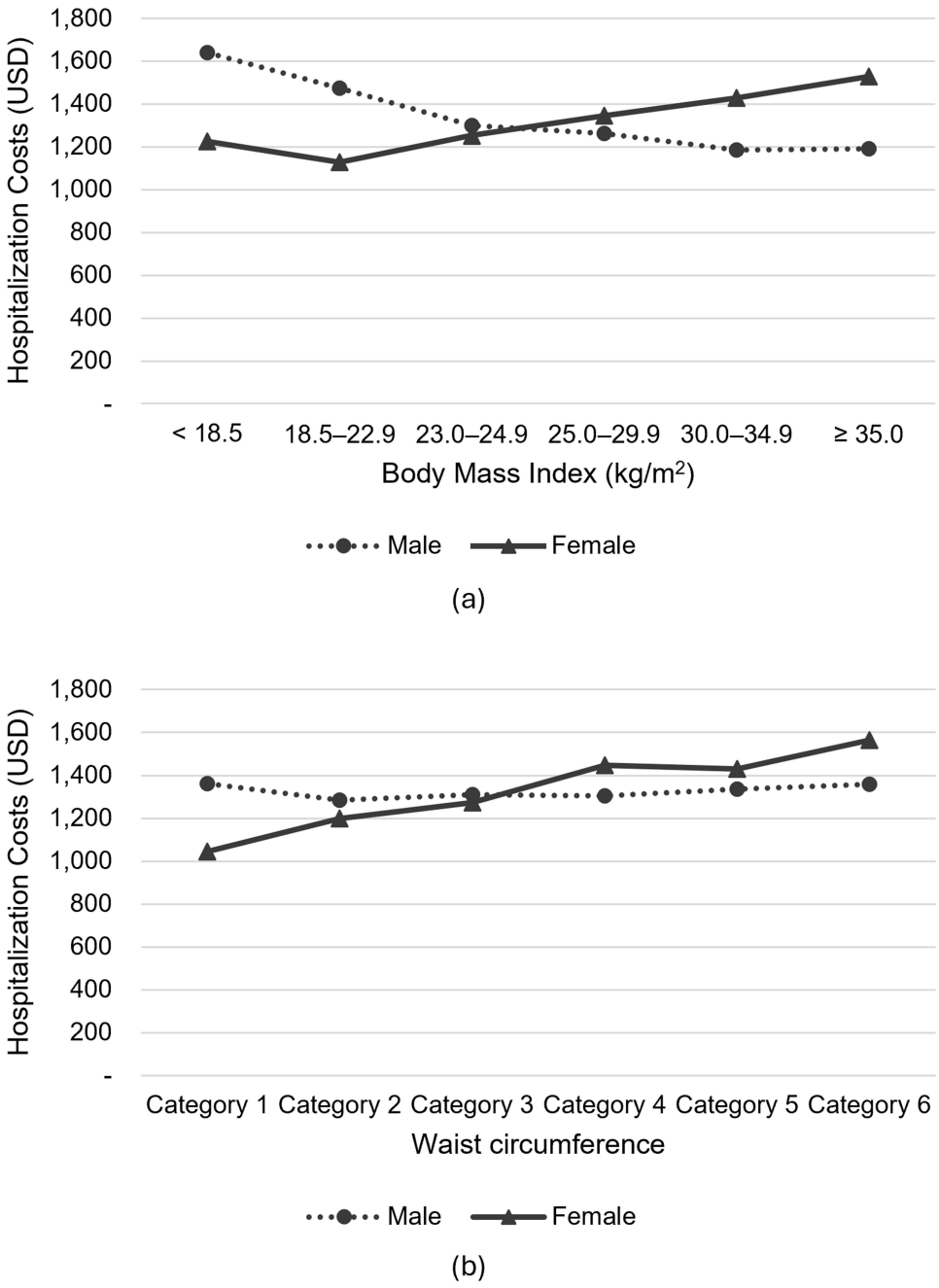

Figure 2 Hospitalization costs by obesity level in patients with SSTI. (**a**) Body Mass Index (**b**) Waist Circumference.

