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# Preoperative Stoma Site Marking Decreases Stoma and Peristomal Complications

## *A Meta-analysis*

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**ABSTRACT**

**PURPOSE:** We systematically reviewed the literature in order to determine whether evidence indicated that preoperative stoma site marking reduces the occurrence of postoperative stoma and peristomal complications.

**DESIGN:** Systematic review with meta-analysis of pooled findings.

**SUBJECTS/SETTING:** We systematically reviewed 6 electronic databases including PubMed, MEDLINE, CINAHL, Cochrane Library for English language articles, along with the Airiti Library and Wanfang Data for Chinese articles for evidence related to the effects of stoma site marking on stoma and peristomal complications. We sought articles published from their inception to January 31, 2018.

**METHODS:** Ten studies that included 2109 participants, each comparing 2 groups of patients who did and did not undergo preoperative stoma site marking, were retrieved and analyzed.

**RESULTS:** In patients who underwent stoma site marking, the marking was associated with reduced stoma and peristomal complications in all stoma types (odds ratio [OR] = 0.52; 95% CI, 0.42-0.64; $P < .001$). Patients who underwent stoma and had fecal ostomies experienced fewer complications (OR = 0.34; 95% CI, 0.25-0.47; $P < .001$) than patients with unmarked stomas. In contrast, patients with urostomies did not experience fewer complications when compared to those with unmarked ostomies (OR = 0.531; 95% CI, 0.23-1.21; $P = .132$). Persons with fecal ostomies also had fewer hernias and peristomal skin complications (ORs = 0.25 and 0.30; 95% CIs, 0.09-0.71 and 0.20-0.44, respectively; both $P$s $< .001$). The results revealed that stoma site marking was associated with reduced early and late stoma and peristomal complications (ORs = 0.76 and 0.38; 95% CIs, 0.61-0.94 and 0.32-0.46; $P = .010$ and $P < .001$, respectively).

**CONCLUSIONS:** Preoperative stoma site marking is associated with a reduced occurrence of stoma and peristomal complications and should be considered as a standard of preoperative care.

**KEY WORDS:** Complications, Early and late complications, Ostomy, Stoma, Stoma and peristomal complications, Stoma site marking.

## INTRODUCTIONS

The reported incidence rates of stoma and peristomal complications (SPCs) vary from 12% to 72%.[1] Stoma and peristomal complications are considered quality indicators as they can lead to physical and emotional health problems, reduced health-related quality of life, increased health care costs, prolonged hospitalization, and increased morbidity.[2-4] Taneja and colleagues[4] reported that peristomal skin complications were associated with economic burden; patients with SPCs have higher medical costs and longer hospitalization duration (11 days) than those without peristomal skin complications (6.8 days). Thus, interventions to prevent SPCs and negative outcomes for patients with stomas are crucial.

Stoma and peristomal complications may be classified as early and late according to the time of occurrence after surgery; early complications are defined as occurring within 30 days of surgery and late complications occur after this initial postoperative recovery period.[5-14] The incidence of early complications such as mucocutaneous separation, stoma retraction, necrosis, and peristomal skin irritation occurring within 30 days surgery is 28.4% to 39.0%.[5-10] Data from a survey of patients conducted 2 months after surgery showed the incidence of late SPCs such as mechanical injury, irritant dermatitis, pseudoverrucous lesions, infection, and allergic responses is 6% to 47%.[12,13]

Colwell and Beitz[14] summarized and proposed definitions for 18 SPCs. Stoma complications defined were prolapse, necrosis, mucocutaneous separation, retraction, stenosis, fistula, and trauma.[14] Peristomal complications (PSCs) included

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parastomal hernia, varices, candidiasis, folliculitis, mucosal transplantation, pseudoverrucous lesions, pyoderma gangrenosum, suture granulomas, peristomal moisture-associated skin damage (MASD, a form of irritant contact dermatitis), allergic contact dermatitis, and trauma.[14,15] This taxonomy achieved high content validation (content validity indices: 0.96-0.97) among a group of WOC nurse raters. Thus, SPCs may be identified on the basis of WOCN experts' judgment or expertise with respect to their standard definitions.[16,17] More recently, an expert panel provided consensus- and evidence-based guidance for assessment and management of peristomal medical adhesive–related skin injury (MARSI).[18]

