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Preventing incisional hernia after ileostomy closure: Budget impact analysis of prophylactic biosynthetic mesh use in Italy

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ABSTRACT

Background: Stoma-site incisional hernia is a frequent complication after stoma closure, causing morbidity and health care burden. Prophylactic mesh reinforcement, particularly with biosynthetic meshes, has shown promise in reducing these hernias without increasing the risk for infection. This study aimed to assess the budget effects of using biosynthetic mesh prophylactically during ileostomy closure for hernia prevention, from hospital, National Healthcare Service, and societal perspectives in the Italian health care context.
Methods: A budget impact model was developed over a 5-year time period to compare standard care (no mesh) with increasing adoption of prophylactic mesh (5–25%). Costs included hospital micro-costing data, national diagnosis-related group tariffs, and patient productivity losses. Clinical effectiveness referred to a prospective observational study showing a significant reduction in stoma-site incisional hernia incidence with mesh (8 vs. 24%, $P = .029$).
Results: From the hospital perspective, excluding costs that are common to both strategies for operating room and health care personnel, per-patient costs were 1,428.93€ with mesh and 2,290.00€ without mesh (saving 861.07€). Savings were also observed from the National Healthcare Service (179.84€ per patient) and societal (328.45€ per patient) perspectives. At a national level, considering 4,000 ileostomy closures per year, increasing mesh uptake to 25% projected cumulative savings of about €1.32 million (hospital), €0.44 million (National Healthcare Service), and €0.89 million (society). Scenario analysis confirmed consistency of savings across various European cost structures.
Conclusions: Prophylactic biosynthetic mesh during stoma closure appears cost-saving, reducing stoma-site incisional hernia and reinterventions. Although long-term quality-of-life benefits remain uncertain, short-term outcomes support selective use in high-risk patients. Findings may inform health policy and future health technology assessment processes.

Introduction

A stoma is a surgically created opening that diverts the normal passage of food or the elimination of stool or urine, either temporarily or permanently, when organs can no longer function adequately.[1] Once the underlying condition is resolved, a stoma reversal (re-anastomosis) can restore normal intestinal continuity.[2] However, the former stoma site represents a full-thickness fascial defect and is functionally equivalent to a hernia, so closure with simple fascial suturing is associated with a high risk for hernia development and recurrence.

Previously published observational studies consistently report rates between 30% and 35%, with up to about 65% of cases ultimately requiring surgical repair.[3,4] Contemporary data unequivocally demonstrate this risk: In a single-center retrospective cohort of 340 patients, the incidence of hernia at the former stoma site after reversal was 24.4%, with a combined rate of any hernia, including pre-existing parastomal hernias.[5] Moreover, the systematic review and meta-analysis by Lambrichts et al[6] examined

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33 studies involving 4,679 stoma reversal procedures to assess the incidence, risk factors, and prevention of stoma-site incisional hernias (SSIHs). The overall hernia incidence was 6.5%, increasing to 17.7% in studies specifically focused on stoma-site hernias. Key risk factors included higher body mass index (BMI), diabetes, and a history of malignancy. Importantly, prophylactic mesh during stoma closure significantly reduced hernia rates without increasing surgical site infections (SSIs). The authors conclude that SSIHs are common and often underrecognized, and that preventive strategies, especially mesh reinforcement, may be particularly beneficial in high-risk patients.

These findings emphasize the considerable morbidity associated with stoma-site hernia formation and underscore the need for preventive strategies, such as reinforcing mesh closure, especially in high-risk patients. In this context, mesh placement has been shown to significantly reduce the incidence of incisional hernia after midline laparotomy compared with primary suture closure.[7,8] Based on this evidence, prophylactic mesh reinforcement has been adopted as a strategy to strengthen the abdominal wall at the site of stoma reversal.[9] However, its use in ileostomy reversal presents specific challenges, including the lateral location of the defect and concerns regarding mesh infection, given the possible contamination from bowel contents. Currently, 3 main categories of mesh are available in clinical practice: nonabsorbable synthetic, absorbable synthetic (biosynthetic), and biologic meshes.[10] All have been used in efforts to prevent incisional hernia after stoma closure. However, consensus on the optimal mesh type and placement technique remains limited. Emerging evidence suggests that specific combinations of mesh characteristics and positioning may be associated with improved outcomes. In particular, recent comparative data[11] indicate that prophylactic placement of prosthetic or bioprosthetic mesh in the retromuscular plane offers the most favorable balance between efficacy and safety. Prosthetic mesh appears to be the most effective in reducing the risk for SSIH, followed by bioprosthetic mesh, whereas biologic mesh shows less consistent benefit. Among placement techniques, the retromuscular position is associated with superior biomechanical support and lower complication rates compared with onlay or intraperitoneal approaches, achieving significant hernia risk reduction without an apparent increase in SSIs. Nevertheless, heterogeneity across studies persists, highlighting the need for further high-quality comparative research and the development of standardized guidelines.

The present study aimed at conducting a budget impact analysis (BIA) from different perspectives (hospital, National Healthcare Service [NHS], and society) in Italy, comparing the clinical pathways of patients undergoing ileostomy closure with and without mesh implantation (long-term absorbable) for hernia prevention.

