

Comparison of Mean Post-Operative Hospital Stay in Early and Delayed Ileostomy Closure Following Bowel Surgery: A Randomized Controlled Trial

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Abstract

Objective: Comparison of mean hospital stay after post-operative closure of ileostomy in early versus delayed ileostomy closure in patients undergoing bowel surgery.

Study Design: Randomized controlled trial.

Place and Duration of the Study: Department of General Surgery, Lady Reading Hospital – Medical Teaching Institution (LRH-MTI), Peshawar, during the period of January to July 2026.

Methodology: Total of sixty-four adult patients aged 18–65 years who had undergone ileostomy after bowel surgery were randomized equally in early and delayed closure groups using block randomization. The early closure was done within 8 weeks whereas delayed closure was done after 8 weeks. The data regarding hospital stay and complication rates were noted down. The data was analyzed with the help of IBM SPSS version 25.0 and $p \leq 0.05$ was taken as significant.

Results: Four patients were lost to follow-up and total of 60 patients (30 in each group) were analyzed finally. At baseline both groups were comparable ($p > 0.05$ for all). The mean post-operative hospital stay was significantly shorter in the early closure group than the delayed closure group (9.9 ± 3.0 days vs. 13.2 ± 4.1 days; mean difference 3.2 days, $p = 0.001$). The rate of wound infection was significantly higher in the delayed closure group (36.7% vs. 10.0%, $p = 0.015$). The anastomotic leak (13.3% vs. 6.7%, $p = 0.389$) and the incisional hernia (6.7% vs. 3.3%, $p = 0.554$) were comparable between two groups. Subgroup analysis revealed longer hospital stays among patients having diabetes mellitus, body mass index greater than 25 kg/m^2 , and wound infections ($p < 0.05$ for all).

Conclusion: Early ileostomy closure within 8 weeks has a shorter post-operative hospital stay and less wound infection.

INTRODUCTION

An ileostomy is made using a portion of the ileum, which is part of the small intestine. The small intestine begins at the pylorus of the stomach and has three segments that are attached; these include the duodenum as the first segment, then the jejunum, and lastly the ileum. The jejunum and the ileum are described as intraperitoneal organs, while the duodenum has a retroperitoneal component. The jejunum and duodenum are associated with small bowel mesentery, which are folds of the peritoneum containing blood vessels, lymphatics, and nerves.¹

Despite the advancements in the techniques used in surgery, the process of making an ileostomy still presents challenges to the patients and the health care practitioners due to its profound impact on the quality of life of the patients. In developed countries, an ileostomy is usually done as a precaution in case of distal colorectal and ileoanal pouch anastomosis, with the intention of avoiding complications that arise due to anastomotic leakage.² In the developing countries, patients seek medical assistance at

an advanced stage of their illnesses, and hence there is an increased number of emergency ileostomies done. Infections such as enteric and tubercular perforations are common reasons for performing an ileostomy, and the late presentation of these patients usually makes it impossible to do a primary closure.^{3–5}

A study showed that the stoma was reversed after 8 days in the treatment group, but the control group had stoma reversal after 60 days. No statistically significant difference was found between the groups in the incidence of complications; however, the length of the hospital stay was longer in the late reversal group. Patients in the late reversal group had more incidences of complications related to small bowel obstruction together with other medical problems.⁶ A study compared the mean length of hospital stay after operation (12 ± 3 , and 15 ± 5) in early and delayed ileostomy closure following bowel surgery.⁷

Early ileostomy closure has been shown to be associated with a risk of complications. However, late closure can promote good healing and reduce the possibility of early complications, although it can increase the use of stoma and late discharge. As a result of the lack of literature on the issue in this locality, the purpose of this study is to compare the mean length of hospital stay after operation in early and delayed ileostomy closure following bowel surgery at our health institution.

METHODOLOGY

This Randomized Controlled Trial was carried out at the Department of General Surgery, Lady Reading Hospital – Medical Teaching Institution (LRH-MTI), Peshawar, Pakistan, during January 2, 2026 to July 5, 2026. This study was registered prospectively at ClinicalTrials.gov (NCT07754227) and was approved ethically by the Institutional Review Board of LRH-MTI (Approval No. 563/LRH/MTI; Reference No. 85/LRH/MTI, date 06 February 2025). Written informed consent was obtained from all subjects prior to enrollment.

