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Original article

# Postoperative care fragmentation in bariatric surgery and risk of mortality: a nationwide study

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## Abstract

**Background:** Readmission after bariatric surgery may lead to fragmentation of care if readmission occurs at a facility other than the index hospital. The effect of readmission to a nonindex hospital on postoperative mortality remains unclear for bariatric surgery.

**Objectives:** To determine postoperative mortality rates according to readmission destinations.

**Setting:** Nationwide analysis of all surgical facilities in France.

**Methods:** Multicenter, nationwide study of adult patients undergoing bariatric surgery from January 1, 2013, through December 31, 2018. Data from all surgical facilities in France were extracted from a national hospital discharge database.

**Results:** In a cohort of 278,600 patients who received bariatric surgery, 12,760 (4.6%) were readmitted within 30 days. In cases of readmission, 23% of patients were admitted to a nonindex hospital. Patients readmitted to a nonindex facility had different characteristics regarding sex (men, 23.6% versus 18.2%, respectively;  $P < .001$ ), co-morbidities (Charlson Co-morbidity Index, .74 versus .53, respectively;  $P < .001$ ), and travel distance (38.3 km versus 26.9 km, respectively;  $P < .001$ ) than patients readmitted to the index facility. The main reasons for readmission were leak/peritonitis and abdominal pain. The overall mortality rate after readmission was .56%. The adjusted odds ratio (OR) of mortality for the nonindex group was 4.96 (95% confidence interval [CI], 3.1–8.1;  $P < .001$ ). In the subgroups of patients with a gastric leak, the mortality rate was 1.5% and the OR was 8.26 (95% CI, 3.7–19.6;  $P < .001$ ).

**Conclusion:** Readmissions to a nonindex hospital are associated with a 5-fold greater mortality rate. The management of readmission for complications after bariatric surgery should be considered as a major issue to reduce potentially preventable deaths. (Surg Obes Relat Dis 2021;17:1327–1333.) © 2021 American Society for Bariatric Surgery. Published by Elsevier Inc. All rights reserved.

## Keywords:

Readmission; Bariatric surgery; Mortality

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Unplanned hospital readmissions are considered a quality metric of a hospital's performance, in particular after surgery [1]. A large number of studies have been published on this topic in the last decade [2], and a major issue that is commonly outlined is the destination of the readmission. In fact, patients are not systematically readmitted to the hospital where the surgery was performed (the index hospital), but they can be readmitted to a different institution (the non-index hospital). Nonindex hospital readmissions have been reported in 3.1% to 21.1% of cases after bariatric surgery [3,4]. This disruption of the continuity of care, or care fragmentation, may result in poorer outcomes, especially after surgery. For instance, readmissions to nonindex hospitals after different major surgeries are associated with an odds ratio (OR) of mortality ranging from 1.05 to 3.14 [5].

For this reason, a few authors have expressed their concerns about the trend toward a progressive centralization of care, consisting of pooling surgical activity in few regional centers, because this could lead to the inadvertent fragmentation of care [6,7], which is potentially associated with higher rates of adverse events.

In bariatric surgery, postoperative mortality is an uncommon event, reported to be around .1% [8]; therefore, large cohorts of patients are needed to identify differences among groups. In fact, contradictory results have been reported on mortality according to the readmission destination [3].

Using a large national claims database, we aimed to assess 30-day postoperative mortality in readmitted patients after bariatric surgery. Our hypothesis is that care fragmentation will increase the mortality rate among patients readmitted to a nonindex hospital.

## Methods

### *Study design and setting*

This is an observational analytic study on the impact of the readmission destination after bariatric surgery on mortality. Data were extracted from a national discharge database, the Programme De Médicalisation des Systèmes d'Information (PMSI), which collects all discharge reports from any hospital in France, irrespective of their ownership and academic affiliation. Discharge reports are mandatory and represent the basis for hospital funding. For this reason, the database is comprehensive for all reimbursed surgical interventions in the country.