However, further research examining the economic implications of SSTIs in patients with obesity is necessary to strengthen these observations.

The pathophysiological mechanisms through which obesity complicates SSTI management are multifaceted. These include reciprocal interactions between metabolic dysregulation and infectious pathogenesis, wherein obesity not only increases susceptibility to infections but may also be aggravated by infectious triggers.[15] Obesity-associated chronic low-grade inflammation elevates proinflammatory cytokines, including interleukin-6 (IL-6) and tumor necrosis factor-alpha (TNF-α), leading to impaired immune responses, delayed wound healing, and increased bacterial colonization.[16–18] These immunometabolic alterations have been comprehensively reviewed in recent literature, highlighting the multifactorial pathways through which obesity impairs host immunity and increases infection susceptibility.[19] Adipose tissue functions

Table 2 SSTI-Related Readmission within Two Years in Terms of Obesity Level

	Total N	Follow-Up Years	Cases	Incidence (Per 1000 Person-Years)	Hazard Ratio[a] (95% CI)
Male					
Body mass index (kg/m^2)					
Continuous					1.028 (1.019–1.038)
< 18.5	547	936	58	62.0	1.044 (0.798–1.365)
18.5–22.9	6945	12,599	688	54.6	Ref.
23.0–24.9	6567	12,039	646	53.7	1.002 (0.900–1.116)
25.0–29.9	11,752	21,738	1110	51.1	0.979 (0.889–1.077)
30.0–34.9	2485	4531	305	67.3	1.353 (1.179–1.553)
≥ 35.0	608	1072	103	96.1	2.030 (1.643–2.509)
Waist circumference					
Continuous					1.015 (1.011–1.018)
Category 1	5562	10,214	468	45.8	Ref.
Category 2	5984	11,003	568	51.6	1.116 (0.988–1.262)
Category 3	6468	11,858	666	56.2	1.210 (1.075–1.362)
Category 4	5083	9352	482	51.5	1.087 (0.957–1.235)
Category 5	2982	5408	352	65.1	1.355 (1.179–1.556)
Category 6	2825	5081	374	73.6	1.559 (1.360–1.788)
Female					
Body mass index (kg/m^2)					
Continuous					1.015 (1.006–1.025)
< 18.5	816	1489	77	51.7	0.991 (0.784–1.252)
18.5–22.9	8461	15,570	819	52.6	Ref.
23.0–24.9	5460	9991	571	57.1	1.026 (0.921–1.143)
25.0–29.9	7864	14,428	851	59.0	1.035 (0.939–1.141)
30.0–34.9	1786	3225	230	71.3	1.244 (1.074–1.441)
≥ 35.0	364	645	53	82.1	1.463 (1.107–1.933)
Waist circumference					
Continuous					1.008 (1.004–1.012)
Category 1	7328	13,551	684	50.5	Ref.
Category 2	4766	8712	501	57.5	1.062 (0.945–1.193)
Category 3	4740	8710	482	55.3	0.999 (0.887–1.126)
Category 4	3590	6590	378	57.4	1.011 (0.888–1.151)
Category 5	2200	3965	278	70.1	1.223 (1.060–1.411)
Category 6	2127	3821	278	72.8	1.247 (1.081–1.439)

Note: [a]Hazard ratios were calculated using Cox proportional hazards models, adjusting for age, Charlson Comorbidity Index score, income level, and residential area type.

Abbreviations: CI, Confidence interval; Ref, Reference; SSTI, Skin and Subcutaneous Tissue Infection.

Table 3 SSTI-Related Readmission Costs within Two Years Estimated Using a Two-Part Model (Unit: USD)

