Clinical Gastroenterology and Hepatology 2018;16:357–369

Patient Characteristics Associated With Quality of Colonoscopy Preparation: A Systematic Review and Meta-analysis

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This article has an accompanying continuing medical education activity, also eligible for MOC credit, on page e37. Learning Objective–Upon completion of this activity, successful learners will be able to identify risk factors for inadequate bowel preparations in their patients undergoing screening colonoscopy.

BACKGROUND & AIMS: **Some features of patients are associated with inadequate bowel preparation, which reduces the effectiveness of colonoscopy examination. We performed a systematic review and meta-analysis of the association between patients' sociodemographic characteristics, health conditions, and medications with inadequate bowel preparation.**

METHODS: **We searched the PubMed, Scopus, and Cochrane Review databases for randomized controlled trials cohort (prospective and retrospective), case–control, and cross-sectional studies published through March 2016. We collected information on study design, study population, and bowel preparation. For each factor, we obtained the odds ratio (OR) for inadequate bowel preparation. We conducted the meta-analyses using the random-effects approach and investigated any identified heterogeneity and publication bias via graphical methods, stratification, and meta-regression.**

RESULTS: **We performed a meta-analysis of 67 studies, comprising 75,818 patients. The estimated pooled OR for inadequate bowel preparation was small for sociodemographic characteristics: 1.14 for age, and 1.23 for male sex (excluding studies in Asia, which had substantial heterogeneity and publication bias), and 1.49 for low education. The effect of high body mass index differed significantly in studies with mostly female patients (OR, 1.05) vs those with mostly male patients (OR, 1.30) ($P = .013$ for the difference). ORs for constipation and cirrhosis were heterogeneous; adjusted ORs were larger than unadjusted ORs (1.97 vs 1.29 for constipation and 3.41 vs 1.36 for cirrhosis). Diabetes (OR, 1.79), hypertension (OR, 1.25), stroke or dementia (OR, 2.09), and opioid use (OR, 1.70) were associated with inadequate bowel preparation. History of abdominal surgery (OR, 0.99) did not associate with inadequate bowel preparation. Use of tricyclic antidepressants had a larger effect on risk of inadequate bowel preparation in studies of mostly female patients (OR, 2.62) than studies of mostly male patients (OR, 1.42) ($P = .085$ for the difference).**

CONCLUSIONS: **In a systematic review and meta-analysis, we found no single patient-related factor to be solely associated with inadequate bowel preparation. Health conditions and use of some medications appear to be stronger predictors than sociodemographic characteristics.**

Keywords: Colonoscopy; Inadequate Preparation; Predictors; Meta-Analysis.

Performance of high-quality colonoscopy is affected by bowel preparation. Prior studies have estimated rates of inadequate bowel preparation (IBP) as high as 25%.[1] IBP is associated with missed adenomatous polyps, longer procedure time, and a decreased rate of cecum intubation.[2–6] Furthermore, IBP leads to reduced adherence to screening and surveillance guidelines, and repeat colonoscopies, which are burdensome for the patient and health care system.

There is little recourse when patients have IBP on the day of colonoscopy, and therefore the focus must be on

Abbreviations used in this paper: BMI, body mass index; IBP, inadequate bowel preparation; OR, odds ratio.

Most current article

1542-3565/$36.00
https://doi.org/10.1016/j.cgh.2017.08.016

prevention. Identifying patients at risk for IBP may prevent colonoscopy failure. Previous research has identified various patient characteristics potentially associated with IBP, including sociodemographics (older age, male sex, low education, or low socioeconomic status), comorbidities (diabetes, cirrhosis, and chronic constipation), and medications (opioids or antidepressants). However, prior study results have been somewhat inconsistent and the magnitude of these associations is unclear. Our study objectives were as follows: to perform a systematic review of prior research on various patient characteristics that may be associated with IBP, and to conduct a formal meta-analysis for each factor when feasible.

Methods

Identification of Studies

We conducted systematic literature searches to identify studies that reported on factors potentially associated with the quality of the bowel preparation for colonoscopy in adults. Randomized controlled trials, cohort (prospective and retrospective), case-control, and cross-sectional studies all were eligible for inclusion. Searches of PubMed, Scopus, and the Cochrane database were conducted in March 2016. The corresponding queries are shown in the Supplementary Materials section and the search process results are summarized in Supplementary Figure 1.

In addition to publications that reported on relevant risk factors, we also considered publications that appeared relevant but did not directly report results usable for our meta-analyses. We attempted to contact all investigators of potentially relevant publications that occurred after 2010 to request any available unpublished data. Because of the low response rate, we did not attempt to contact the investigators of potentially relevant publications that occurred before 2010. Finally, we also considered for inclusion additional studies identified through other means (eg, backtracking references of relevant articles).

Data Abstraction

For all included studies, information was abstracted and checked independently by at least 2 authors (K.G. and C.D.). Disagreements were resolved through discussion and consensus. Investigators were sent requests for clarifications of inconsistencies or supplementary information when needed.

For each study, we abstracted information on key characteristics, including the following. The first characteristic was study information, including study design (cross-sectional, case-control, cohort, or randomized controlled trial), geographic location, number of sites, sample size, and data sources for the information regarding the predictors and the quality of the colonoscopy preparation (medical records, patient interviews or surveys, endoscopist reports, and so forth). The second characteristic was information on the study population, including the percentage of outpatients, mean age, percentage of males, percentage of Caucasians, mean body mass index (BMI), and the frequency of hypertension and diabetes. The third characteristic was preparation-related data, including preparation type (polyethylene glycol electrolyte solution, sodium phosphate, and so forth), method of assessment of the preparation adequacy (Boston Bowel Preparation Scale, Ottawa Bowel Preparation Scale, or variations of the Aronchick scale),[7–12] and the proportion of inadequate preparations.

There is currently no generally acceptable tool for the assessment of the quality of observational studies.[13,14] Empiric studies have shown that quality scoring scales do not correlate with study results,[15,16] and even can introduce bias.[17] Therefore, almost all experts and modern recommendations advise against the use of such quality scoring scales.[18–21] Both the Cochrane Handbook (section 8.3.3)[22] and the Meta-analysis Of Observational Studies in Epidemiology (MOOSE) Group recommendations[23] explicitly discourage the use of quality scoring scales. On the other hand, qualitative checklists developed mainly for general critical appraisal of a published report, rather than formal meta-analyses, often are validated inadequately, and do not generalize well across different fields and topics.[13] Furthermore, they can be used only in meta-analyses if a researcher is willing to derive an ad hoc overall summary judgment for each study, without the benefit of a formal rubric or weighting scheme for the various checklist items. Such summary judgments are even more subjective than formal scoring schemes and lack any methodologic support for their validity.

Recognizing these serious weaknesses of summary study quality assessment, we followed current expert recommendations that suggest coding key the components of study design that are considered relevant and using them as separate covariates in the assessment of heterogeneity and publication bias.[15,17,21,23] More specifically, we coded each study for the following characteristics: year of publication, geographic location, single-site or multisite study, study design, sample size, data sources for both predictors and quality of bowel preparation, average age of patients, proportion of male patients, preparation type, rating scale of preparation quality, fraction of procedures rated inadequate, and whether the study contributed adjusted or unadjusted results.

For our systematic reviews, we focused on the following 16 factors that potentially were associated with the quality of colonoscopy preparation (the subgroups more likely to have inadequate preparation are shown in parentheses). These factors were prespecified before the start of our study. The sociodemographic characteristics were as follows: age (older), sex (male), education (lower), socioeconomic status (lower). The health/medical history was as follows: BMI (higher), constipation,