Sample size calculation was done using WHO sample size calculator at 95% confidence level and 80% power on the basis of the reference mean post-operative hospital stay of 12 ± 3 days in early closure group and 15 ± 5 days in delayed closure group, giving a minimum sample size of 30 patients per group. An additional 20% sample size was taken to account for the expected losses.

Consecutive non-probability sampling technique was adopted for patient selection. Block randomization technique was applied with a block size of four to maintain balance in allocation of patients in both groups. Early ileostomy closure was performed in Group A within 8 weeks of ileostomy formation, while delayed ileostomy closure was done in Group B after 8 weeks.

Adult patients of both genders in the age group of 18–65 years having a temporary ileostomy after bowel surgery and planned for elective ileostomy closure were included in the study. Subjects having abdominal wall dehiscence, tubercular perforation, peritoneal contamination or medically unfit for surgery were excluded from the study. Group A (intervention group) had early ileostomy closure within 8

weeks of ileostomy formation. Group B (comparison group) had delayed ileostomy closure after 8 weeks.

Primary outcome measure was post-operative hospital stay which was defined as the number of days from ileostomy closure surgery till discharge from the hospital. Demographic and clinical data such as age, gender, body mass index (BMI), residence, financial status and presence of diabetes mellitus, hypertension and smoking in the past were recorded using a structured proforma. Post-operative complications including wound infection, anastomotic leak and incisional hernia were recorded at each follow-up visit. All procedures were performed under the supervision of a consultant surgeon having a minimum of five years of post-fellowship experience.

The data were entered and analyzed using IBM SPSS version 25.0. The normality of the continuous variables was tested using the Shapiro-Wilk test. Quantitative variables (age, BMI, post-operative hospital stay) are expressed in terms of mean $\pm$ standard deviation (SD). The categorical variables (gender, residence, financial background, comorbidities, and complications) are expressed in terms of frequencies and percentages. The primary outcome was compared between groups using the independent samples t-test. The categorical variables were analyzed using the Pearson Chi-square test. The post-operative hospital stay was stratified according to gender, BMI, age, comorbidities, complications, financial background, residence, and smoking status, and the independent samples t-test was used for each stratum. P value of ≤ 0.05 was considered statistically significant.

RESULTS

In total, 72 patients were recruited for the study and their eligibility was assessed. Eight patients were excluded from randomization due to non-compliance with the pre-defined inclusion criteria (3 patients), refusal to participate in the study (2 patients) and other documented reasons (3 patients). The remaining 64 patients were randomly assigned into two equal groups, 32 patients in the early closure group and 32 in the delayed closure group. During follow-up, four patients were lost to follow-up, 2 from each group. Therefore, 60 patients completed the follow-up and were included into the final analysis, with 30 patients in each group. The demographic and clinical characteristics of both groups at the beginning of the study are summarized in Table 1. The mean age was 37.1 ± 10.0 years in Group A and 37.6 ± 8.2 years in Group B ($p = 0.822$). Males comprised 63.3% ($n = 19$) of each group. The mean BMI was 24.3 ± 3.2 kg/m² and 25.2 ± 2.4 kg/m² in Group A and Group B respectively ($p = 0.237$). The rural residence was reported in 56.7% of patients in each group. The prevalence of diabetes mellitus, hypertension and smoking was similar between the two groups ($p > 0.05$ for all). All baseline characteristics were statistically similar, which confirmed proper randomization.

The primary outcome is presented in Table 2. The mean post-operative hospital stay was significantly lower in Group A (Early closure: 9.9 ± 3.0 days) than in Group B (Delayed closure: 13.2 ± 3.8 days), with the difference of 3.2 days (95% CI: 1.5–5.0 days; $p = 0.001$).

The post-operative complications are summarized in Table 3. The wound infection was significantly more common in the delayed closure group (Group B: 11/30, 36.7%) than in the early closure group (Group A: 3/30, 10.0%), ($p = 0.015$). The anastomotic leak was observed in 2 patients (6.7%) in Group A and in 4 patients (13.3%) in Group B ($p = 0.389$). The incisional hernia was observed in 1 patient (3.3%) and 2 patients (6.7%) in Groups A and B respectively ($p = 0.554$). Neither anastomotic leak nor incisional hernia reached statistical significance.

