APPENDIX

**Developing and Deploying an Automated Quality Reporting System in Your Practice: Learning from the Stanford Colonoscopy Quality Assurance Program**

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*Algorithm details*

A colonoscopy is considered complete to the cecum when the choice selected in the first level menu for extent of exam is:

* + - 1. “Cecum,” and second level menu choices for means of identification are “Appendix and ileocecal valve,” “Appendix and ileocecal valve and palpation,” “Appendix and ileocecal valve and transillumination,” “Appendix” or “Ileocecal valve.”
      2. “Terminal ileum,” with second level menu choices for means of identification of “Appendix and Ileocecal valve,” “Appendix” or “Ileocecal valve.”
      3. “Terminal ileum.”
      4. or “Terminal ileum” with second level documentation of distance intubated.

Colonoscopy indication is ascertained and categorized as follows:

* + - 1. “Screening, first” when first-level menu choice is “Screening,” and second level choice is “Screen for colorectal cancer, average risk,” and in addition, another first-level menu choice of “No previous colonoscopy” is also selected (Appendix Figure 1A).
      2. “Screening, not first” when first-level menu choice is “Screening,” and second level choice is “Screen for colorectal cancer, timeframe” with a specified timeframe from previous colonoscopy (Appendix Figure 1B).
      3. “Surveillance” when first-level menu choice is “Surveillance,” and second level choices are “Personal history polyps,” “Polyps unknown histology timeframe” and a timeframe specified, “Personal history adenomatous polyps timeframe” and any of the subsequent menu choices are selected, “Personal history adenomatous polyps” and any of the subsequent menu choices are selected, or “Personal history serrated polyps” and any of the subsequent menu choices are selected, but not any of the choices reflecting family history of polyposis, Lynch syndrome or a genetic syndrome
      4. “Family history” when first-level menu choice is “Screening,” and second level choices are “Family history colon cancer” with any of the subsequent choices documenting the details of affected relatives, “Family history advanced adenoma,” “Family history polyps” or “Family history serrated polyp,” but not any of the choices reflecting family history of polyposis, Lynch syndrome or a genetic syndrome; or alternatively, a first-level menu choice of “Surveillance,” and second level choices of “Family history colon cancer,” “Family history anal or rectal cancer,” “Family history colon advanced adenoma” or “Family history colon polyps,” but not any of the choices reflecting family history of polyposis, Lynch syndrome or a genetic syndrome.
      5. “Follow-up, FIT” when first-level menu choice is “Gastrointestinal bleeding” or “Assessment/Tests” and second-level choice is “FIT test positive.”
      6. “Follow up, other screening test” first-level menu choice is “Gastrointestinal bleeding” or “Assessment/Tests” and second-level choice is “Cologuard Test Positive,” or first-level menu choice is “Gastrointestinal bleeding” and second-level choice is “Heme positive stool,” or first-level menu choice is “Abnormal imaging” and second-level choice is “Virtual colonoscopy” or ‘Abnormal VCE,” or first-level menu choice is “Polyps” and second-level menu choice is “Colon Polyp Seen on Flex Sig” or “Rectal Polyp Seen on Flex Sig.”
      7. “Other” when any other indication is selected and none of the above indications are selected. This category is heterogeneous, and includes, for instance, colonoscopies for symptoms, treatment of known polyps, follow-up of piecemeal polypectomy or abnormal imaging, and surveillance for inflammatory bowel disease (IBD) or genetic syndromes.

Because factors such as adequacy of preparation, comorbidities, other relevant clinical factors, and patient preferences are not explicitly considered by the algorithm that determines the recommended surveillance interval per guidelines, we have taken a liberal approach when assessing adherence rates to recommended surveillance intervals that are <95-100%.

**Appendix Figure Legends**

Appendix Figure 1. Sample abbreviated individual level report card. An expanded report includes all colonoscopy indications.

Appendix Figure 2. Screenshot from ProVation©  (ProVation Medical Inc., Minnesota USA) endoscopy report-writing software: Example of drop-down menu choices for indication of “Screening, not first.”

Appendix Figure 3. Screenshot from EPIC® 2018 (Epic Inc., Wisconsin USA) standardized pathology note / letter: Menu for total polyp number.

Appendix Figure 4. Screenshot from EPIC® 2018 (Epic Inc., Wisconsin USA) standardized pathology note / letter: Example for selecting more than 1 polyp type.

Appendix Figure 5. Screenshot from EPIC® 2018 (Epic Inc., Wisconsin USA) standardized pathology note / letter: Sample menu for polyp number by type.

Appendix Figure 6. Screenshot from EPIC® 2018 (Epic Inc., Wisconsin USA) standardized pathology note / letter: Menu for colonoscopy interval (the choice feeds the “Health Maintenance” tab in the electronic medical record).

Appendix Figure 7. Screenshot from EPIC® 2018 (Epic Inc., Wisconsin USA) standardized pathology note / letter: Sample completed letter.

Appendix Figure 8. Screenshot from application developed in Qlikview (Qlik Technologies Inc., Pennsylvania USA), with dashboard and versatile data visualization options: Sample 12-month audit for all division, part 1.

Appendix Figure 9. Screenshot from application developed in Qlikview (Qlik Technologies Inc., Pennsylvania USA), with dashboard and versatile data visualization options: Sample 12-month audit for all division, part 2.

Appendix Figure 10. Screenshot from application developed in Qlikview (Qlik Technologies Inc., Pennsylvania USA), with dashboard and versatile data visualization options: Sample 12-month audit for all division, part 3.

Appendix Figure 11. Customized Adenoma Detection Rate (ADR) Workspace (red circle highlights the tab) in EPIC® 2018 (Epic Inc., Wisconsin USA). The workspace consists of a window with side-by-side display of pathology and colonoscopy report texts with blue hyperlinks to “Complete Results” including endoscopic photos, at left top; a Progress Notes field with a “Speed Button” (thick red arrow) to populate it with the results letter text and drop-down menus, at right; and a “Quick Action” window converting the progress note (which contains the queriable elements in drop-down menus) to “Communications” (electronic, fax or mail) to the patient and care team at the push of the “Send Now” button (long, thin red arrow). The gray boxes in this figure mask protected information.

Appendix Table 1. Database and algorithm validation

|  |  |  |
| --- | --- | --- |
| **Data Capture / Programming Errors \*** | | |
|  | **Count** | **% out of n=428** |
| Counting procedure that was not performed | 2 | 0.5% |
| Procedure erroneously included in Surveillance audit | 1 | 0.2% |
| Duplicate procedure | 1 | 0.2% |
| Pathology letter missed in audit | 2 | 0.5% |
| Withdrawal time mis-assigned | 1 | 0.2% |
| **Documentation Errors by Faculty \*\*** | | |
|  | **Count** | **% out of n=428** |
| Error in pathology letter documentation | 24 | 5.6% |
| Boston Bowel Preparation Scale not coded | 23 | 5.4% |
| Indication not coded appropriately | 8 | 1.9% |
| Withdrawal time not documented | 4 | 0.9% |
| Complete exam extent not documented appropriately | 3 | 0.7% |
| Surveillance recommendation not documented appropriately | 2 | 0.5% |

\* In response, programming code was corrected. No further errors have been identified after implementation and routine clinical application.

\*\* Individual and group-level education was pursued to minimize future occurrence of these error types.