By evaluating which option offers better value for money, balancing economic impact with clinical outcomes, the analysis can inform health care decision-makers and contribute valuable evidence to support health technology assessment (HTA) processes at the European level[12,13] as well as the Italian national HTA program for medical devices.[14]

Materials and methods

A BIA model was developed in Microsoft Excel to assess the financial implications of introducing prophylactic mesh use into routine clinical practice for the prevention of incisional hernia in patients undergoing ileostomy closure. The analysis started with the estimation of per-patient costs associated with the 2 alternative strategies (mesh versus no mesh), capturing the full clinical pathway, including the index stoma closure procedure, procedure-related complications, and the management of incisional hernias when they occurred.

These per-patient cost estimates were then scaled to the population level to evaluate the overall budget impact. The analysis was conducted from 3 perspectives. From the NHS perspective, costs were estimated using national reimbursement tariffs based on diagnosis-related groups (DRGs). The hospital perspective incorporated detailed hospital costs derived from micro-costing data. Finally, the societal perspective extended the NHS perspective by additionally accounting for productivity losses associated with patients' time off work.

The analysis has been reported according to the Consolidated Health Economic Evaluation Reporting Standards (CHEERS).[15,16]

Clinical data inputs and patient pathway

A recently published study, in the French context, comparing the clinical outcomes regarding the use of a prophylactic biosynthetic mesh (poly-4-hydroxybutyrate; Phasix, Becton Dickinson, Franklin Lakes, NJ) versus no mesh, has been used as source of clinical data for the economic evaluation.[17] The outcomes of consecutive patients undergoing ileostomy closure with prophylactic biosynthetic mesh reinforcement for colorectal cancer were prospectively collected and compared with those of a historical cohort from a tertiary care center who underwent ileostomy reversal with standard fascial closure without mesh (control group). Both groups, composed of 50 individuals each, with mean age of 67 years, were closely matched for key demographic and clinical variables, including age, sex, BMI, and American Society of Anesthesiologists score, ensuring comparability. After a mean follow-up of 4 years, the incidence of SSIH, as confirmed by computed tomography imaging, was significantly lower in the mesh group than in the control group (8 vs. 24%, $P = .029$).

With respect to the stoma closure intervention, the French reference study[17] reported SSI rates of 4% in the mesh group and 6% in the no-mesh group.

Based on published literature[6] indicating that approximately 50% of patients diagnosed with an incisional hernia after stoma closure eventually undergo surgical repair, a 50% conversion rate was applied to the incidence of incisional hernia after stoma closure to estimate the rates of surgical interventions (the parameter considered is “% of hernias that are repaired”).

To estimate the distribution of hernia repairs across time, we referred to an analysis performed on the Hospital Discharge Records (SDO) for the period 2015 to 2019.[18] This analysis quantified the population of patients who underwent abdominal hernia repair after abdominal surgeries or after a diagnosis of inflammatory bowel disease (IBD) in Italy. Results were stratified by index procedure (ileostomy, colostomy, ileostomy + colostomy). For the specific scope of our analysis, ileostomies were considered as they are more likely to require stoma closure.[19] For this type of patients, the distribution of hernia repairs across a 4-year period was 40% in the first year, 33.33% in the second year, 15.83% in the third year, and 10.83% in the fourth year. This distribution was then applied to the estimated rate of hernia repair surgeries in our model. The parameters considered are “% distribution of hernia repairs (year 1),” “% distribution of hernia repairs (year 2),” “% distribution of hernia repairs (year 3),” “% distribution of hernia repairs (year 4).”

Cost inputs: NHS perspective

From the NHS perspective, costs were estimated using national reimbursement tariffs for both the stoma closure procedure, with or without mesh implantation (DRG 153 - Minor Small & Large

Bowel Procedures w/o CC) and for the surgical hernia repair (DRG 160 - Hernia Procedures Except Inguinal & Femoral Age >17 w/o CC). Importantly, DRG reimbursement tariffs are identical regardless of whether mesh is used during stoma closure or in subsequent hernia repair.

SSI incidence rates were weighted by the corresponding hospital reimbursement tariff for their management, as defined under DRG 418 (Postoperative & Post-Traumatic Infections) when considering the NHS perspective.

Cost inputs: Hospital perspective

A micro-costing analysis reported by Rampado and colleagues[20] was used as a source of costs for incisional hernia repair from the hospital perspective. This study evaluated 3 patient groups based on the complexity of care required: patients without comorbidities who underwent a standard incisional hernia repair (SIHR) using synthetic mesh, patients with comorbidities who received the same procedure, and patients who underwent a complex incisional hernia repair (CIHR), involving the use of biologic mesh. Given the elevated risk for contamination typically associated with parastomal hernia repair, and considering that Rampado and colleagues placed patients undergoing ostomy reversal or colon resection in the highest contamination category, for the purposes of our analysis, this scenario was classified as a CIHR. The following cost items were retrieved from the cited study: preoperative investigations, surgical operation, health care personnel, disposal materials (without mesh), sterilization, equipment amortization (general costs), hospital stay, and general costs. Because various types of meshes are currently used in clinical practice, our model considered the average cost of a 20 × 25 cm mesh (synthetic, biosynthetic, hybrid, composite, or biologic), estimated at 2,165€, rather than the biologic mesh cost (3,274€) reported by Rampado et al.[20]

From the hospital perspective, the model for the index stoma closure procedure accounted only for the cost differences between the 2 strategies (mesh and no mesh), specifically, the cost of the mesh (for the strategy involving its use) and the additional costs related to health care personnel (surgeon)[21] and operating room (OR) time for mesh placement, estimated at 6.70 minutes based on the reference study.[17] Cost components that were common to both strategies, including baseline OR and health care personnel costs, were excluded from the analysis.