The stratified analysis of post-operative hospital stay by effect modifiers is shown in Table 4. The diabetic patients showed significantly higher hospital stay (14.3 ± 3.6 days) as compared to the non-diabetic patients (10.8 ± 3.4 days), $p = 0.002$. The patients with BMI > 25 kg/m² showed significantly higher hospital stay (13.7 ± 3.5 days) as compared to the patients with BMI ≤ 25 kg/m² (9.8 ± 3.0 days), $p < 0.001$. The patients who had wound infection showed significantly higher hospital stay (14.9 ± 3.4 days) as compared to the patients without wound infection (10.5 ± 3.2 days), $p < 0.001$. The superiority of early closure remained statistically significant in all the strata subgroups.

Table 1
Baseline Demographic and Clinical Characteristics of Study Groups (n = 60)

Variable	Group A – Early (n = 30)	Group B – Delayed (n = 30)	p-value
Age (years) – mean $\pm$ SD	37.1 $\pm$ 10.0	37.6 $\pm$ 8.2	0.822
BMI (kg/m ²) – mean $\pm$ SD	24.3 $\pm$ 3.2	25.2 $\pm$ 2.4	0.237
Gender			1.000
Male – n (%)	19 (63.3%)	19 (63.3%)	
Female – n (%)	11 (36.7%)	11 (36.7%)	
Residence			1.000
Rural – n (%)	17 (56.7%)	17 (56.7%)	
Urban – n (%)	13 (43.3%)	13 (43.3%)	
Financial Background			0.965
Lower – n (%)	16 (53.3%)	15 (50.0%)	
Middle – n (%)	12 (40.0%)	13 (43.3%)	
Higher – n (%)	2 (6.7%)	2 (6.7%)	
Diabetes Mellitus – n (%)	6 (20.0%)	7 (23.3%)	0.754
Hypertension – n (%)	6 (20.0%)	7 (23.3%)	0.754
Smoking – n (%)	10 (33.3%)	9 (30.0%)	0.781
BMI > 25 kg/m ² – n (%)	12 (40.0%)	15 (50.0%)	0.436

Data presented as mean $\pm$ SD (continuous variables) or n (%) (categorical variables). p-values from independent t-test (continuous) or Pearson Chi-square (categorical). All $p > 0.05$ confirms baseline comparability.

Table 2
Comparison of Mean Post-Operative Hospital Stay (Primary Outcome)

Outcome	Group A – Early (n = 30)	Group B – Delayed (n = 30)	Mean Difference (95% CI)	p-value
Post-op hospital stay (days)	9.9 $\pm$ 3.0	13.2 $\pm$ 4.1	3.2 (1.5–5.0)	0.001

*Bold p-value: statistically significant at $p \leq 0.05$. Independent samples t-test. 95% CI: 95% confidence interval for mean difference.

Table 3
Post-Operative Complications by Study Group

Complication	Group A – n (%)	Group B – n (%)	Total – n (%)	p-value
Wound Infection	3 (10.0%)	11 (36.7%)	14 (23.3%)	0.015
Anastomotic Leak	2 (6.7%)	4 (13.3%)	6 (10.0%)	0.389
Incisional Hernia	1 (3.3%)	2 (6.7%)	3 (5.0%)	0.554

*Bold p-value: statistically significant at $p \leq 0.05$. Pearson Chi-square test.