The data collected included patient demographic characteristics (age, sex, zip code, and admission and discharge dates); primary and associated diagnoses based on codes from the *International Classification of Disease*, 10th edition (ICD-10); and therapeutic procedures based on codes from the Common Classification of Medical Acts, Classification Commune des Actes Médicaux (CCAM), 11th edition, which is a national standardized classification of medical procedures [9].

### *Participants*

We included all adult patients ( $\geq 18$  yr old) who underwent bariatric surgery between January 1, 2013, and December 31, 2018. Patients were identified in the database through the CCAM codes for bariatric procedures, including adjustable gastric banding (HFMA009, HFMC007, HFKC001, and HFKA002), sleeve gastrectomy (HFMA010, HFMC006, HFFA011, and HFFC018), gastric bypass (HFCC003 and HFCA001), and biliopancreatic diversion (HFFC004, HFFA001, HGCC027, and HGCA009).

To be included in the analysis, patients needed to be readmitted within 30 days of discharge after bariatric surgery. Patients who were not discharged to home after surgery but transferred to another institution were not included. Only unplanned readmissions were considered, which were defined as any admission passing through an emergency service. In case of multiple readmissions for the same patient, we examined all unplanned readmissions occurring in the first 30 days postoperatively.

### *Exposures and confounders*

The exposure variable was the readmission destination, which was defined by whether a patient was readmitted to the hospital where the bariatric procedure took place (the index hospital) or to a different institution (the nonindex hospital). The reference group included all patients directly readmitted to an index hospital and patients who were readmitted to a nonindex hospital but transferred to the index hospital within 24 hours.

Potential confounders in the readmission destination were assessed at several levels. Baseline patient characteristics included age, sex, body mass index, and co-morbidities, based on the Charlson Co-morbidity Index (CCI). For the CCI, we used the version from Bannay et al. [10], which was recently validated using the same data source (the PMSI database). At a surgical level, we assessed the type of bariatric procedure, the surgical approach (open or laparoscopy), and whether it was a primary or revisional procedure. Concerning the index admission (where the bariatric procedure took place), we also assessed major complications, which were defined as any reoperations under general anesthesia or during an intensive care unit stay of at least 2 days. We also assessed the time between the discharge and readmission. Causes of readmission were assessed through the principal diagnosis code for each readmission. Reasons are classified in 9 groups according to ICD-10 main categories (digestive system, circulatory system, endocrine system, genitourinary system, respiratory system, injury, skin and soft tissues, symptoms, and others). Ten subcategories are also reported, describing common postoperative complications: gastric leak and peritonitis, bleeding, intestinal obstruction, pulmonary embolism, phlebitis and

thrombophlebitis, diabetes, urolithiasis, trauma, abdominal pain, and vomiting. The list of codes is reported in the [Supplementary Data](#).

We retrieved several characteristics for hospitals where patients were readmitted. Firstly, we assessed the surgical volume as the number of bariatric procedures per year. We defined 4 levels of surgical volume, with cutoffs set at 100, 200, and 300 procedures per year for better readability and interpretation. We also retrieved hospital ownership (public, private for-profit, and private nonprofit), academic affiliation, and accreditation from the Center of Excellence in Obesity Care.

### Outcomes

The main outcome was in-hospital mortality after readmission, irrespective of the cause and the time between the day of readmission and event.

As a secondary outcome, we assessed the cause of readmission. We also assessed the in-hospital mortality in the subgroup of patients with gastric leak/peritonitis.

### Statistical methods

Descriptive statistics were used to describe differences among the 2 groups of readmitted patients (index versus nonindex hospital) using univariate tests ( $\chi^2$ , Mann-Whitney, and analysis of variance). We used a logistic regression analysis to assess whether patients readmitted in a nonindex hospital had a different likelihood of in-hospital mortality. The final model was then built using a stepwise backward selection procedure. We performed several sensitivity analyses to assess the robustness of our findings. We performed an alternative analytic strategy, using a 1:1 propensity score. The propensity score was calculated using the probability of each patient being readmitted to the index hospital, with a logistic regression incorporating all matching variables.