Stoma site marking is an important preoperative intervention of quality of patient care that has been linked to higher health-related quality of life and personal independence following ostomy surgery when compared to individuals with unmarked ostomies.[19-21] Proper stoma placement enables the pouching system to be tightly sealed, increasing its wear time, and promotes patient self-management.[22-24] However, whether stoma site marking mitigates stoma complications remains unclear. In a study of 192 patients with colorectal cancer with stoma, results showed that no stoma site marking was a significant risk factor for early stoma complications.[25] Similarly, a retrospective study of 1216 patients living with an ostomy for 10 years revealed that preoperative stoma site marking significantly reduced the risk of stoma complications.[26] Data from another study of ostomy patients showed no significant relationship between preoperative stoma site marking and early or late ostomy complications.[8] A systematic review by Colwell and Gray[27] assessed the surgical outcomes of preoperative teaching and stoma site marking in patients undergoing ostomy surgery; however, the relationship between preoperative stoma site marking and peristomal or stoma complications was not clarified.[27] The purpose of this meta-analysis was to identify whether preoperative stoma site marking can reduce the risk of SPCs in patients with fecal and urinary ostomies.

## METHODS

We conducted a literature search of English language articles in the PubMed, MEDLINE, CINAHL, and Cochrane Library. We also searched Chinese language articles in the Airiti Library and Wanfang Data from the inception of each database until January 31, 2018 (ie, without publication year restrictions). Search terms included "colostomy," "stoma," "ostomy," "ileostomy," "urostomy," "gastrostomy," "jejunostomy," "stoma site marking," "stoma marking," "stoma site," "stoma site procedure," and "stoma selection for interventions." The title and abstract of each article were screened for inclusion criteria including published in a peer-reviewed journal, patients undergoing any type of ostomy surgery with and without stoma site marking (control group), and evaluation of the outcomes of complications based on the definitions of stoma complications proposed by Colwell and Beitz,[14] including early and late complications. When a stoma complication was evaluated in fewer than 3 studies, that complication was excluded from the quantitative analysis. Data were extracted independently by 2 authors (M.Y.H. and J.P.L.). The following data were extracted from each publication: (1) study characteristics (author names, year of publication, and country), (2) stoma information (stoma type and who marked the stoma site), and (3) stoma complication information (assessment time, type of stoma complication, and who assessed the stoma complication) (Table). Any disagreements such as classification of variables and outcomes were resolved through discussion with a third author (Y.L.W.).

Stomas were classified as fecal or urinary. Complications were classified as stoma or peristomal. Any patients with both fecal and urinary stomas were placed in a third subgroup called combination stoma type. We searched for the following stoma complications: prolapse, necrosis, mucocutaneous separation, retraction, stenosis, fistula, and trauma. We searched for the following peristomal complications: parastomal hernia, peristomal varices, peristomal candidiasis, peristomal folliculitis, mucosal transplantation, pseudoverrucous lesions, peristomal pyoderma gangrenosum, peristomal suture granulomas, peristomal MASD (irritant dermatitis), peristomal allergic contact dermatitis, and peristomal trauma. The SPCs were further separated into early (≤30 days) and late (>30 days) complications.

### Data Analysis

Data were entered into Comprehensive Meta-Analysis version 2.0 (Biostat, Englewood, New Jersey), and 2-sided tests were conducted. The data were analyzed using a random-effects modeling.[28] Odds ratios (ORs) and 95% confidence intervals (CIs) were calculated for sample size numbers of SPCs in stoma marked and unmarked groups; OR less than 1 indicated that stoma site marking reduced stoma complications. In addition, subgroup analyses were performed according to stoma type, complication type, and duration of follow-up. $Q$ statistics and $I^2$ values were used to examine heterogeneity or the variability in treatment outcomes, meaning, are the findings from the individual studies similar enough to determine whether the combined effect is similar; $Q \leq 0.05$ and $I^2 > 50\%$ indicate heterogeneity across studies.[29,30] A funnel plot, Begg's rank correlation test,[31] and Egger's intercept test[32] were used to examine publication bias; significance for these evaluations was set at $P = .05$. The trim-and-fill method was employed to test and adjust for possible bias in the overall effect size by considering effect sizes based on the estimated number of missing studies.[33] Two reviewers (Y.L.W. and M.Y.H.) independently assessed quality using the Newcastle-Ottawa Scale (NOS).[34-36] The NOS includes the domains of selection (representativeness), comparability (design and analysis), and outcome assessment (follow-up duration was long enough for outcomes to occur and outcome effectiveness), which were used to investigate the risk of bias in this study. The NOS scores range from 0 to 9; higher scores indicate higher quality. The maximum possible score is 4 in the selection domain, 2 in the comparability domain, and 3 in the outcome domain.

