



Original article

Incidence of chronic intestinal failure due short bowel syndrome in adults: A feasibility study



Loris Pironi^{a,b,*}, Federica Sacilotto^b, Anna Simona Sasdelli^b, Carlotta Cavoli^b, Mariacristina Guidetti^b, Gentilini Lorenzo^d, Claudio Ricci^{a,c}, Riccardo Casadei^{a,c}, Gilberto Poggioli^a

^a Department of Medical and Surgical Sciences, University of Bologna, Bologna, Italy

^b Centre for Chronic Intestinal Failure, IRCCS AOUBO, Bologna, Italy

^c Division of Pancreatic Surgery, AOUBO, Bologna, Italy

^d Surgery of the Alimentary Tract, AOUBO, Bologna, Italy

ARTICLE INFO

Article history:

Received 10 July 2025

Accepted 6 August 2025

Keywords:

Short bowel syndrome

Intestinal failure

Home parenteral nutrition

Epidemiology

SUMMARY

Background: The incidence of short bowel syndrome associated chronic intestinal failure (SBS-CIF) is entirely unknown. A feasibility study was carried out in the tertiary-level hospital of the Bologna University (Italy), to test a protocol devised to investigate the in-hospital and the population incidences of SBS-CIF.

Methods: A 3-month (January–March 2024) retrospective survey was carried out in the two digestive disease surgical units of the hospital. Patient inclusion criteria were: age ≥ 18 years, abdominal surgery with small bowel resection and no-home parenteral nutrition (HPN) before hospital admission. Exclusion criterion: patient already on HPN at hospital admission. Criterion for the diagnosis of “SBS-CIF” was patient discharge on HPN within 3 months from inclusion of the study (end of the follow-up, June 30th 2024).

The 3-month in-hospital and population incidences were calculated as percentage of patients who underwent abdominal surgery with a small bowel resection procedure and who developed SBS-CIF, and as “SBS-CIF” per million of inhabitants of the Bologna metropolitan area, respectively.

Results: Sixty-seven patients met the inclusion criteria. At June 30th, 56 patients were discharged without HPN (83.5 %), 5 died during hospitalization, 6 were discharged on HPN (in-hospital incidence SBS-CIF: 8.9 %). Two SBS-CIF were resident in the Bologna metropolitan area (SBS-CIF incidence: 1.96 cases/10⁶ inhabitants).

Conclusions: Our study proposes a model to investigate the incidence of SBS-CIF in adults. The results provide new data on this hitherto unexplored area of SBS-CIF epidemiology and, importantly, offer a model for multicenter studies to further investigate the epidemiology of SBS-CIF on a national and international scale.

© 2025 The Authors. Published by Elsevier Ltd on behalf of European Society for Clinical Nutrition and Metabolism. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

1. Background

The term short bowel syndrome (SBS) defines “the clinical feature associated with a remaining small bowel in continuity of less than 200 cm from the ligament of Treitz” [1]. The presence of clinical features of SBS despite a residual small-bowel length >200 cm is termed “functional SBS” [1]. Short bowel syndrome

occurs in acute or chronic gastrointestinal diseases requiring extensive small bowel resection, such as Crohn’s disease, mesenteric ischemia, intra-abdominal adhesions, post-operative complications and radiation enteritis [2]. In adults, SBS represents around two-thirds of cases of chronic intestinal failure (CIF) [2], defined as “persistent reduction of the gut function below the minimum necessary for the absorption of macronutrients and/or water and electrolytes, such that intravenous supplementation (IVS) is required to maintain health and/or growth” [1]. The SBS-associated CIF (SBS-CIF) can be reversible by intestinal rehabilitation programs, that allow patients to be weaned off IVS [1].

* Corresponding author. Department of Medical and Surgical Sciences, University of Bologna, Italy.

E-mail address: loris.pironi@unibo.it (L. Pironi).

<https://doi.org/10.1016/j.clnesp.2025.08.009>

2405–4577/© 2025 The Authors. Published by Elsevier Ltd on behalf of European Society for Clinical Nutrition and Metabolism. This is an open access article under the CC BY license (<http://creativecommons.org/licenses/by/4.0/>).