From the hospital perspective, a cost of 2,288.61€ was applied for the management of SSI, specifically deep infection, based on the study by Rognoni et al,[22] updated to 2025 values.

Cost inputs: Societal perspective

The societal perspective in the analysis extended the NHS perspective by incorporating patient loss of productivity. Age-specific wages were obtained from national statistics[23] and converted into daily productivity losses. For cases involving surgical repair of incisional hernia, a 30-day work absence was assumed, based on the study by Rampado and colleagues.[20]

Given the absence of robust data quantifying work impairment associated with nonrepaired incisional hernias, this source of uncertainty was addressed through a conservative scenario analysis. In this scenario, a limited number of productivity-loss days was assigned to patients with nonrepaired hernias, allowing quantification of the potential impact while avoiding overstatement of effects in the base-case analysis. Additional assumptions were informed by available literature on functional impairment and quality-of-life impact associated with incisional hernia morbidity. In particular, a reference value of 25 working days lost (median) was derived from the Annual Survey of Occupational Injuries and Illnesses of the U.S. Bureau of Labor Statistics, as reported by Kang et al.[24] This value was applied for each year that the patient remained with a nonrepaired hernia. This estimate was used as an external benchmark to explore the potential productivity burden of nonrepaired hernias in a conservative manner.

Considering the retirement age in Italy is 67 years,[25] productivity losses were included in the model only for the first year, as the mean age of the patients in the analysis was also 67 years. Table I summarizes the model inputs.

Budget impact analysis

A dynamic BIA model was developed to compare the standard of care scenario for managing patients undergoing stoma closure surgery without mesh implants with hypothetical future scenarios. These scenarios involve an increased adoption of mesh use, projected to rise from 5% to 25% over the next 5 years (5% in year 1, 10% in year 2, 15% in year 3, 20% in year 4, and 25% in year 5). Currently, the use of mesh is not recommended by any guidelines in Italy, so the present scenario assumes 100% adherence to the standard of care for managing patients.

To perform the BIA, a review of epidemiologic data has been conducted on the number of patients with ileostomy undergoing stoma closure each year in Italy. From the SDO analysis, it emerged that between the years 2015 and 2019, about 8,000 ileostomies were performed annually. Assuming, according to literature data,[27] that about 50% of these undergo closure, we can estimate that about 4,000 interventions are performed each year.

The costs of the current and proposed scenarios were calculated by multiplying the annual cost of each strategy by the proportion of the eligible population using it, accounting for new incident cohorts each year to reflect a dynamic model. Costs were reported in undiscounted terms, as the analysis focused on the expected budget impact at each time point.

The costs of the current and proposed scenarios were estimated by multiplying the annual per-patient cost of ileostomy closure with and without prophylactic mesh (see Table II) by the proportion of eligible patients undergoing each strategy. The model accounted for new cohorts of patients undergoing ileostomy closure each year (4,000 individuals each), reflecting a dynamic budget impact framework. Costs were reported in undiscounted terms, as the analysis focused on the expected budget impact at each annual time point rather than on long-term cost accumulation.[28]

To identify the parameters with the greatest influence on the model outcomes, 1-way sensitivity analyses on per-patient costs for mesh and no mesh were performed by varying parameters by ±30% from their baseline values, except where literature-based ranges were available. The results are presented using tornado diagrams.

To assess the broader applicability of our results across European countries, we conducted a scenario analysis designed to simulate cross-country cost variability. This analysis systematically adjusted all cost parameters to reflect realistic cost differences commonly observed among European hospitals. Using the Organization for Economic Cooperation and Development (OECD) health price index as a benchmark—where Italy is indexed at 96—we modeled a range of cost scenarios spanning from the Czech Republic (index 33) to Switzerland (index 172), representing the lowest and highest price levels, respectively.[29] Accordingly, we applied cost adjustments from –66% to +79% relative to the Italian baseline. By capturing this spectrum of costs, the scenario analysis strengthens the external validity of our model and supports the