	Mean	SD	95% CI	Cost Ratio
Male				
Body mass index (kg/m^2)				
< 18.5	264.9	29.8	263.0–266.7	1.52
18.5–22.9	174.2	4.0	174.0–174.5	Ref.
23.0–24.9	159.9	3.5	159.6–160.1	0.92
25.0–29.9	126.3	1.8	126.2–126.4	0.72
30.0–34.9	155.6	4.4	155.3–155.8	0.89
≥ 35.0	237.6	9.7	237.0–238.2	1.36
Waist circumference				
Category 1	122.0	3.2	121.8–122.2	Ref.
Category 2	142.0	3.9	141.7–142.2	1.16
Category 3	159.9	3.5	159.7–160.1	1.31
Category 4	146.7	3.4	146.5–146.9	1.20
Category 5	162.5	3.4	162.2–162.7	1.33
Category 6	189.5	4.3	189.2–189.7	1.55
Female				
Body mass index (kg/m^2)				
< 18.5	102.7	8.6	102.1–103.2	0.89
18.5–22.9	115.5	2.6	115.4–115.7	Ref.
23.0–24.9	131.6	3.1	131.4–131.7	1.14
25.0–29.9	138.7	2.0	138.5–138.8	1.20
30.0–34.9	178.9	5.4	178.5–179.2	1.55
≥ 35.0	230.9	13.3	230.1–231.8	2.00
Waist circumference				
Category 1	88.3	1.9	88.2–88.5	Ref.
Category 2	138.9	4.0	138.6–139.1	1.57
Category 3	126.2	3.1	126.0–126.4	1.43
Category 4	150.3	2.9	150.1–150.5	1.70
Category 5	165.3	3.7	165.1–165.5	1.87
Category 6	205.3	4.8	205.0–205.5	2.32

Note: Readmission costs were estimated using a two-part model, and the mean values were calculated based on 1000 bootstrap resamples.
Abbreviations: CI, Confidence interval; Ref, Reference; SD, Standard deviation; SSTI, Skin and Subcutaneous Tissue Infection.

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as an active immunological organ in individuals with obesity, harboring proinflammatory M1 macrophages that exacerbate systemic inflammation and compromise host immune response. This chronic inflammatory state contributes to metabolic dysregulation and insulin resistance, further complicating SSTI treatment.[16,20] Pharmacokinetic alterations in obesity, characterized by increased drug distribution volume and clearance rates, present significant challenges for antimicrobial therapy. These modifications may reduce standard antibiotic regimen efficacy, as demonstrated by Longo et al's[21] observation of increased antibiotic treatment failure rates in patients with obesity. Moreover, treatment complexities are amplified in outpatient SSTI cases with comorbid conditions such as heart failure, where obesity serves as an independent predictor of treatment failure.[22] These findings emphasize the necessity for personalized treatment approaches, incorporating weight-based dosing and therapeutic drug monitoring, to optimize clinical outcomes in this population.

The analysis revealed notable sex-specific differences in SSTI outcomes. Female patients demonstrated longer hospital stays and higher costs than male patients, potentially attributable to sex-specific variations in fat distribution and hormonal influences on immune function.[6] The higher proportion of subcutaneous fat relative to visceral fat in females modulates inflammatory responses and influences infection severity.[23] This pattern aligns with evidence that increased subcutaneous fat thickness in females contributes to more severe SSTI presentations.[24] Prior reviews have illustrated a U-shaped relationship between BMI and infection risk, suggesting increased susceptibility not only among individuals with obesity but also in underweight patients, underscoring the complexity of BMI as a predictive measure.[25] Furthermore, hormonal factors, particularly estrogen, influence immune responses and may further modify infection outcomes in females.[6] While enhanced immune responses can be protective in certain contexts, they may contribute to increased tissue damage and more severe SSTI manifestations in female patients.[26]

The increased healthcare expenditures associated with obesity and SSTIs are well-documented. Patients with obesity require more frequent and prolonged hospitalizations, significantly escalating healthcare costs. In the United States, medical care costs due to obesity are estimated to be 20–30% higher than for individuals of normal weight, primarily due to increased resource utilization.[5] This cost differential is even more pronounced in SSTI management, where obesity-related complications, including delayed wound healing and increased infection severity, necessitate extended treatment periods and intensive medical resource utilization.[27] Treatment duration is frequently prolonged in patients with obesity because of pharmacokinetic alterations affecting antibiotic efficacy, including increased drug distribution volumes and modified clearance rates, complicating effective antimicrobial therapy and contributing to higher rates of treatment failure.[28] Ihm et al[29] further demonstrated that SSTI patients with obesity or heart failure experience increased adverse outcomes, characterized by longer hospital stays and higher treatment costs. Optimizing antimicrobial use is crucial to mitigate these economic impacts. Implementing strategies, including weight-based dosing adjustments, therapeutic drug monitoring, and early transition to oral therapy, has improved treatment outcomes and reduced healthcare expenditures.[30]