The epidemiology of both CIF and SBS-CIF has been assessed by studies on the prevalence of patients on home parenteral nutrition (HPN) programs providing the IVS at home. In Europe, the prevalence of HPN has been observed to range from 5 to 80 cases per million of the population, with the highest prevalence observed in Denmark [3,4]. As SBS-CIF represents around 65 % of CIF [2], the prevalence of SBS-CIF would range from 3.2 to 52 cases/million inhabitants. A recent survey in the United States showed a prevalence of HPN of 79 cases per million inhabitants, but the malignant or benign nature of the underlying disease and the pathophysiologic causes of CIF were not reported [5]. An individual center study on the clinical trajectory of SBS-CIF showed an incidence of successful weaning from IVS of 38.7 % (95 % CI 33.2–44.3) of cases at 5 years after HPN initiation [6]. Very few data are available about the incidence of SBS-CIF. Crawford et al. reported that acute mesenteric ischemia, one of the main causes of massive intestinal resection, accounted for less than 0.1 % of hospital admissions [7]. A recent international multicenter cross-sectional study by the European Society for Clinical Nutrition and Metabolism (ESPEN) observed that acute IF accounted for 13/1000 acute care beds, and that SBS was the cause of 5.8 % of them [8]. Knowing the incidence of SBS is essential to better understand its epidemiology and estimate the health resource required for its treatment. We therefore devised a study protocol to investigate both the in-hospital and the population-based incidence of SBS-CIF. The protocol was applied in a tertiary level hospital to assess its operational feasibility and to evaluate its potential applicability and reliability for multicenter surveys on SBF-CIF incidence.

2. Methods

2.1. Study design

This was a retrospective quality assessment audit to evaluate the incidence of SBS-CIF carried out at the Saint Orsola university hospital of Bologna (Italy). Bologna is the capital city of the Emilia-Romagna region, one of the 20 Italian administrative Regions, with a population of 4,473,570 inhabitants. The Bologna metropolitan area has a population of 1,020,865 inhabitants [9] (Supplemental Fig. 1).

The Saint Orsola university hospital is a tertiary-level research hospital (IRCCS) with 89 units and 1374 beds. The hospital includes two regionally accredited centers, the center for CIF and the center for inflammatory bowel disease (IBD). The survey was carried out on the two digestive disease surgical units of the hospital (70 beds), incorporating both elective and emergency abdominal surgery procedures.

The patient enrollment period was from January 1st 2024 to March 31st 2024 and the in-hospital follow up period of enrolled patients ended at June 30th 2024. Patient inclusion criteria were: adult age (age \geq 18 years), abdominal surgery with small bowel resection during the 3-month period and no-HPN-treatment before hospital admission. Patient exclusion criterion was being already on HPN for SBS-CIF at hospital admission.

The criterion for the diagnosis of “new SBS-CIF” inpatients included in the study was discharge on HPN after abdominal surgery with a small bowel resection procedure (new case of SBS-CIF) within 3 months from inclusion of the study.

2.2. Identification of patients who underwent abdominal surgery with small bowel resection during the 3 months of patient enrollment

The hospital Information Technology office identified patients by the following surgical procedure codes of the International Codes of Disease version 9 (ICD-9): from 42.XX to 54.XX,

abdominal surgery; 45.61, multiple small bowel resection; 45.62, partial/segmental small bowel resection; 46.02, exteriorized small bowel resection.

2.3. Identification of patients excluded from the survey

Patients who were already on HPN for SBS-CIF at hospital admission were identified using the hospital patient record.

2.4. Patients' characteristics and outcome

The following data of patients included in the study were collected in a structured excel file: residence (Bologna metropolitan area, Emilia-Romagna Region outside the Bologna metropolitan area, other Italian regions), age, sex, underlying disease requiring surgery, type of surgical procedure (elective or emergency), length of hospital stay (LOS), patient outcome and Diagnosis Related Group (DRG) [10] at June 30th 2024, reported in the patient discharge form. Patient outcome was categorized as: discharged without HPN, SBS-CIF (discharged on HPN), deceased. The following additional data were collected for SBS-CIF or deceased patients: SBS anatomy, length of remnant bowel, presence of stoma or entero-cutaneous fistulas, number of transfers between hospital units during the hospitalization (i.e. ICU, gastroenterology etc.), listing for intestinal continuity reconstruction at discharge, referral to intestinal transplantation center, type of IVS (fluids and electrolytes alone, FE; parenteral nutrition, PN).