Table I
Model input parameters

Parameter	Baseline value	Min	Max	Reference
Patients' age	67	46.90	87.10	Drissi 2025[17]
Timing				
Mesh - Additional operating time (min)	6.70	4.69	8.71	Drissi 2025[17]
Working days lost for hernia intervention	30	21	39	Rampado 2017[20]
Complication rates				
Mesh - stoma closure SSI	4%	0.03	0.05	Drissi 2025[17]
Mesh - Incisional hernia rate	8%	0.06	0.10	Drissi 2025[17]
No mesh - stoma closure SSI	6%	0.04	0.08	Drissi 2025[17]
No mesh - Incisional hernia rate	24%	0.17	0.31	Drissi 2025[17]
Hernia repair rates				
% of hernias that are repaired	50%	0.35	0.65	Lambrichts 2018[6]
% distribution of hernia repairs (year 1)	40%	0.28	0.52	SDO analysis[18]
% distribution of hernia repairs (year 2)	33.33%	0.23	0.43	SDO analysis[18]
% distribution of hernia repairs (year 3)	15.83%	0.11	0.21	SDO analysis[18]
% distribution of hernia repairs (year 4)	10.83%	0.08	0.14	SDO analysis[18]
Health care personnel cost/min				
Cost surgeon (min)	1.11€	0.78€	1.45€	MEF 2022 data uplifted to 2025[21]
Costs				
Stoma closure - cost mesh	545.37€	381.76€	708.98€	Cost provided by the producer
Cost operating room/min	10.00€	7.00€	13.00€	Patel 2022[26]
Stoma closure - DRG (153)	4,491.00€	3,143.70€	5,838.30€	National tariff - DRG 153 MINOR SMALL & LARGE BOWEL PROCEDURES W/O CC
Cost SSI	2,288.61€	1,602.03€	2,975.19€	Rognoni 2017[22] (updated to 2025), cost for deep infection
SSI - DRG (418)	3,508.00€	2,455.60€	4,560.40€	National tariff - DRG 418 POSTOPERATIVE & POST-TRAUMATIC INFECTIONS
Hernia repair - cost preoperative investigations	577.32€	404.12€	750.52€	Rampado 2017 (updated to 2025)[20]
Hernia repair - cost personnel	2,709.69€	1,896.78€	3,522.60€	Rampado 2017 (updated to 2025)[20]
Hernia repair - cost disposal materials (without mesh)	1,067.41€	747.19€	1,387.64€	Rampado 2017 (updated to 2025)[20]
Hernia repair - sterilization cost	350.08€	245.06€	455.11€	Rampado 2017 (updated to 2025)[20]
Hernia repair - equipment amortization (general costs)	1,485.80€	1,040.06€	1,931.55€	Rampado 2017 (updated to 2025)[20]
Hernia repair - cost hospital stay	7,046.87€	4,932.81€	9,160.93€	Rampado 2017 (updated to 2025)[20]
Hernia repair - general costs	2,536.87€	1,775.81€	3,297.93€	Rampado 2017 (updated to 2025)[20]
Hernia repair - cost surgery	15,774.05€	11,041.84€	20,506.27€	Calculated
Hernia repair - cost mesh	2,165.00€	1,515.50€	2,814.50€	Mean cost of different mesh types (20 × 25 cm)
Hernia repair - DRG (160)	1,371.00€	959.70€	1,782.30€	National tariff - DRG 160 HERNIA PROCEDURES EXCEPT INGUINAL & FEMORAL AGE >17 W/O CC
Daily productivity loss year 1	154.80€	108.36€	201.25€	https://www.forbes.com/advisor/it/business/stipendio-medio-italia/[23]
Daily productivity loss year 2	0.00€	0.00€	0.00€	https://www.forbes.com/advisor/it/business/stipendio-medio-italia/[23]
Daily productivity loss year 3	0.00€	0.00€	0.00€	https://www.forbes.com/advisor/it/business/stipendio-medio-italia/[23]
Daily productivity loss year 4	0.00€	0.00€	0.00€	https://www.forbes.com/advisor/it/business/stipendio-medio-italia/[23]

DRG, diagnosis-related group; *MEF*, Ministero dell'Economia e delle Finanze - Italian Ministry of Economy and Finance; *SDO*, Hospital Discharge Records; *SSI*, surgical site infection.

Table II
Per-patient economic impact of mesh compared with no mesh on the clinical pathway over a 4-year period

Mesh vs. No mesh	Hospital perspective			NHS perspective (reimbursements)			Societal perspective		
Health care resources	Mean cost of health care resources per patient		Difference	Mean cost of health care resources per patient		Difference	Mean cost of health care resources per patient		Difference
	Mesh	No mesh		Mesh	No mesh		Mesh	No mesh	
Stoma closure – mesh	545.37€	0.00€	545.37€	4,491.00€	4,491.00€	0.00€	4,491.00€	4,491.00€	0.00€
Stoma closure – operating room	67.00€	0.00€	67.00€						
Stoma closure – health care personnel	7.45€	0.00€	7.45€						
Stoma closure – complications management	91.54€	137.32€	−45.77€	140.32€	210.48€	−70.16€	140.32€	210.48€	−70.16€
Management of hernia – intervention – year 1	287.02€	861.07€	−574.05€	21.94€	65.81€	−43.87€	21.94€	65.81€	−43.87€
Management of hernia – intervention – year 2	239.19€	717.56€	−478.37€	18.28€	54.84€	−36.56€	18.28€	54.84€	−36.56€
Management of hernia – intervention – year 3	113.61€	340.84€	−227.23€	8.68€	26.05€	−17.37€	8.68€	26.05€	−17.37€
Management of hernia – intervention – year 4	77.74€	233.21€	−155.47€	5.94€	17.82€	−11.88€	5.94€	17.82€	−11.88€
Productivity losses for hernia intervention – year 1	–	–	–	–	–	–	74.31€	222.92€	−148.61€
Productivity losses for hernia intervention –year 2	–	–	–	–	–	–	0.00€	0.00€	0.00€
Productivity losses for hernia intervention –year 3	–	–	–	–	–	–	0.00€	0.00€	0.00€
Productivity losses for hernia intervention –year 4	–	–	–	–	–	–	0.00€	0.00€	0.00€
TOTAL	1,428.93€*	2,290.00€*	**−861.07€**	4,686.16€	4,866.00€	**−179.84€**	4,760.47€	5,088.92€	**−328.45€**