To confirm that the observed associations were not the result of unmeasured differences in the severity of the cause of readmission, we repeated the primary analysis in a subgroup of patients presenting with a code for gastric leak/peritonitis.

### Data access and linkage

In the PMSI database, each patient is assigned a unique identifier, which remains unchanged over time. Thus, linking a patient's different hospital stays in different hospitals is possible. As the identifier is anonymous, patient consent was not required. Yet, access to the database authorized by the National Commission on Informatics and Liberty. The authorization number for this study is 01947391.

## Results

### Participants

Between January 1, 2013, and December 31, 2018, 278,600 bariatric procedures were performed on 272,500 patients. The most common technique was sleeve gastrectomy ( $n = 178,800$ ; 64.2%), followed by gastric bypass ( $n = 79,800$ ; 28.6%), adjustable gastric banding ( $n = 18,800$ ; 6.8%) and biliopancreatic division ( $n = 1200$ ; .4%). The great majority of these procedures were performed by laparoscopy (99.2%), and the rate of revisional procedures was 7.9% ( $n = 22,100$ ). In total, 12,760 (4.6%) patients were readmitted within 30 days after discharge. Most of these patients were readmitted to the index hospital ( $n = 9828$ ; 77.0%), while 23.0% of patients were readmitted to another center (i.e., nonindex hospital).

### Descriptive data

Patients' characteristics are reported in [Table 1](#). Patients readmitted to a nonindex hospital were older (42.5 versus 41.7 yr old, respectively;  $P = .002$ ), were more likely to be male (23.6% versus 18.2%, respectively;  $P < .001$ ), and had more co-morbidities (mean CCI, .74 versus .53, respectively;  $P < .001$ ) than those readmitted to the index hospital.

Time and distance to the hospital were different in the 2 groups, as patients readmitted to a nonindex hospital lived further (38.3 km versus 26.9 km, respectively) and had a longer travel time (57.1 versus 45.3 min, respectively) than those readmitted to the index hospital. The standardized mean difference for baseline characteristics was .09 (IQR, .04–.11; range, .01–.32).

The causes of readmission are reported in [Table 2](#). Symptoms associated with the digestive system (leak/peritonitis, bleeding, or intestinal obstruction) and specific symptoms (abdominal pain and vomiting) were significantly more common in cases of readmission to facilities where the initial surgery was performed. On the contrary, patients admitted to nonindex facilities presented more frequently with diagnoses associated with the circulatory system, endocrine system, genitourinary system, and respiratory system.

### Outcome data

The overall mortality rate among readmitted patients was .56% (72 of 12,760). Among patients readmitted to an index hospital, the mortality rate was .28% (28 of 9828), and among patients readmitted to a nonindex hospital, the mortality rate was 1.5% (44 of 2932), which corresponds to an absolute risk reduction of 1.2% and to a need to treat (readmit to an index hospital) 83 patients to prevent 1 death.

Univariate and multivariate analyses of in-hospital mortality are reported in [Table 3](#). In the final model,

Table 1  
Baseline characteristics during the initial bariatric procedure according to destination of readmission