## RESULTS

Our initial search identified 533 articles. Title and abstracts reviews reduced the number to 39 studies that were read in full. Based on review of the full text of the article, we eliminated an additional 29 studies; reasons for these eliminations are summarized in Figure 1.

We identified 10 studies that met inclusion and exclusion criteria.[24,37-45] Five were quasi-experimental,[40,42-45] 3 employed a retrospective descriptive design,[37,39,41] and 2 used a prospective descriptive design for data collection.[24,38] These studies enrolled a pooled sample of 2109 patients; data from these studies area were included in our meta-analysis (Figure 2). Stoma site marking was performed by a surgeon, other physician,

**TABLE.**
**Summary of Characteristics of the Included Studies Determining the Effects of Preoperative Stoma Site Marking on Stoma and Peristomal Complications**

| Author (Year of Publication) | Country | Study Design | Stoma Type | Sample Size (Marked/Unmarked) | Follow-up | Stoma and Peristomal Complications | Who Mark Stoma | Who Followed up |
|---|---|---|---|---|---|---|---|---|
| Bass et al (1997)[37] | United States | Retrospective study | F + U | 292/301 | <30 d; >30 d | Necrosis, stenosis, retraction, prolapse, infection, parastomal hernia, skin problem, fistula, and bleeding | Enterostomal therapist | Enterostomal therapist |
| Millan et al (2009)[38] | Spain | Prospective study | F | 123/147 | Early; 3 mo | Retraction, prolapse, skin irritation, ischemia, edema and other | Enterostomal therapist | Enterostomal therapist |
| Person et al (2012)[24] | Israel | Prospective study | F + U | 52/53 | UR | Prolapse, parastomal hernia, and skin irritation | Enterostomal therapist | Enterostomal therapist |
| Baykara et al (2014)[39] | Turkey | Retrospective study | F + U | 284/354 | 1 y | Retraction, skin problem, and mucocutaneous separation | Enterostomal therapist and/or surgeon | Enterostomal therapist |
| Dong and Li (2009)[40] | China | Quasi-experimental | F | 96/96 | 5 y | Necrosis, stenosis, retraction, prolapse, parastomal hernia, and peristomal dermatitis | UR | UR |
| Xiao (2011)[41] | China | Retrospective study | F | 32/28 | 5 y | Parastomal hernia | Physician | Physician and enterostomal therapist |
| Yu and Shen (2013)[42] | China | Quasi-experimental | U | 38/35 | UR | Prolapse, irritant dermatitis, and mechanical dermatitis | RN | UR |
| Liang et al (2014)[43] | China | Quasi-experimental | F | 30/30 | 1 y | Retraction, infection, parastomal hernia, and leak | Surgeon and enterostomal therapist | Enterostomal therapist |
| Huo et al (2015)[44] | China | Quasi-experimental | F | 18/18 | UR | Stenosis, prolapse, mucocutaneous separation, parastomal hernia, peristomal irritant dermatitis, and tumor recurrent | Team (physician, enterostomal therapist, and RN | UR |
| Ma et al (2017)[45] | China | Quasi-experimental | U | 40/42 | 3 mo; 6 mo | Necrosis, prolapse, peristomal dermatitis, and UTI | Team (physician, enterostomal therapist, and RN | Enterostomal therapist |

Abbreviations: F, fecal stoma; U, urinary stoma; UR, unreported; UTI, urinary tract infection.