NHS, National Healthcare Service.
* Total costs do not include the cost components that are identical for both strategies; therefore, a direct comparison of the total cost per strategy across the different perspectives is not appropriate.

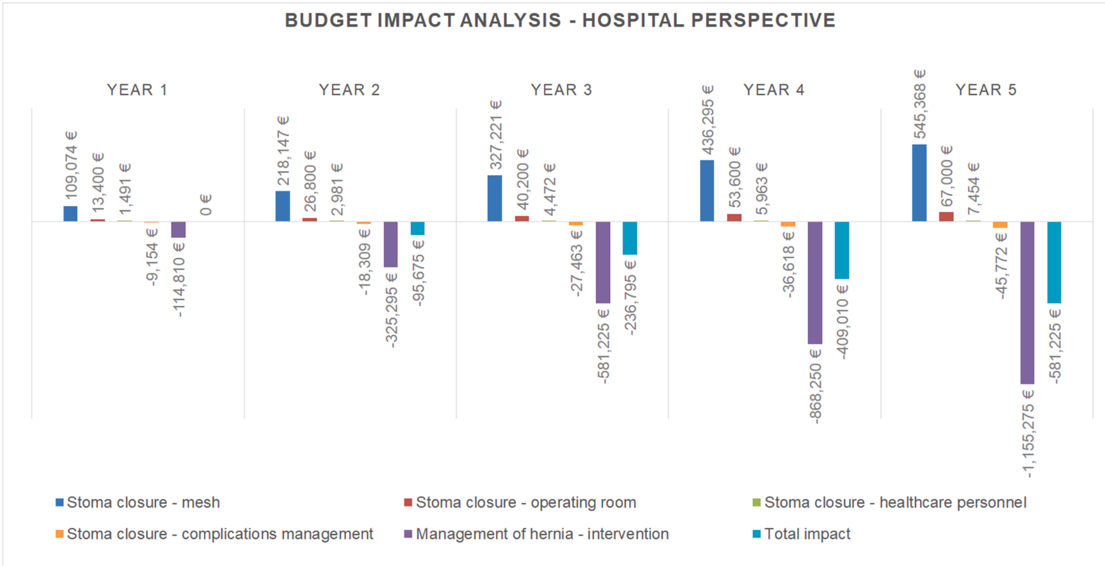

Figure 1. Budget impact analysis from the hospital perspective.

relevance and generalizability of our findings across a wide range of European health-system settings.

Results

A cost comparison between the use of mesh and no mesh in stoma closure procedures was conducted from 3 perspectives: hospital, NHS, and society. Table II presents the detailed per-patient costs for each treatment strategy (mesh versus no mesh) over a 4-year time period and demonstrates that the mesh strategy saves costs across all perspectives considered. From the hospital perspective, the average per-patient cost was 1,428.93€ with mesh versus 2,290.00€ without mesh, yielding a savings of 861.07€. It is worth noting that, from this perspective, total costs do not include cost components that are common to both strategies, such as OR and health care personnel costs. From the NHS reimbursement perspective, the mesh approach reduced costs by 179.84€ per patient. Under this framework, DRG reimbursement tariffs are the same regardless of whether mesh is used for stoma closure or subsequent hernia repair. As a result, the differences between the two strategies are mainly due to variations in complication rates and the use of additional resources, leading to a smaller cost difference when viewed from the hospital's perspective. Finally, from the societal perspective, which extends the NHS perspective by including indirect costs such as loss of productivity, the mesh strategy led to a per-patient cost reduction of 328.45€. The scenario that also included productivity losses for patients with nonrepaired hernias resulted in a per-patient cost reduction of 823.83€ (see Supplementary Table S1 for detailed results).

These findings support the overall economic advantage of mesh use in stoma closure procedures.

The analysis under the minimum cost scenario (lowest price levels: Czech Republic) resulted in savings of 292.77€, 61.15€, and 111.67€ from the hospital, NHS, and societal perspectives, respectively. In contrast, the maximum cost scenario (highest price levels: Switzerland) generated substantially higher savings, 1,541.32€ for the hospital perspective, 321.91€ for the NHS, and 587.93€ from the societal perspective.

Over a 5-year time period, assuming an increase in mesh utilization from 5% to 25% compared with no mesh, the BIA, considering 4,000 ileostomy closure interventions per year, estimated a total national savings of 1,322,706€, 443,184€, and 889,021€ from the hospital (Figure 1), NHS (Figure 2), and societal perspectives (Figure 3), respectively. These figures correspond to mean per-patient savings of 66.14€, 22.16€, and 44.45€, respectively. The scenario analysis conducted from the societal perspective, which also included productivity losses for patients with nonrepaired hernias, resulted in national savings of 2,375,145€, corresponding to a per-patient savings of 118.76€. From year 1 onward, savings are non-negative across all perspectives considered.