The underlying disease requiring surgery were described using the principal ICD-9-CM Diagnosis Code [11] reported in the patient discharge form. The SBS anatomy was categorized as: SBS type-1, jejunum- or ileo-ostomy without or with remnant colon not in continuity; SBS type-2, jejunum- or ileo-colon anastomosis; SBS type 3, jejunum-ileo anastomosis with ileo-cecal valve and total colon in continuity.

The data were retrieved from the ward record, the operation note and the discharge form and letter.

2.5. Ethics

The audit was agreed with the hospital Clinical Governance Unit and was conducted with full regard to the confidentiality of the individual patient and the principles of the Declaration of Helsinki. Patients' informed consent was not required for an audit of existing clinical practice. The collected individual patient data were anonymized.

2.6. Statistical analysis

The incidence of SBS-CIF during the 3-month audit period was calculated as “in-hospital incidence” and “population-based incidence”.

The in-hospital incidence was calculated as percentage of “patients who underwent abdominal surgery with a small bowel resection procedure” who developed “SBS-CIF”.

The population-based incidence was calculated as “SBS-CIF” per “million of inhabitants of the Bologna metropolitan area”.

Where required, data are reported as mean, standard deviation (SD) and percentage.

3. Results

3.1. Patient cohort

During the 3 months of enrollment, 645 patients underwent abdominal surgery, 75 of whom had a small bowel resection. Eight

patients were excluded from the analysis because they were already on HPN for SBS-CIF at hospital admission. The cohort of patients who underwent abdominal surgery with a small bowel resection included in the analysis consisted of 67 patients, females 32 (47.7 %), age 55.5 ± 19.2 (range: 18–94) years, LOS 17.7 ± 17.4 (range: 1–78) days, residence in Bologna metropolitan area 26 (38.8 %), in Emilia-Romagna Region outside the Bologna metropolitan area 8 (12.0 %), in other Italian regions 33 (49.2 %). Crohn's disease and cancer were the most frequent underlying diseases (n.31, 46.1 % and n. 11, 16.4 %, respectively), followed by mesenteric ischemia (n.4, 5.9 %) and colostomy/ileostomy surgery (n.5, 7.4). The type of surgery was elective in 56 (83.6 %) cases and emergency in 11 (16.4 %) (Table 1).

3.2. Patient outcome and SBS-CIF incidence

At June 30th, the outcome of the 67 patients included in the analysis was: discharged without HPN 56 (83.5 %), deceased during the hospitalization 5 (7.5 %), SBS-CIF 6 (8.9 %). The 3-month in-hospital incidence of SBS-CIF was 8.9 % of the abdominal surgery procedures with small bowel resection.

The 6 SBS-CIF patients (Table 2) had mean age 50.3, the underlying disease was Crohn's in 3, the type of surgery was elective in 5, and the mean LOS was 31.1 days. The SBS anatomy was type-1 without colon-in-continuity in 5 patients and with colon-in-continuity in 1. The remnant small bowel length was unknown in 4 SBS-CIF, 150 and 100 cm in the other 2 cases. At discharge, 3 SBS-CIF patients were listed for intestinal continuity reconstruction procedure. No patient was referred for intestinal transplantation. The type of IVS was FE in the 3 patients listed for intestinal continuity reconstruction and PN in the other 3 patients.

Table 1

Principal ICD-9-CM Diagnosis Code and type of surgical procedure (elective or emergency) of the patient cohort who underwent abdominal surgery with small bowel resection in the 3-month survey period.

Principal ICD-9-CM Diagnosis Code	Patients, n.	Elective surgery, n.	Emergency surgery, n.	
555.0	Reg enteritis, sm intest	8	7	1
555.2	Reg enterit sm/lg intest	23	23	0
556.2	Ulcerative proctitis	1	1	0
556.9	Ulceratve colitis unspcf	1	1	0
151.9	Malig neopl stomach NOS	1	1	0
152.9	Mal neo small bowel NOS	2	2	0
153.1	Mal neo transverse colon	2	1	1
153.6	Malig neo ascend colon	2	1	1
153.9	Malignant neo colon NOS	1	1	0
154.1	Malignant neopl rectum	1	1	0
197.6	Sec mal neo peritoneum	1	1	0
202.83	Lymphomas NEC abdom	1	1	0
557.9	Vasc insuff intest NOS	3	1	2
445.89	Atheroembolism, site NEC	1	0	1
569.6	Colstmy/enteros comp NEC	1	1	0
569.69	Colostomy/enter comp NOS	1	1	0
V55.2	Atten to ileostomy	3	3	0
569.81	Intestinal fistula	2	2	0
998.6	Persistent postoperative fistula	1	1	0
540	Ac append w peritonitis	1	0	1
569.83	Perforation of intestine	2	1	1
550	Inguinal hernia, with gangrene	1	1	0
551.1	Umbilical hernia w gangr	2	0	2
553.29	Ventral hernia NEC	1	1	0
560.81	Intestinal adhes w obstr	1	1	0
578.9	Gastrointest hemorr NOS	1	1	0
751.1	Atresia small intestine	1	1	0
997.4	Digestive system complications	1	1	1
Total	67	56	11	