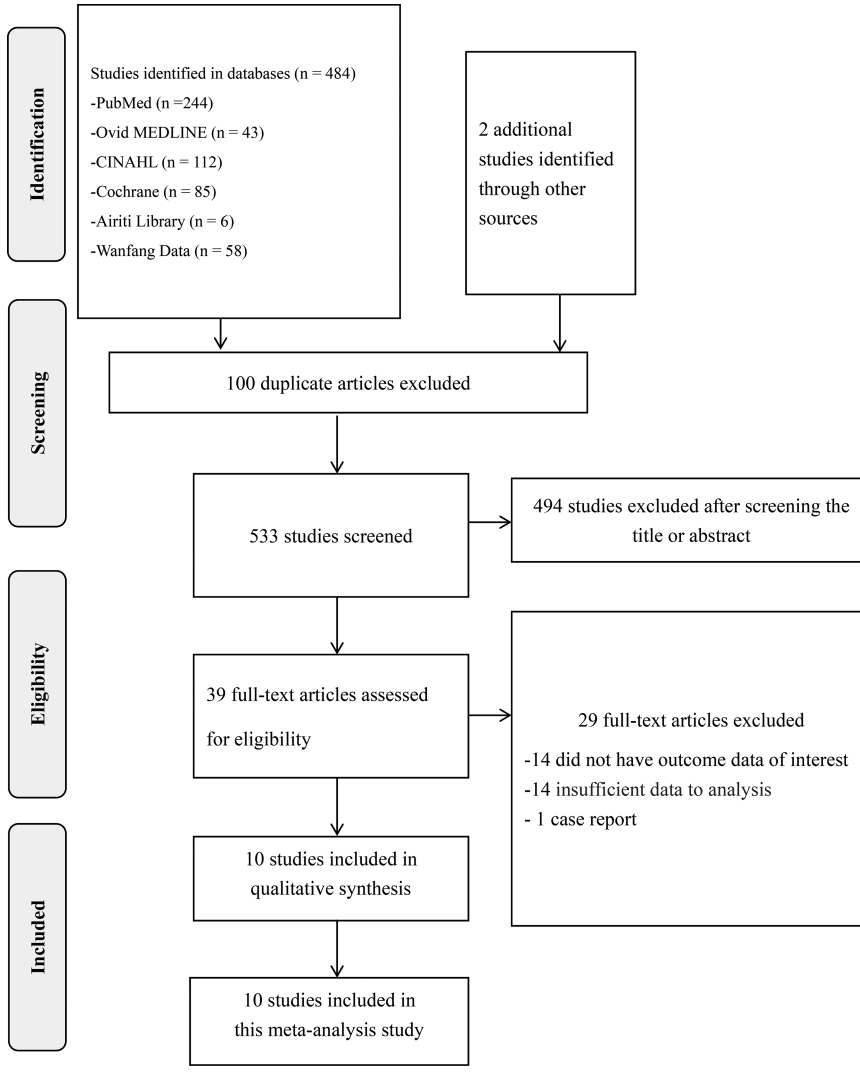


**Figure 1.** Flow diagram of Preferred Reporting Items for Systematic reviews and Meta-analyses.

WOC or enterostomal thearpy nurse, enterostomal therapist (not educated as an RN), or RN. The Table summarizes the characteristics of the 10 studies included in our meta-analysis.

## Effects of Stoma Site Marking

We analyzed 47 data items for patients with fecal and urinary stomas. Compared with unmarked stoma sites, marked stoma sites were associated with reduced overall SPCs in all stoma types (OR = 0.519; 95% CI, 0.421-0.640). Significant heterogeneity was observed among the trials ($Q$ = 75.39, $P$ = .004, and $I^2$ = 39.0%).

Stoma site marking was associated with an overall reduction in both early and late complications in the fecal and combination (fecal and urinary) ostomy groups (ORs = 0.343 and 0.637; 95% CIs, 0.251-0.470 and 0.487-0.833, respectively) but not in patients with a urostomy (OR = 0.531; 95% CI,

| Stoma type | Effect size and 95% CI | | | | Heterogeneity | | |
|---|---|---|---|---|---|---|---|
| | N | Odds ratio | 95% CI | *p* value | *Q* | *p* value | $I^2$ |
| Overall | 47 | 0.519 | 0.42 - 0.64 | *<.001* | 73.39 | *0.004* | 38.98 |
| Combination stoma | 23 | 0.637 | 0.49 - 0.83 | *0.001* | 44.19 | *0.003* | 50.21 |
| Fecal stoma | 19 | 0.343 | 0.25 - 0.47 | *<.001* | 19.89 | *0.339* | 9.50 |
| Urinary stoma | 5 | 0.531 | 0.23 - 1.21 | *0.132* | 1.123 | *0.890* | <0.001 |