For the BIA, in the minimum cost scenario, the average savings per patient were 22.49€ from the hospital perspective, 7.53€ from the NHS perspective, and 15.11€ from the societal perspective. Under the maximum cost scenario, these savings increased substantially to 118.38€, 39.67€, and 79.57€, respectively.

One-way sensitivity analyses comparing per-patient costs showed that, from the hospital perspective, the most significant parameters were the rates of incisional hernia for both strategies, the percentage of hernias repaired, and the cost of hernia repair (Supplementary Figure S1). From the NHS perspective (Supplementary Figure S2), the rates of SSIs for stoma closure in both strategies, the rate of incisional hernia for the no-mesh strategy, and the percentage of hernias repaired were the most influential parameters affecting the model results. When considering the societal perspective (Supplementary Figure S3), the factors leading to the greatest variations in the model results included the rates of incisional hernia and SSI for no-mesh strategy, the percentage of hernias repaired, the distribution of hernia repairs within the first year, and the working days lost due to hernia interventions.

Across all scenarios, parameter variations consistently yielded cost savings with mesh compared with no-mesh strategies. It is worth noting that the cost of the mesh for stoma closure did not substantially influence the model results.

Discussion

Prophylactic mesh during stoma closure effectively reduces SSIHs, a frequent complication causing morbidity. By reinforcing

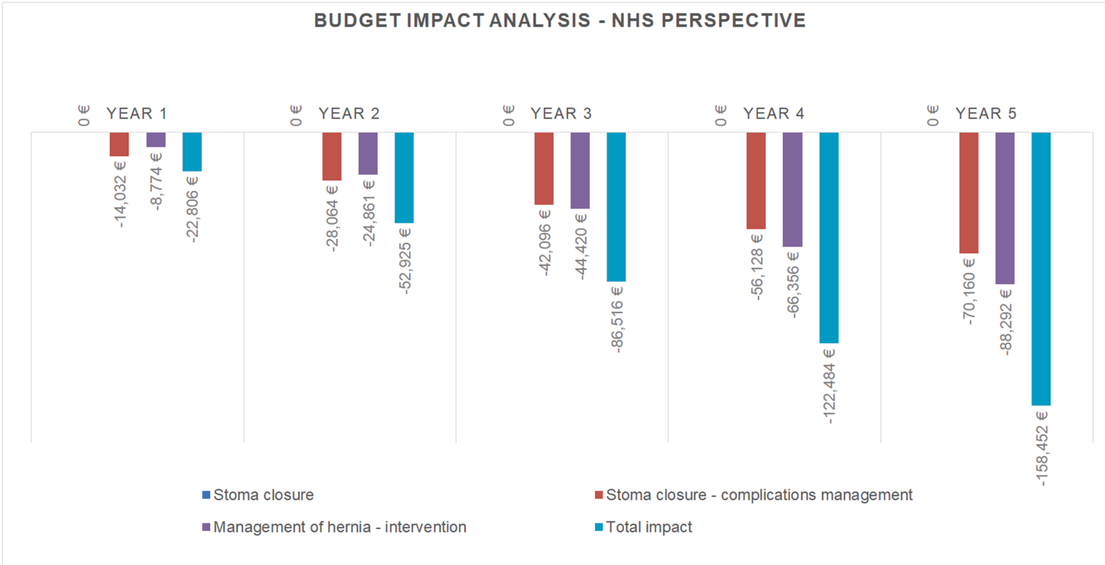

Figure 2. Budget impact analysis from the NHS perspective.