This study's findings emphasize the importance of addressing obesity as a modifiable risk factor. Weight management interventions, including lifestyle modifications, pharmacological therapies, or bariatric surgery, demonstrate the potential to reduce SSTI incidence and improve treatment outcomes.[3,6] Furthermore, implementing individualized antibiotic dosing strategies for patients with obesity may enhance therapeutic efficacy.[21,28] Sex-specific treatment protocols warrant particular attention, as females' distinct physiological and hormonal profiles necessitate specialized approaches to obesity management and infection treatment.[6,24]

Several methodological limitations warrant consideration. First, while comprehensive for medical services, administrative insurance claims data precludes access to detailed clinical parameters such as laboratory results, microbiological data, or infection severity metrics, potentially limiting the ability to account for all outcome-relevant confounders. Second, obesity indicators measured during routine health examinations, rather than at SSTI diagnosis, may not accurately reflect patients' weight status during hospitalization, introducing potential misclassification bias. Third, the reliance on BMI as an obesity metric presents inherent limitations, failing to account for body composition variations, such as muscle mass or fat distribution patterns, which are critical to understanding the metabolic health of individuals. Integrating advanced metrics, including body fat percentage and imaging-based assessments, could provide more nuanced insights into the relationship between obesity and SSTI outcomes. Fourth, the single-nation study design within South Korea's national healthcare system may limit the generalizability to systems with differing demographics, clinical

practices, and insurance structures. Further studies in diverse populations are necessary to validate these findings globally. Finally, retrospective cohort studies are inherently prone to selection bias and unmeasured confounding. While robust statistical techniques such as multivariable adjustments addressed potential selection bias and confounding, residual confounding effects cannot be definitively excluded. Despite these limitations, the study provides valuable insights into obesity's clinical and economic impacts on SSTI outcomes, emphasizing the need for tailored management strategies and further research to address these gaps.

Future research directions should explore molecular mechanisms linking obesity with impaired immune responses and explore the role of microbiota and inflammation in SSTI pathogenesis.[16] Integrating personalized medicine approaches, including genomic insights from Mendelian randomization studies, could enhance risk prediction and guide targeted interventions.[6]

Conclusion

This study demonstrates the substantial clinical and economic impact of obesity on SSTI management outcomes. The findings emphasize the importance of addressing obesity as a modifiable risk factor in efforts to improve patient outcomes and optimize healthcare resource utilization. Integration of obesity management strategies into infection treatment protocols may enhance therapeutic efficacy and facilitate more efficient resource allocation in the care of this high-risk population.

Abbreviations

ATC, Anatomical Therapeutic Chemical; BMI, Body Mass Index; CCI, Charlson Comorbidity Index; CI, Confidence Interval; GDP, Gross Domestic Product; HR, Hazard Ratio; ICD-10, International Classification of Diseases, 10th Revision; IL-6, Interleukin-6; USD, US dollar; NHIS, National Health Insurance Service; SSTIs, Skin and Subcutaneous Tissue Infections; TNF-α, Tumor Necrosis Factor-Alpha; WC, Waist Circumference; WHO, World Health Organization.

Ethics Approval and Informed Consent

The study was conducted according to the guidelines of the Declaration of Helsinki and was exempted from review by the Institutional Review Board of Daegu Catholic University (IRB number: CUIRB-2023-E002). Permission to access and utilize data from the National Health Insurance Service (NHIS) database was sought and obtained under the project approval number NHIS-2023-1-662. All data were used in compliance with NHIS guidelines and regulations to ensure proper handling and confidentiality. The requirement for informed consent was waived as the data analysis was conducted retrospectively using anonymized claims data from the NHIS in South Korea.

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Disclosure

The authors report no conflicts of interest in this work.

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