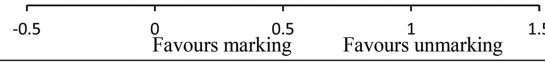


**Figure 2.** Summary estimates of odd rations for overall stoma complication between different stoma types and corresponding heterogeneity across studies. N indicates number of estimates. *Note*: *P* value of *Q* statistics less than .05 or $I^2 \geq 50\%$ reflects statistical heterogeneity across studies.

0.233-1.211). Significant heterogeneity (variability) was observed among trials in the combination stoma group ($Q$ = 44.19, $P$ = 0.003, $I^2$= 50.2%), and homogeneity was observed among trials enrolling patients with fecal ($Q$ = 19.89, $P$ = 0.339, $I^2$= 9.502%) and urinary ($Q$ = 1.128, $P$ = 0.890, $I^2$ = 0%) ostomies.

Four early and late SPCs (prolapse, retraction, parastomal hernia, and skin problems) in the fecal group were reported.[24,37-41,43,44] Specifically, stoma site marking was associated with reduced peristomal hernia and skin damage including peristomal MASD (ORs = 0.251 and 0.295; 95% CIs, 0.089-0.711 and 0.198-0.439, respectively). A mixed-effects subgroup analysis revealed subgroup differences among the various stoma types ($Q$ = 8.652, degree of freedom [*df*] ($Q$) = 2, $P$ = .013) (Figure 3).

Thirty-four data items for stoma complications and 13 for peristomal complications were divided into subgroups and analyzed (Figure 4). Stoma site marking significantly reduced the ORs of the SPC groups (ORs = 0.761 and 0.381; 95% CIs, 0.61-0.94 and 0.32-0.46, respectively). No heterogeneity was observed in either the stoma or peristomal complication groups ($Q$ = 34.98 and 16.9, $P$ = .421 and 0.153, $I^2$ = 2.81% and 29.03%, respectively). Stoma complications were divided into early (≤30 days) and late (>30 days); however, only 4 of the 10 studies reported this information.[37,38,41,45] As shown in Figure 4, stoma site marking significantly reduced the ORs for the unreported (not reported in the study), early, and late groups (ORs = 0.472, 0.582, and 0.549; 95% CIs, 0.350-0.637, 0.346-0.987, and 0.397-0.761, respectively).

### Quality Assessment and Publication Bias

The average total NOS score was 7.2 (4, 0.2, and 3 for the selection, comparability, and outcome domains, respectively). Regression analyses of Begg's rank correlation test and Egger's intercept test were not statistically significant for any model, suggesting the absence of publication bias.

## DISCUSSION

We systematically reviewed multiple electronic databases of literature published in English and Chinese languages from their inception through 2018 and identified 10 studies that evaluated the effect of stoma site marking on SPCs. Results showed that preoperative stoma site significantly reduced both early and late SPCs compared with unmarked stomas.

| **Fecal stoma complication** | | |
|---|---|---|
| **Prolapse** | Odds ratio | 95% CI |
| Dong, 2009 | 1 | 0.42-0.63 |
| Huo, 2015 | 0.074 | 0.01-0.68 |
| Millan, 2009 | 1.198 | 0.17-8.63 |
| | 0.435 | 0.07-2.72 |
| **Retraction** | Odds ratio | 95% CI |
| Dong, 2009 | 1 | 0.14-7.25 |
| Ling, 2014 | 0.483 | 0.04-5.63 |
| Millan, 2009 | 0.86 | 0.34-2.22 |
| | 0.829 | 0.34-1.85 |
| **Fecal peristomal complication** | | |
| **Parastomal hernia** | Odds ratio | 95% CI |
| Dong, 2009 | 0.387 | 0.07-2.05 |
| Huo, 2015 | 0.092 | 0.01-0.06 |
| Ling, 2014 | 0.467 | 0.04-5.44 |
| Xiao, 2011 | 0.188 | 0.02-1.79 |
| | 0.251 | 0.09-0.71 |
| **Skin problem** | Odds ratio | 95% CI |
| Dong, 2009 | 0.532 | 0.21-1.34 |
| Huo, 2015 | 0.092 | 0.01-0.86 |
| Millan, 2009a | 0.393 | 0.20-0.78 |
| Millan, 2009b | 0.393 | 0.18-0.85 |
| Millan, 2009c | 0.174 | 0.09-0.35 |
| Millan, 2009d | 0.214 | 0.10-0.48 |
| | 0.295 | 0.20-0.44 |