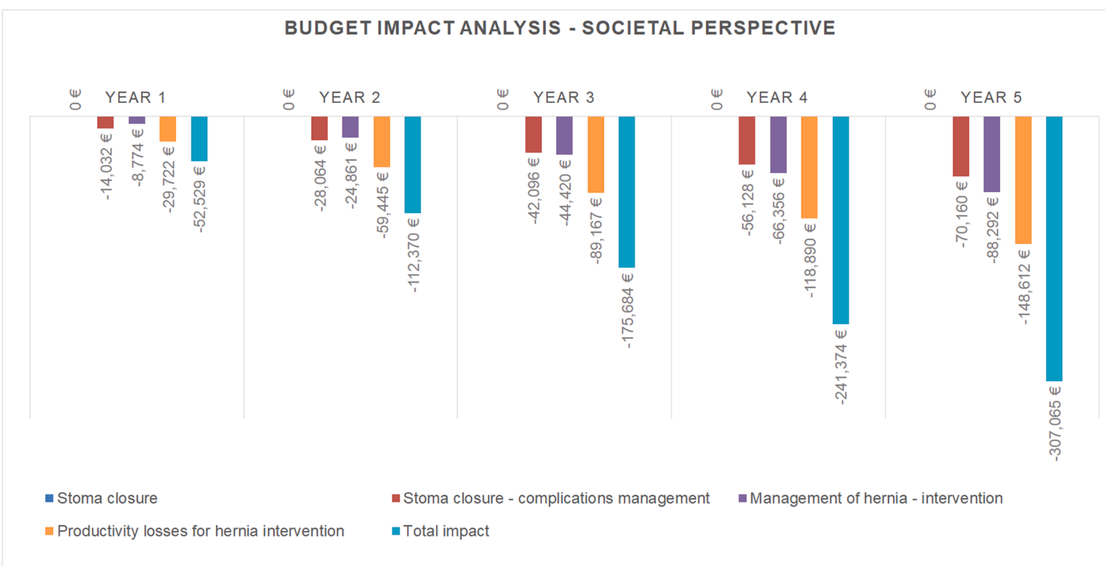

Figure 3. Budget impact analysis from the societal perspective.

the abdominal wall at reversal, mesh lowers the risk for fascial dehiscence and hernia. Studies show this approach decreases hernia rates without increasing the risk for infections, especially with biosynthetic or absorbable meshes. It may also reduce reoperations, improving outcomes and lowering long-term costs.

In the present study, we assessed per-patient costs from the hospital, NHS, and societal perspectives for the management of patients undergoing stoma closure intervention over a 4-year time period. The mesh strategy consistently proved to be cost-saving. Average per-patient costs were lower with mesh across all the perspectives: 1,428.93€ versus 2,290.00€ from the hospital perspective, excluding common costs for OR and health care personnel (saving 861.07€), 4,686.16€ versus 4,866.00€ from the NHS perspective (saving 179.84€), and 4,760.47€ versus 5,088.92€ from the societal perspective (saving 328.45€). These results highlight the possible economic advantage of incorporating mesh in stoma closure procedures.

When productivity losses associated with nonrepaired incisional hernias were included in a conservative scenario analysis, the economic advantage of the mesh strategy increased. This scenario resulted in a per-patient cost reduction of 823.83€ along the clinical pathway and national savings of 2,375,145€, corresponding to 118.76€ per patient from the societal perspective. However, these estimates should be interpreted with caution. Robust, condition-specific evidence quantifying work impairment attributable to nonrepaired incisional hernias is currently lacking, and available data are largely indirect. For this reason, productivity losses were not incorporated into the base-case analysis but explored through scenario analysis using conservative assumptions. The resulting estimates are therefore intended to illustrate the potential magnitude of the productivity impact rather than to provide precise measurements, and they likely represent a lower-bound approximation of the true societal burden associated with nonrepaired hernias.

The study emphasizes that the initially higher cost of the mesh for stoma closure may be justified by the benefit it provides and can therefore be considered an investment that yields greater long-term benefits for patients.

The BIA, projected that increasing mesh usage from 5% to 25% over the next 5 years would generate savings at national level across all perspectives—hospital, NHS, and societal—in the range 22 to 66€ per patient.

To our knowledge, no studies have performed this type of analysis considering the use of a biosynthetic mesh.

Compared with permanent synthetic meshes, biosynthetic meshes offer the advantage of gradual resorption while providing sufficient temporary reinforcement, potentially reducing long-term foreign-body related complications, particularly in contaminated or potentially contaminated fields such as stoma closure.

Evidence from studies on biologic meshes, including the long-term follow-up of the ROCSS (Reinforcement of Closure of Stoma Site) study,[30] highlights early clinical benefits, while long-term outcomes related to quality of life and cost-effectiveness require further investigation. The ROCSS trial found no significant difference in the primary outcome—quality of life measured through hernia-related quality-of-life survey scores—between patients who received prophylactic biologic mesh and those who underwent standard repair, with a mean difference of 1.48 (95% CI, −2.35 to 5.32; $P = .45$), nor was there a long-term cost benefit observed for mesh use across the entire cohort. However, a notable short-term advantage emerged: Patients in the mesh group experienced significantly fewer stoma site complications and required fewer surgical reinterventions within the first 3 years post-reversal (32 vs. 54; incidence rate ratio 0.55; 95% CI, 0.31–0.97; $P = .04$).

In contrast, emerging evidence on biosynthetic meshes indicates a more favorable balance between clinical effectiveness and cost, especially in the short- to medium-term. Synthetic meshes have also been shown to be cost-effective in selected settings; however, concerns related to infection risk and mesh-related complications have limited their routine use at stoma sites. A recent study[11] on the use of synthetic prophylactic mesh in the context of stoma closure showed that both selective use in high-risk patients and universal use are cost-effective in the Colombian setting, with universal placement offering slightly greater effectiveness at a modest additional cost. These findings suggest that although routine use of prophylactic mesh should be approached with caution, selective use in patients at higher risk for early postoperative complications may be beneficial, as avoiding reintervention is both clinically and economically meaningful.

In the context of stoma closure, biosynthetic meshes may represent a pragmatic compromise between durability, safety, and economic sustainability.

Despite the potential clinical and economic advantages, several barriers may limit the widespread implementation of prophylactic mesh reinforcement in Italy. These include the absence of national or international clinical guidelines specifically recommending mesh use at stoma closure, heterogeneity in surgical practice, and variability in surgeons' training and familiarity with mesh placement techniques in lateral abdominal wall defects. Additional organizational factors, such as OR time, local hospital protocols, and budgetary constraints at the hospital level, may further influence adoption decisions, particularly in settings with limited experience in complex abdominal wall reconstruction.