Covariate	Whole sample	Readmission to index hospital	Readmission to nonindex hospital	P value
	(n = 12,760)	(n = 9828)	(n = 2932)	
Sex				
Male	2464 (19.3%)	1802 (18.3%)	662 (22.6%)	<.001
Female	10296 (80.7%)	8026 (81.7%)	2270 (77.4%)	
Age, yr, mean (SD)	41.9 (12.2)	41.7 (12.1)	42.5 (12.6)	.002
Age, yr				<.001
18–29	2389 (18.7%)	1869 (19%)	520 (17.7%)	
30–39	3294 (25.8%)	2525 (25.7%)	769 (26.2%)	
40–49	3362 (26.3%)	2646 (26.9%)	716 (24.4%)	
50–59	2663 (20.9%)	2036 (20.7%)	627 (21.4%)	
≥60	1052 (8.2%)	752 (7.7%)	300 (10.2%)	
BMI				.018
30–40	4694 (36.8%)	3552 (36.1%)	1142 (38.9%)	
40–50	6780 (53.1%)	5284 (53.8%)	1496 (51%)	
>50	1286 (10.1%)	992 (10.1%)	294 (10%)	
OSAS				.259
1	4588 (36%)	3508 (35.7%)	1080 (36.8%)	
Charlson Co-morbidity Index, mean (SD)	.6 (1.4)	.5 (1.2)	.7 (1.9)	<.001
Charlson Co-morbidity Index				.001
0	9308 (72.9%)	7246 (73.7%)	2062 (70.3%)	
1	1299 (10.2%)	974 (9.9%)	325 (11.1%)	
≥2	2153 (16.9%)	1608 (16.4%)	545 (18.6%)	
Bariatric procedure				<.001
Adjustable gastric banding	479 (3.8%)	308 (3.1%)	171 (5.8%)	
Biliopancreatic division	87 (.7%)	69 (.7%)	18 (.6%)	
Gastric bypass	4634 (36.3%)	3681 (37.5%)	953 (32.5%)	
Sleeve Gastrectomy	7560 (59.2%)	5770 (58.7%)	1790 (61.1%)	
Surgical approach				.501
Laparoscopic	12543 (98.3%)	9665 (98.3%)	2878 (98.2%)	
Open	217 (1.7%)	163 (1.7%)	54 (1.8%)	
Revisional procedure	1441 (11.3%)	1078 (11%)	363 (12.4%)	.034
LOS, mean (SD)	5.3 (5.7)	5.3 (5.7)	5.3 (5.6)	.597
Hospital ownership				<.001
Private for profit	7319 (57.4%)	5347 (54.4%)	1972 (67.3%)	
Private not-for-profit	707 (5.5%)	581 (5.9%)	126 (4.3%)	
Public	4734 (37.1%)	3900 (39.7%)	834 (28.4%)	
Academic				<.001
1	2369 (18.6%)	1915 (19.5%)	454 (15.5%)	
Center of excellence				<.001
1	2595 (20.3%)	2074 (21.1%)	521 (17.8%)	
Surgical volume per year				.283
0–99	2627 (20.6%)	2006 (20.4%)	621 (21.2%)	
100–199	3684 (28.9%)	2870 (29.2%)	814 (27.8%)	
200–299	2620 (20.5%)	2031 (20.7%)	589 (20.1%)	
≥300	3829 (30%)	2921 (29.7%)	908 (31%)	
Time to hospital, min, mean (SD)	48 (55.2)	45.3 (53.3)	57.1 (60.1)	<.001
Distance to hospital, km, mean (SD)	29.5 (32.1)	26.9 (28.9)	38.3 (39.8)	<.001

SD = standard deviation; BMI = body mass index; OSAS = obstructive sleep apnea syndrome; LOS = length of stay.

Data are n (%) unless otherwise stated.

readmission to a nonindex hospital resulted in an OR of 4.96 (95% confidence interval [CI], 3.09–8.09;  $P \leq .001$ ) of mortality.

In the subgroup of patients with a diagnosis of gastric leak or peritonitis, the overall mortality was 1.5%. In this subgroup, after adjustment for the inverse probability of treatment weighting, patients readmitted to a nonindex hospital

had an even higher risk of death (adjusted OR, 8.26; 95% CI, 3.73–19.58;  $P < .001$ ).

We performed a sensitivity analysis using a different statistical approach: 1:1 propensity-score matching. The final result was consistent with the primary analysis, as the OR for mortality and destination was 4.46 (95% CI, 2.26–9.84;  $P < .001$ ).