MCC/CC, Major Complications or Comorbidities.

NOS, Non Otherwise Specified.

NEC, Not Elsewhere Classified.

The DRG code was “Major Small And Large Bowel Procedures With MCC” in all 6 patients.

Two SBS-CIF were resident in the Bologna metropolitan area; the underlying disease was cancer in one and Crohn's disease in the other. Both underwent elective surgery. In the Bologna metropolitan area, the 3-month population-based incidence of SBS-CIF was 1.95 cases/10⁶ inhabitants.

The 5 deceased patients (Table 2) had a mean age 83.3 years, the underlying disease was cancer in 3, the type of surgery was emergency in 4, and the mean LOS was 15.4 days. The cause of death was septic shock due to post-operative intestinal perforation in old polymorbidity patients. The remnant small bowel length of the deceased patients was unknown (2 had a small bowel ostomy); therefore, it was not possible categorize them as SBS. The DRG code was “Major Small And Large Bowel Procedures With MCC” in 3 patients, “Stomach, Esophageal And Duodenal Procedures With MCC” and “Respiratory System Diagnosis With Ventilator Support >96 Hour”.

4. Discussion

This audit provides new information about the epidemiology of SBS-CIF and proposes a model for multicentred investigations on the incidence of SBS-CIF. Data on incidence are the missing piece of the epidemiology of SBS-CIF. Knowing the rate of new cases of SBS-CIF will improve the understanding of the disease patterns and trends, help the appropriate allocation of healthcare resources to prevent and treat the disease, and address research needs. Homogenizing the methodology of epidemiological surveys would allow the comparison of data retrieved in countries with different environments and population characteristics, as well as different health care systems and economical resources.

Table 2

Characteristics of patients deceased and the SBS-CIF (discharged on home parenteral nutrition for chronic intestinal failure due to short bowel syndrome) after abdominal surgery with small bowel resection in the 3-month survey.

	SBS-CIF	Deceased
Patients, n.	6	5
Residence, n.		
Bologna metropolitan area	2	3
Emilia-Romagna region, outside Bologna metropolitana	1	2
Other Italian regions	3	0
Females/Males, n.	2/4	2/3
Age, years (range)	50.3 ± 16.1 (34–81)	83.3 ± 5.0 (79–91)
ICD-9 diagnosis code, n.		
555.0-Reg enteritis, sm intest	1	0
555.2-Reg enterit sm/lg intest	2	0
153.9-Malignant neo colon NOS	1	0
197.6-Sec mal neo peritoneum	1	0
997.4-Digestive system complications	1	0
151.9-Malig neopl stomach NOS	0	1
153.6-Malig neo ascend colon	0	1
153.1-Mal neo transverse colon	0	1
557.9-Vasc insuff intest NOS	0	1
569.83-Perforation of intestine	0	1
Type of surgery, n.		
Elective	5	1
Emergency	1	4
SBS type		
1-jejuno or ileo-ostomy	3	1
1-jejuno or ileo-ostomy with remnant colon not in continuity	2	1
2-jejuno or ileo-colon anastomosis	1	3
Remnant small bowel length, cm, n. of patients	150, 1 100, 1 NR, 4	NR
Ward transfers during hospitalization, n.		
0	4	2
1	1	2
2	0	1
6	1	0
Length of hospital stay, days (range)	31.1 ± 22.1 (9–70)	15.4 ± 27.2 (1–64)
ICD-9, DGR code, n.		
569-Major Small And Large Bowel Procedures With MCC	6	3
567-Stomach, Esophageal And Duodenal Procedures With MCC	0	1
541-Respiratory System Diagnosis With Ventilator Support >96 H	0	1

NR, not reported.