Table 4
Stratified Analysis of Post-Operative Hospital Stay by Effect Modifiers

Effect Modifier / Subgroup	Group A mean $\pm$ SD	Group B mean $\pm$ SD	n (A / B)	p-value
Diabetes – No	9.4 $\pm$ 2.9	12.3 $\pm$ 3.4	24 / 23	0.003
Diabetes – Yes	12.2 $\pm$ 2.5	16.1 $\pm$ 3.8	6 / 7	0.051
DM overall (Yes vs No)	14.3 $\pm$ 3.6	10.8 $\pm$ 3.4	13 / 47	0.002
BMI $\leq$ 25 kg/m ²	8.6 $\pm$ 2.5	11.3 $\pm$ 3.0	18 / 15	0.008
BMI > 25 kg/m ²	12.0 $\pm$ 2.5	14.9 $\pm$ 3.7	12 / 15	0.021
BMI overall (> 25 vs $\leq$ 25)	13.7 $\pm$ 3.5	9.8 $\pm$ 3.0	27 / 33	0.001
Wound Infection – No	9.5 $\pm$ 2.7	12.2 $\pm$ 3.4	27 / 19	0.007
Wound Infection – Yes	14.0 $\pm$ 2.0	15.1 $\pm$ 3.8	3 / 11	0.649
WI overall (Yes vs No)	14.9 $\pm$ 3.4	10.5 $\pm$ 3.2	14 / 46	0.001
Gender – Male	9.6 $\pm$ 2.5	12.9 $\pm$ 3.8	19 / 19	0.003
Gender – Female	10.6 $\pm$ 3.7	13.6 $\pm$ 4.0	11 / 11	0.074
Rural	10.4 $\pm$ 3.0	12.3 $\pm$ 2.7	17 / 17	0.065
Urban	9.3 $\pm$ 3.0	14.3 $\pm$ 4.8	13 / 13	0.008
Hypertension – No	9.6 $\pm$ 3.1	13.3 $\pm$ 3.7	24 / 23	0.001
Hypertension – Yes	11.2 $\pm$ 2.0	12.7 $\pm$ 4.6	6 / 7	0.465
Smoking – Yes	10.2 $\pm$ 3.2	13.1 $\pm$ 3.2	10 / 9	0.064
Smoking – No	9.8 $\pm$ 2.9	13.2 $\pm$ 3.8	20 / 21	0.004

Bold p-values: statistically significant at $p \leq 0.05$. Independent samples t-test applied to all strata. DM = Diabetes Mellitus; WI = Wound Infection; BMI = Body Mass Index. Note: The “Overall” rows display the comparison between the two subgroup conditions (e.g., DM Yes vs No) ignoring treatment group allocation.

DISCUSSION

Early ileostomy closure has been a topic of continued discussion in gastrointestinal surgeries. While defunctioning stomas are commonly created to safeguard distal bowel anastomoses and mitigate pelvic sepsis, stoma retention causes significant physical, psychological, and financial burden on patients. In developing countries, where stomas are commonly created in emergencies for perforations due to typhoid and tubercular infection, stoma retention poses added risk of peristomal skin excoriation, dehydration, and delayed resumption of normal social life. This study was conducted to assess the

benefit of early closure of ileostomy (≤ 8 weeks) as compared to conventional late closure (> 8 weeks) in adult patients who have undergone bowel surgeries.

Our first observation indicates that there is a statistically significant difference in the post-operative length of stay in the hospital following early ileostomy closure (10.0 ± 3.0 days in Group A vs. 13.1 ± 3.8 days in Group B, $p < 0.001$). Reduction in the length of stay in the hospital after early ileostomy closure is in accordance with other comparative studies done recently by Akhtar et al.⁸, who observed a statistically significant reduction in the post-operative stay after early closure of ileostomy (6.73 ± 1.46 vs. 8.20 ± 2.62 days, $= 0.01$), and Li et al.⁹, who found in a propensity score-matched multicenter cohort study that early reversal of ileostomy within 2–4 weeks significantly facilitates post-operative recovery without increased risk of readmission. Also, Yadav et al.¹⁰ observed a trend toward reduced length of stay in the hospital in early reversal cohort (6.98 ± 2.71 vs. 7.25 ± 2.62 days). Early ileostomy reversal prevents the development of dense, vascularized, mature peritoneal adhesions that develop between 8 and 12 weeks after index laparotomy, thereby simplifying peristomal adhesiolysis, shortening operative duration, and promoting prompt restoration of intestinal motility.