Table 2  
Main diagnoses for readmission according to destination

Main category	Subcategory	Readmission to index hospital (n = 9828)	Readmission to nonindex hospital (n = 2932)	P value
Circulatory system	-	276 (2.8)	216 (7.4)	<.001
-	Phlebitis and thrombophlebitis	111 (1.1)	29 (1.0)	.590
-	Pulmonary embolism	66 (.7)	45 (1.5)	<.001
Digestive system	-	4804 (48.9)	916 (31.2)	<.001
-	Bleeding	515 (5.2)	114 (3.9)	.004
-	Leak, peritonitis	1908 (19.4)	497 (17.0)	.003
-	Intestinal obstruction	571 (5.8)	72 (2.5)	<.001
Endocrine system	-	671 (6.8)	239 (8.2)	.016
-	Diabetes	38 (.4)	91 (3.1)	<.001
Genitourinary system	-	298 (3.0)	277 (9.4)	<.001
-	Urolithiasis	115 (1.2)	107 (3.6)	<.001
Injury	-	748 (7.6)	219 (7.5)	.830
-	Trauma	273 (2.8)	101 (3.4)	.069
Respiratory system	-	267 (2.7)	187 (6.4)	<.001
Skin and soft tissues	-	333 (3.4)	101 (3.4)	.928
Symptoms	-	2819 (28.7)	625 (21.3)	<.001
-	Abdominal pain	1481 (15.1)	245 (8.4)	<.001
-	Vomiting	647 (6.6)	51 (1.7)	<.001
Other	-	683 (6.9)	619 (21.1)	<.001

Data are reported as n (%).

## Discussion

In this study, we found that approximately one-fourth of readmissions after bariatric surgery were to nonindex hospitals in this nationwide data set. Nonindex readmissions were associated with 5-fold higher odds of mortality compared with readmissions to index hospitals. To our knowledge, this is the first study to assess readmissions to nonindex hospitals after bariatric surgery, and the first to associate such care fragmentation with mortality on a comprehensive national level with no sampling of the population.

Similar to our study, prior reports have also highlighted a high degree of care fragmentation after bariatric surgeries. Canner et al. [4], in an analysis of the National Readmission Database (NRD) from the Agency for Healthcare Research and Quality Healthcare Cost and Utilization Project, found a nonindex readmission rate of 17.6% during the period of 2010 to 2014. Schulman et al. [3], also using the NRD for the year 2016 (with a 90-day period of observation), reported a nonindex readmission rate of 21.1%. Conversely, data from the study by Juo et al. [5], who used the Metabolic and Bariatric Surgery Accreditation and Quality Improvement Program (MBSAQIP) database as a source of data, were not consistent with those from the 2 previous studies, as they reported a nonindex readmission rate of 3.1% in 2015. In this last study, the authors discussed the concern for the lack of generalizability of data from centers using the MBSAQIP database.

Concerning the association between nonindex readmission and mortality, Schulman et al. [3] reported on about

11,500 readmitted patients (9000 index and 2500 nonindex), with an adjusted OR of 1.40 (95% CI, .50–3.91;  $P = .65$ ), while Juo et al. [5] found a mortality rate of 3.1% in the 325 patients in the nonindex population, corresponding to an adjusted OR of 4.4 (95% CI, 2.6–9.2;  $P < .01$ ).

In our study, we found an overall mortality rate of .6% among 12,700 readmitted patients, and an overall mortality rate of 1.6% for the 2900 patients readmitted to a nonindex institution. This gave an adjusted OR of roughly 5.0 in different types of statistical analyses.

A possible explanation for this discrepancy in the OR of mortality may be found in the low mortality rate of bariatric surgery, which has been recently reported at about .1% [11]. Small variations in the number of events provoked important changes in the OR estimation, which are in general reported with large CIs.

Several systems of care around the world are going toward a progressive regionalization of care, in particular for surgery. High-volume and highly specialized centers have clearly shown a real benefit for patient outcomes. Nevertheless, the benefits of regionalization are tempered by the significantly higher risk of mortality in cases of local (or nonindex) readmission. As it is neither feasible nor desirable to reverse this global trend for surgery toward centralization, the risks of care fragmentation should be addressed with alternative organization. It has been suggested that the disruption of continuity of care is associated with worse outcomes for several possible reasons [12]. First, the index hospitals could simply provide a better system of care for management of complications than do nonindex hospitals. In fact, we found that being readmitted in a Center