NOS, Non Otherwise Specified.

MCC/CC, Major Complications or Comorbidities.

During the 3-months of the survey, the in-hospital incidence of SBS-CIF was 8.9 % of patients who underwent abdominal surgery with a small bowel resection. At discharge, 3 patients with SBS-CIF were listed for intestinal continuity restoration. These data suggest that a total of 24 SBS-CIF and 12 hospital admissions for SBS-CIF-related surgical procedures would be expected on a yearly basis. The assessment of the in-hospital incidence is useful for planning hospital resource requirements for SBS-CIF and also to identify factors and elements required for service improvements. The analysis and the interpretation of the data needs to consider the characteristics of the hospital; the Bologna Saint Orsola university hospital is a tertiary-level hospital that includes the Emilia-Romagna regional center for CIF and the regional center for IBD, two highly-specialized units that care for complex clinical cases referred from all over the country. Indeed, 50 % of the patient cohort, as well as the SBS-CIF patients, were resident outside the Emilia-Romagna region and had Crohn's disease as the underlying disease. It may therefore be predicted that lower incidences of SBS-CIF occur in hospitals of lower intensity levels and/or without specialized centers for CIF or IBD.

The 3-month population-based incidence of SBS-CIF was 1.96 cases/10⁶ inhabitants of the Bologna metropolitan area, projecting an expected yearly incidence of 7.84 new SBS-CIF/10⁶ inhabitants. The Italian Health Care System is based on national legislation,

which defines the general rules for providing health care, and on Regional Health Care Systems by which the 20 administrative regions provide health care to their residents. In an individual region, the territory is divided into local health-care units (LHCUs), which are the operative arms of the Regional Health Care System [11]. The Bologna metropolitan area is managed by two LHCUs. A formal agreement is in place between the regional center for CIF of the Saint Orsola hospital and the two LHCUs of the Bologna metropolitan area to refer all the SBS-CIF cases to the CIF center. Therefore, the observed population-based incidence of SBS-CIF in the Bologna metropolitan area can be considered reliable.

There are no published data on population-based incidence of SBS-CIF to be directly compared with our results. An indirect comparison could be proposed with the Jeppesen's perspective on epidemiology of CIF, based on data from Denmark [12]. The Denmark healthcare system allows free access to organ failure treatment and is based on the centralized referral of patients. All patients with CIF receive HPN and are registered, so that Denmark reports the highest point-prevalence of HPN for CIF, that is ~80/10⁶ inhabitants. Considering that the point-prevalence of adult patients receiving renal replacement therapy (RRT; dialysis) in Denmark was ~800/10⁶, Jeppesen hypothesised that, in an environment with free access to organ failure treatment and accurate registering, the expected ratio of patients receiving HPN compared

to patients receiving RRT should be ~1:10. In 2022 in Italy, the annual incidence of RRT was 173/10⁶ [13]. We calculated an annual SBS-CIF incidence of ~8/10⁶. Considering that in adults, SBS-CIF represents 65 % of total CIF [2], the annual incidence of CIF would be ~12/10⁶, accounting for a HPN to RRT ratio of ~0.7:10, consistent with Jeppesen's hypothesis.

The ability of patients with SBS-CIF to receive appropriate diagnosis and treatment relies on clinical expertise, as well as on national and local healthcare resources for CIF, which differ greatly both within and between individual countries [14]. Epidemiological multicenter studies require protocols able to homogenize the modality of data collection in order to compare the impact of these existent differences in CIF care delivery. The feasibility of our study protocol relies on the hospital use of ICD classification of surgical procedures and on registering all new SBS-CIF cases occurring in the population of a well-defined geographical area within a given period of time. As such, the protocol can provide a template for multi-centre data collection, informing regional, national and international SBS-CIF incidences.

In conclusion, we devised and tested a study protocol to investigate the incidence of SBS-CIF and applied it in a tertiary-level hospital. The results provide new data on this hitherto unknown area of SBS-CIF epidemiology and provide a feasible model for future multicenter studies.

Author contribution

LP devised the study protocol, analyzed the results and drafted the manuscript.

FS collected the data, cured the data, discussed and approved the protocol study, discussed the results and reviewed the manuscript before submission.

ASS, CC, MG, LG, CR, RC, GP, discussed and approved the protocol study, discussed the results and reviewed the manuscript before submission.