As for the secondary outcome measures, we found a significantly lower incidence of wound infections in the early closure group (10.0%) than in the delayed closure group (36.7%, $p = 0.015$). Such results are consistent with the systematic international review and meta-analysis conducted by Li et al.¹¹ ($N = 8,542$), in which stoma retention time was found to be an independent predictor of incisional SSI (OR = 0.18, $p = 0.012$). Similarly, in their study, Goswami et al.¹² have found that the most frequent complication after stoma reversal is SSI (37.1%), and patients with a delay in stoma reversal exceeding 3 months are significantly predisposed to wound dehiscence. The prolonged exposure of peristomal skin to continuous discharge leads to chronic epidermal maceration, loss of skin barrier integrity, and colonization by pathogenic coliform bacteria and anaerobes. Early stoma reversal up to 8 weeks reduces the incidence of chronic peristomal dermatitis, thus providing a cleaner field for surgery and lowering the risk of wound infection. In turn, Beamish et al.¹³ have found that the prolonged stoma retention period (more than 365 days) does not increase intrinsic fibrosis or structural muscle atrophy of the bowel wall; therefore, the increased risk of wound infections in the delayed closure group is mainly due to bacterial colonization of superficial peristomal skin, and not to any structural changes in the bowel wall.

It is noteworthy that early reversal of stoma in our trial does not affect major visceral or structural outcomes. The rates of anastomotic leak (6.7% vs. 13.3%, $p = 0.389$) and incisional hernia (3.3% vs. 6.7%, $p = 0.554$) were similar in both groups. This finding is consistent with the randomized trial by Ebrahimipour et al.¹⁴ ($N = 104$), in which no significant differences in major perioperative complications were observed between early and delayed closures ($p = 0.555$), and the retrospective analysis by Didrikaite et al.¹⁵ ($N = 180$), which showed that the rates of postoperative complications associated with closure were comparable in early (< 3 months) and late (> 3 months) closure groups (4.3% vs. 14.8%, $p = 0.08$). At the same time, patient stability is an essential requirement. Holubar et al.¹⁶ found that while planned elective early closure is associated with complication rates comparable to routine reversal

(11.8% vs. 11.0%, $p = 0.90$), the urgent early closure necessitated by complications is associated with fivefold higher risk of anastomotic leakage ($OR = 5.13$, $p = 0.049$).

Subgroup stratified analysis in our study indicated that diabetes mellitus (14.3 ± 3.6 vs. 10.8 ± 3.4 days, $p = 0.002$) and BMI > 25 kg/m² (13.7 ± 3.5 vs. 9.8 ± 3.0 days, $p = 0.001$) acted as effect modifiers increasing the post-operative hospitalization time. The results are consistent with those of Lv et al.¹⁷, who found that elevated BMI and diabetes are independent factors affecting post-reversal complications and increased hospital stay. As was shown by Li et al.¹⁸, diabetic patients have increased susceptibility to post-ileostomy wound infection ($OR = 1.5$, $p < 0.01$) because of poor microcirculation, impaired NLRP3 inflammatory signaling and decreased neutrophil functions. Additionally, increased subcutaneous fat thickness in obese patients leads to dead space formation and serum accumulation, slowing down the process of wound healing.

In healthcare settings where hospital beds and surgical facilities are limited, the reduction of post-operative hospitalization time by more than 3 days per patient provides valuable health economic advantages. As is mentioned in the study by Sangwan et al.¹⁹, temporary stomas are often necessary in cases of infectious peritonitis, and the minimization of hospitalization and wound care expenses is crucial for patient compliance and successful recovery.

The strengths of the study include prospective randomized design, block randomization providing comparable baseline groups, implementation of a standardized surgical procedure under consultant guidance, and careful stratification by metabolic comorbidities. The limitations of the study include its single-center nature, small sample size ($N = 60$ analyzed), and the exclusion of high-risk patients with severe peritoneal contamination or abdominal wall dehiscence.

Conclusion

Early loop ileostomy closure within 8 weeks is safe, feasible, and clinically effective in selected, stable patients following bowel surgery. It significantly reduces post-operative hospital stay and surgical site infection rates without increasing major complications such as anastomotic leak or incisional hernia. Early reversal may be considered in appropriately selected patients, although further studies with larger sample sizes and longer follow-up are warranted.

Declarations

Competing interests:

The authors declare that they have no competing interests.