In this context, the adoption of biosynthetic mesh should be supported by strong clinical evidence, enabling the development of multidisciplinary consensus statements and shared clinical guidelines. These efforts can facilitate the definition of standardized eligibility criteria and surgical techniques, to be embedded within structured patient pathways where prevention represents a specific and explicit component. At the same time, early economic evidence, such as the current BIA, can enhance clinical data by assisting decision-makers and informing implementation strategies.

Although the analysis was grounded in the Italian health care context, it included a scenario analysis that considered pricing variations between countries, based on OECD reference indices for health services. This approach offers a strong approximation of cost structures across various European health care systems. By simulating health care cost levels from the lowest (eg, Czech Republic) to the highest (eg, Switzerland), the model consistently demonstrated that the use of preventive mesh leads to cost savings. These results reinforce the reliability of the findings and suggest their applicability across different national settings, indicating that mesh use is likely to continue being a cost-saving strategy throughout Europe. Future research should focus on refining the model by engaging national HTA bodies and incorporating real-world data from multiple health care systems.

The present study has several limitations that should be acknowledged. The clinical effectiveness of using prophylactic mesh was evaluated based on a recent observational study,[17] which reported a reduced incidence of incisional hernia in the mesh group compared with the no-mesh group among selected patients undergoing stoma closure. However, as this was not a randomized controlled trial and involved a relatively small patient cohort, the strength of the evidence and the generalizability of the results should be interpreted with caution.

Notably, the 8% rate of SSIH observed at 4 years in the reference study[17] for the mesh group aligns with the SSIH rate reported by the PRINCESS (Prevention of Incisional Hernia with Biosynthetic Mesh at the Site of Temporary Ileostomy Closure) study,[31] a prospective, single-arm observational study conducted across 14 Italian hospitals in patients undergoing ileostomy reversal with retromuscular placement of a poly-4-hydroxybutyrate mesh. The PRINCESS study reported an SSIH rate of 4.3% at 2 years, which supports the plausibility and robustness of the model input data.

SSIs were infrequent (about 4–6%), and the study was not powered to detect modest differences between mesh and no-mesh strategies. Although these rates are consistent with published figures (~2.7–5%),[32,33] we cannot exclude clinically relevant differences.

Another limitation is the exclusion of clinical and economic consequences for patients with incisional hernia who do not undergo repair. These individuals may experience pain, reduced quality of life, impaired function, and hernia progression, potentially requiring medical management or emergency care for complications such as incarceration or strangulation. These unaccounted costs mean the analysis likely underestimates the true burden of incisional hernia and the long-term benefits of preventive strategies, making the results conservative.

The micro-costing data were mainly derived from a published study in a single Italian hospital with a limited sample. Although this provides detailed, context-specific estimates, the results may not be fully generalizable to other settings, as practice patterns, resource use, and accounting methods can vary across hospitals and regions. Multicenter studies would help validate and strengthen these cost assumptions for national-level applications.

The evaluation of medical devices in this study poses specific challenges, largely due to the rapid pace of technological innovation, outcome variability influenced by user training and experience (ie, the learning curve), and fluctuating pricing dynamics.[12,34] High-volume centers, in particular, may benefit from increased procedural efficiency, leading to better clinical outcomes and lower per-procedure costs.[34]

Although the present analysis included a broader societal perspective, it accounted solely for patient productivity losses. Future research should expand this scope by including data on out-of-pocket expenses and caregiver burden, as these factors may significantly affect the overall value of the intervention.

In conclusion, our results indicate that using long-term absorbable biosynthetic mesh during stoma closure may provide both clinical and economic benefits by reducing SSIH rates. However, further studies are warranted to confirm these findings. The use of this mesh strategy has proven to be cost-effective from the perspective of hospitals, the NHS, and society as a whole, with per-patient savings ranging from 180€ to 861€ over a 4-year clinical pathway.

At the national level, increasing the use of mesh from 5% to 25% over 5 years is expected to generate cumulative savings and short-term benefits, such as fewer reinterventions and complications. This supports a wider adoption of the technique. Scenario analyses based on OECD pricing confirmed the robustness of our results across various European health care systems.

However, there are limitations to our study, including the exclusion of nonsurgical hernia cases, cost estimates taken from a single center, and reliance on an observational study design, Despite these limitations, our findings align broadly with with external sources (eg, the PRINCESS study). Overall, these conclusions endorse the targeted use of biosynthetic mesh as a potentially cost-saving strategy and provide a strong foundation for informing health policy and future HTAs.

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CRediT authorship contribution statement

Carla Rognoni: Writing – review & editing, Writing – original draft, Visualization, Methodology, Investigation, Formal analysis, Conceptualization. **Umberto Bracale:** Writing – review & editing, Validation, Investigation. **Roberto Peltrini:** Writing – review & editing, Validation, Investigation. **Rosanna Tarricone:** Writing – review & editing, Validation, Supervision, Investigation, Funding acquisition.

Supplementary Materials

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