Table 3  
Univariate and multivariate logistic regression for factors associated with mortality during readmission

	Univariate analysis	Multivariate analysis: initial model	Multivariate analysis: final model
	OR (95% CI, <i>P</i> value)	aOR (95% CI, <i>P</i> value)	aOR (95% CI, <i>P</i> value)
Sex			
Male	-	-	-
Female	.51 (.31–.85, <i>P</i> = .008)	.72 (.43–1.24, <i>P</i> = .220)	.68 (.41–1.14, <i>P</i> = .13)
Age, yr			
18–29	-	-	-
30–39	1.74 (.65–5.49, <i>P</i> = .297)	1.63 (.60–5.15, <i>P</i> = .364)	1.62 (.60–5.11, <i>P</i> = .4)
40–49	2.42 (.96–7.38, <i>P</i> = .082)	2.28 (.88–7.03, <i>P</i> = .112)	2.32 (.91–7.09, <i>P</i> = .1)
50–59	4.52 (1.88–13.40, <i>P</i> = .002)	4.01 (1.61–12.14, <i>P</i> = .006)	4.07 (1.68–12.1, <i>P</i> = .005)
≥60	5.97 (2.24–18.63, <i>P</i> = .001)	4.42 (1.58–14.28, <i>P</i> = .007)	4.59 (1.70–14.5, <i>P</i> = .004)
BMI			
30–40	-	-	-
40–50	.81 (.47–1.43, <i>P</i> = .464)	.88 (.50–1.57, <i>P</i> = .664)	-
>50	3.53 (1.95–6.38, <i>P</i> < .001)	3.50 (1.86–6.55, <i>P</i> < .001)	.9 (.51–1.58, <i>P</i> = .7)
OSAS	1.79 (1.12–2.85, <i>P</i> = .014)	1.13 (.67–1.90, <i>P</i> = .648)	3.72 (2.03–6.80, <i>P</i> ≤ .001)
Charlson Co-morbidity Index			
0	-	-	-
1	.90 (.34–1.94, <i>P</i> = .799)	.71 (.27–1.55, <i>P</i> = .431)	-
≥2	1.63 (.92–2.75, <i>P</i> = .080)	1.11 (.60–1.95, <i>P</i> = .737)	-
Bariatric procedure			
Adjustable gastric Banding	-	-	-
Biliopancreatic division	11.25 (1.07–243.60, <i>P</i> = .049)	8.10 (.70–185.65, <i>P</i> = .102)	-
Gastric bypass	2.28 (.48–40.88, <i>P</i> = .420)	2.37 (.48–43.09, <i>P</i> = .405)	-
Sleeve gastrectomy	2.99 (.65–53.02, <i>P</i> = .279)	3.00 (.63–53.83, <i>P</i> = .283)	-
Surgical approach			
Laparoscopic	-	-	-
Open	3.45 (1.04–8.42, <i>P</i> = .017)	2.47 (.72–6.43, <i>P</i> = .097)	2.59 (.77–6.54, <i>P</i> = .074)
Revisional procedure	.98 (.43–1.93, <i>P</i> = .961)	.92 (.39–1.92, <i>P</i> = .845)	-
Hospital ownership			
Private for-profit	-	-	-
Private not-for-profit	.42 (.07–1.36, <i>P</i> = .231)	.43 (.07–1.43, <i>P</i> = .248)	-
Public	.66 (.39–1.09, <i>P</i> = .113)	.73 (.34–1.46, <i>P</i> = .396)	-
Academic	.71 (.34–1.32, <i>P</i> = .308)	.83 (.20–3.72, <i>P</i> = .810)	-
Center of Excellence	.71 (.35–1.29, <i>P</i> = .287)	.88 (.21–3.07, <i>P</i> = .857)	.59 (.29–1.09, <i>P</i> = .11)
Surgical volume per yr			
0–99	-	-	-
100–199	.88 (.46–1.69, <i>P</i> = .697)	.91 (.47–1.78, <i>P</i> = .777)	-
200–299	.77 (.36–1.57, <i>P</i> = .470)	.81 (.37–1.72, <i>P</i> = .587)	-
≥300	.85 (.45–1.63, <i>P</i> = .611)	.82 (.40–1.67, <i>P</i> = .571)	-
Distance to hospital, km, mean (SD)	1.01 (1.00–1.01, <i>P</i> = .086)	1.00 (.99–1.01, <i>P</i> = .874)	-
Destination of readmission			
Index hospital	-	-	-
Nonindex hospital	5.33 (3.33–8.67, <i>P</i> < .001)	4.76 (2.92–7.88, <i>P</i> < .001)	4.96 (3.09–8.09, <i>P</i> ≤ .001)