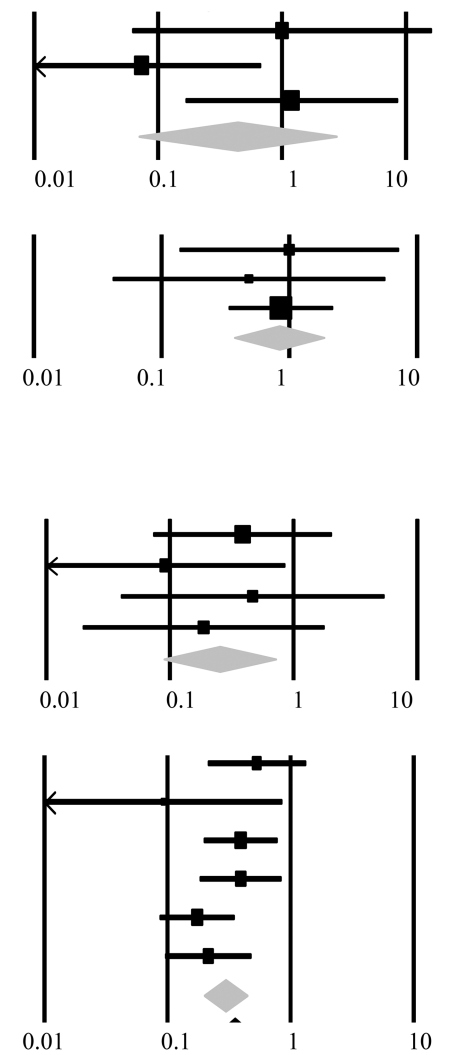


**Figure 3.** Forest plots of odds rations for subgroups by stoma complication of fecal stoma.

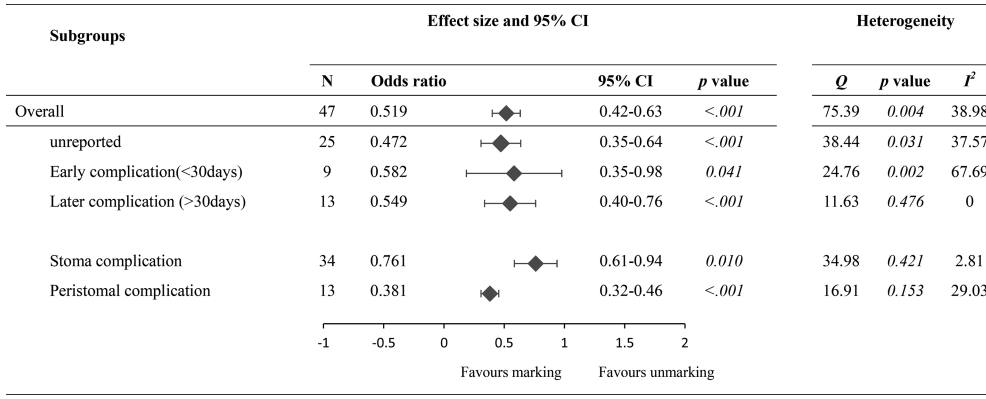


**Figure 4.** Summary estimates of odds ratios for overall stoma complication between different follow-up durations, stoma, and peristomal complications corresponding heterogeneity across studies. N indicates number of estimates. *Note*: *P* value of *Q* statistics less than .05 or $I^2 \geq 50\%$ reflects statistical heterogeneity across studies.

The strongest results indicated that peristomal hernia and skin problems can be significantly mitigated by stoma site marking.