Declaration of Generative AI and AI-assisted technologies in the writing process

Generative AI and AI-assisted technologies were not used in the writing process of this manuscript.

Funding statement

The study was not supported by any funding.

Declaration of competing interest

None to be declared by all the Authors, in relation to the content of the manuscript.

Appendix A. Supplementary data

Supplementary data to this article can be found online at <https://doi.org/10.1016/j.clnesp.2025.08.009>.

References

- [1] Pironi L, Cuerda C, Jeppesen PB, Joly F, Jonkers C, Krznarik Z, et al. ESPEN guideline on chronic intestinal failure in adults – update 2023. *Clin Nutr* 2023;42(10):1940–2021.
- [2] Pironi L, Konrad D, Brandt C, Joly F, Wanten G, Agostini F, et al. Clinical classification of adult patients with chronic intestinal failure due to benign disease: an international multicenter cross-sectional survey. *Clin Nutr* 2018;37(2):728–38.
- [3] Pironi L, Arends J, Baxter J, Bozzetti F, Peláez RB, Cuerda C, et al. ESPEN endorsed recommendations. Definition and classification of intestinal failure in adults. *Clin Nutr* 2015;34(2):171–80.
- [4] Brandt CF, Hvistendahl M, Naimi RM, Tribler S, Staun M, Brøbech P, et al. Home parenteral nutrition in adult patients with chronic intestinal failure: the evolution over 4 decades in a tertiary referral center. *JPEN J Parenter Enteral Nutr* 2017;41(7):1178–87.
- [5] Mundi MS, Pattinson A, McMahon MT, Davidson J, Hurt RT. Prevalence of home parenteral and enteral nutrition in the United States. *Nutr Clin Pract* 2017;32:799–805.
- [6] Fuglsang KA, Brandt CF, Scheike T, Jeppesen PB. Differences in methodology impact estimates of survival and dependence on home parenteral support of patients with nonmalignant short bowel syndrome. *Am J Clin Nutr* 2020 Jan 1;111(1):161–9. <https://doi.org/10.1093/ajcn/nqz242>. PMID: 31562502.
- [7] Crawford RS, Harris DG, Klyushnenkova EN, Tesoriero RB, Rabin J, Chen H, et al. A statewide analysis of the incidence and outcomes of acute mesenteric ischemia in Maryland from 2009 to 2013. *Front Surg* 2016 Apr 14;3:22. <https://doi.org/10.3389/fsurg.2016.00022>. PMID: 27148538; PMCID: PMC4830818.
- [8] Reintam Blaser A, Ploegmakers I, Benoit M, Holst M, Rasmussen HH, Burgos R, et al. AIF study group. Acute intestinal failure: international multicenter point-of-prevalence study. *Clin Nutr* 2020 Jan;39(1):151–8. <https://doi.org/10.1016/j.clnu.2019.01.005>. Epub 2019 Jan 15. PMID: 30683610.
- [9] https://it.wikipedia.org/wiki/Citt%C3%A0_metropolitana_di_Bologna.
- [10] <https://www.findacode.com/jicd-9/jicd-9-cm-diagnosis-codes.html>.
- [11] Pironi L, Candusso M, Biondo A, Bosco A, Castaldi P, Contaldo F, et al. Italian Society for Parenteral and Enteral Nutrition Executive Committee. Prevalence of home artificial nutrition in Italy in 2005: a survey by the Italian Society for Parenteral and Enteral Nutrition (SINPE). *Clin Nutr* 2007 Feb;26(1):123–32. <https://doi.org/10.1016/j.clnu.2006.07.004>. Epub 2006 Aug 30. PMID: 16938366.
- [12] Jeppesen PB. The long road to the development of effective therapies for the short gut syndrome: a personal perspective. *Dig Dis Sci* 2019;64:2717–35. <https://ridt.sinitaly.org/2024/11/21/report-2022-2/>.
- [13] Geransar P, Lal S, Jeppesen PB, Pironi L, Rzepa E, Schneider SM. Survey of healthcare professionals' experiences of care delivery in patients with chronic intestinal failure: ATLAS of Variance. *Clin Nutr ESPEN* 2023 Apr;54:157–65. <https://doi.org/10.1016/j.clnesp.2023.01.017>. Epub 2023 Jan 20. PMID: 36963858.