OR = odds ratio; CI = confidence interval; aOR = adjusted odds ratio; BMI = body mass index; OSAS = obstructive sleep apnea syndrome; SD = standard deviation.

Data are n (%) unless otherwise stated.

of Excellence in Obesity Care was an independent factor for better survival. Second, the index hospitals undoubtedly have more comprehensive information on a specific patient, permitting superior continuity of care. The enhancement of information sharing through information technology is often suggested as a possible solution to the increasing problem of care fragmentation [5]. Finally, surgeons and care providers from the index hospital who performed the initial procedure might feel more concerned by the patient's complications, either because of a stronger sense of duty toward the patients

or simply from being under the pressure of possible legal action [12].

The dilemma between regionalization of care and care fragmentation has to be addressed to provide the best care for bariatric patients. A possible example is the case of a regional bariatric emergency network in France, called OSEAN, that is coordinated by 1 tertiary referral center and enrolls all regional institutions performing bariatric surgery [11]. The regional health authorities funded this organization to centralize the management of severe complications.

The network is based on 3 principles. First, the 24/7 availability of a senior bariatric surgeon from the referral center to provide distant mentoring or to organize, when necessary, emergency transfers. Second, the re-referral of the patient to the center that performed the initial surgery after completion of treatment(s) for complication(s). Third, the attendance of all surgeons at regional morbidity and mortality reviews twice a year. The OSEAN network has shown a reduction in mortality compared to the rest of the country. This type of organization addresses at least 2 of the aforementioned reasons for worse outcomes in nonindex hospitals: in cases of severe complications, patients are admitted to a highly performing referral center, and patient information is directly exchanged among surgeons.

Regionalization of care and centralization of severe complications seems to be a valuable perspective that deserves generalizability.

Our study has several strengths. First, this study is among the largest to investigate the association between postbariatric surgery care fragmentation and mortality, and is the first to comprehensively analyze a nationwide activity without any sampling. Hence, the concept of generalizability at a national scale has no meaning in this case, as all national information is available. However, inferences could be made for other countries with similar healthcare systems. The second major strength of this study is linkage of all hospital stays across the country, despite changes in hospital, region, and year. This allows a thorough and exhaustive description of the clinical pathway.

This study has several limitations. First, because of the retrospective design of the study, the readmission destination for patients was likely affected by selection bias. This might concern factors that determine the severity of cases, time to presentation, and access to healthcare facilities. Hence, patients that returned to the hospital where the surgery was initially performed might have clinical characteristics giving them a survival advantage. Nevertheless, we observed that patients presenting with common and potentially severe complications, such as bleeding, gastric leak/peritonitis, and intestinal obstruction, were more frequently readmitted in index hospitals. In addition, in the subgroup of patient with gastric leak/peritonitis, the analysis confirms a higher mortality rate in the nonindex group.

## Conclusion

Readmissions after bariatric surgery are common, and they are complicated by a higher mortality rate in cases of

readmission to a nonindex hospital. Our study suggests that the organized and structured management of bariatric emergencies could improve quality of care in patients who undergo bariatric surgery.

## Disclosures

*The authors have no commercial associations that might be a conflict of interest in relation to this article.*

## Supplementary materials

Supplementary material associated with this article can be found, in the online version, at <https://doi.org/10.1016/j.soard.2021.03.004>.

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