The European Hernia Society guidelines for the prevention and treatment of parastomal hernias suggest a strong association between end colostomy and parastomal hernia.[46] The incidence of parastomal hernias in patients with end colostomy varies 30% to 58%; it is influenced by age, type of stoma, and duration of follow-up.[46] The relationship between PSCs and preoperative stoma site marking is strengthened by specific instructions to ensure the ostomy is located within the rectus abdominis specifically in order to prevent peristomal hernias.[47-50]

We also found that preoperative stoma site marking can significantly reduce skin problems, including peristomal MASD in patients with fecal ostomies.[38,40,44] Similar to its intended role in prevention of parastomal hernia, stoma site marking is intended to avoid placing an ostomy in a site that lies in a skinfold as the individual assumes an upright position or one that interferes with optimal placement of a pouching system and placement and avoidance of such placement have been associated with lower rates of peristomal skin complications in persons with fecal ostomies.[47-49,51]

We found that preoperative stoma site marking did not significantly reduce the occurrence of PSCs in patients with urostomies. However, only 2 studies with patients who had a urinary stoma were included[42,45] and only 5 data points were analyzed. Additional research with a more robust sample of individuals with urostomies is needed to determine the effects of preoperative stoma site marking on PSCs.

Our review incorporated the site stoma marking performance of WOC nurses,[24,37,38] physicians and surgeons,[42,44] RNs,[42] and teams of physicians, surgeons, and enterostomal therapists.[39,43-45] In 3 of 10 studies, researchers reported that the preoperative stoma site marking performance of WOC nurses reduced the occurrence of SPCs for both early and late complications; however, some limitations were observed.[24,37,38] In the study conducted by Millan and colleagues,[38] only 45.6% of patients with stomas received preoperative stoma site marking by enterostomal therapists and no patients who underwent emergency surgery received preoperative stoma site marking. Differences in training to perform stoma marking may influence the frequency of preoperative marking. For example, surgeons in Spain performing emergency colorectal surgery may not always be trained to perform site marking.[38] Huo and colleagues[44] reported a similar problem in China, where medical professionals lack knowledge and skill regarding stoma site marking. Finally, WOC nurses and other ostomy care specialists are not always available in hospitals, which present obstacles to the promotion of preoperative stoma site marking.

In addition to considering stoma site marking, 3 studies reported results of interventions involving stoma site marking combined with patient education.[37,38,45] A retrospective study found that preoperative educational interventions including a didactic portion outlining postoperative expectations in the management of new ostomies (dietary changes, prevention of dehydration, and an overview of ostomy supplies) and practice stoma care skills for all patients undergoing colorectal surgeries are positive outcomes in terms of reducing PSCs.[50] Clinical experience and sparse research suggests a bundled intervention that incorporates preoperative stoma site marking, education, and interventions designed to promote adaptation to a new ostomy.[52]

### Recommendations for Additional Research

Future studies are recommended to determine the effects of more recently defined PSCs such as peristomal MASD and MARSI.[15,18] We also recommend additional research evaluating the effects of preoperative stoma site marking performed by the various groups delivering this service.

## STRENGTHS AND LIMITATIONS

To the best of our knowledge, this systematic review and meta-analysis is the first to quantitatively evaluate whether preoperative stoma site marking reduced SPCs across studies. In addition our review included studies published in both the English and Chinese languages.

Our study has several limitations. Analysis included relatively recent studies with multiple study designs; 5 were quasi-experimental studies, 3 were retrospective descriptive studies, and 2 were prospective descriptive studies. Therefore, selection bias was a concern because no randomized controlled trials were included. In addition, pooled data analysis revealed heterogeneity among studies. We were unable to ascertain or control for the potential effects of comorbid conditions and other confounding effects such as combined educational and stoma site marking interventions. Finally, the statistical power was negatively influenced by the relatively small number of studies used in the analysis of stoma type and follow-up duration.

## CONCLUSIONS

Findings of our systematic review and meta-analysis suggest that stoma site marking reduces the occurrence of SPCs in patients with fecal incontinence. In contrast, comparison of patients managed with preoperative stoma site marking versus no marking did not result in significant reductions in PSCs, but the statistical power to detect these differences was less robust than that supporting differences in patients undergoing diversion of the bowel. Our findings corroborate the guidelines endorsed by the Wound Ostomy and Continence Nurses Society, the American Society of Colorectal Surgeons, and the American Urology Association, which assert the importance of preoperative stoma site marking in patients with fecal or urinary stomas.[48,49]

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