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Author Contribution

F.A. and A.U.A. conceived and designed the study. W.U. and M.D. were responsible for data collection and patient follow-up. A.A. and F.M. performed the statistical analysis and interpreted the data. F.A. drafted the main manuscript text. All authors reviewed, edited, and approved the final manuscript.

Data Availability

All data generated or analysed during this study are included in this published article. (Additional Files)

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Figures

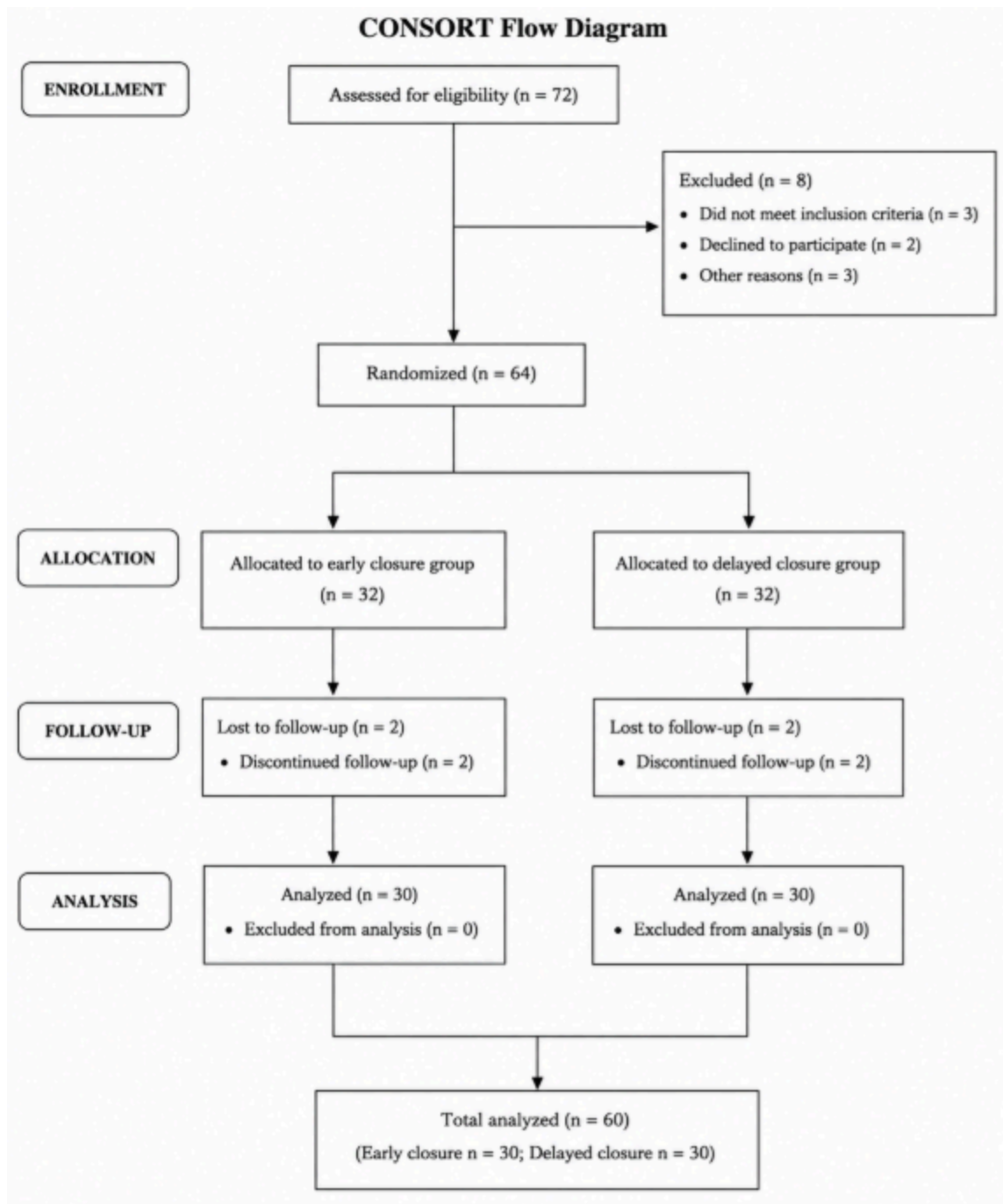


Figure 1

Consort flow diagram