

Final Report
for
Contract No. 200-2002-00573
Task Order 0002

Colorado Survey of Endoscopic Capacity (SECAP)

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December 2006

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Table of Contents

	<i>Page</i>
1.0 INTRODUCTION.....	3
2.0 STUDY METHODS.....	3
2.1 OBJECTIVES OF THE STUDY	3
2.2 SURVEY DESIGN AND ADMINISTRATION	3
2.2.1 <i>Development of the survey instrument</i>	3
2.2.2 <i>Identification of the eligible facilities that perform endoscopy</i>	3
2.2.3 <i>Data collection procedures</i>	3
2.2.4 <i>Region Definitions</i>	3
2.2.5 <i>Survey response rate</i>	3
2.3 ANALYSIS TECHNIQUES	3
2.3.1 <i>Definition of practice specialty</i>	3
2.3.2 <i>Imputation of missing data</i>	3
3.0 CURRENT CAPACITY FOR COLORECTAL CANCER SCREENING AND FOLLOW-UP	3
3.1 CHARACTERISTICS OF PROVIDERS AND PRACTICES PERFORMING ENDOSCOPY	3
3.2 NUMBER AND TYPE OF PROCEDURES PERFORMED	3
3.3 MEASURES TO ADDRESS INCREASED NEED	3
3.4 SCHEDULING PROCEDURES	3
3.5 ACTION TAKEN IF A POLYP IS IDENTIFIED ON SIGMOIDOSCOPY	3
4.0 UNMET NEED FOR SCREENING AND FOLLOW-UP PROCEDURES	3
4.1 DEVELOPMENT OF THE FORECASTING MODEL	3
4.1.1 <i>Population estimates</i>	3
4.1.2 <i>Estimating the unmet need for colorectal cancer screening</i>	3
4.1.3 <i>Need for screening procedures in various screening scenarios</i>	3
4.1.4 <i>Sensitivity analyses</i>	3
4.2 FORECASTING MODEL RESULTS.....	3
4.2.1 <i>Characteristics of the unscreened population</i>	3
4.2.2 <i>Total number of screening and follow-up procedures required</i>	3
4.2.3 <i>Sensitivity Analyses</i>	3
5.0 COMPARISON OF CURRENT CAPACITY AND UNMET NEED.....	3
5.1 CAPACITY FOR SCREENING AND FOLLOW-UP PROCEDURES.....	3
5.2 COMPARISON OF CAPACITY AND UNMET NEED	3
5.3 STUDY LIMITATIONS	3
REFERENCES.....	3
APPENDIX A – Screening Telephone Call Script.....	A-1
APPENDIX B – Colorado Cover Letter and Survey of Endoscopic Capacity.....	B-1
APPENDIX C – Counties in Colorado Regions.....	C-1
APPENDIX D – Logistic Regression Coefficients.....	D-1

List of Tables

		<i>Page</i>
2-1	Number of eligible facilities, by region and survey administration.....	8
2-2	Surveys and response rate, by region and survey administration	8
3-1	Percentage of all flexible sigmoidoscopies and colonoscopies performed by physician specialty for Colorado and the nation.....	13
3-2	Urban/rural and regional breakdown of facilities by practice specialty - Colorado	14
3-3	Percentage of all flexible sigmoidoscopies and colonoscopies performed, by physician specialty, by practice specialty for Colorado.....	15
3-4	Type of lower GI equipment owned, by region	16
3-5	Procedures currently being performed in Colorado and the nation	17
3-6	Measures to address increased need for flexible sigmoidoscopy and colonoscopy in Colorado and the nation	18
3-7	Amount of room time typically scheduled for flexible sigmoidoscopy and colonoscopy, in Colorado and the nation.....	19
3-8	Typical waiting time for various endoscopy procedures for Colorado and the nation.....	20
3-9	Action taken if lesions of various sizes are identified during a screening sigmoidoscopy in a healthy, average-risk patient	21
4-1	Socio-demographic characteristics of the average risk population for Colorado (in thousands)	28
4-2	Number of screening and follow-up tests required to immediately satisfy unmet need for Colorado	29
4-3	Annual number of screening and follow-up endoscopies required to satisfy unmet need over multiple years	31
4-4	Sensitivity analyses for Colorado – base case	32
5-1	Estimated number of practices that provide endoscopies statewide, by regions	34
5-2	Potential volume, current volume, and unused capacity for flexible sigmoidoscopy and colonoscopy, by region – annual number of procedures.....	35
5-3	Comparison of unmet need and unused capacity, base case and options	37
5-4	Comparison of unmet need and unused capacity for flexible sigmoidoscopy and colonoscopy, by region – base case	38
5-5	Difference between unused capacity and unmet need over multiple years, base case and options	39
5-6	Difference between unused capacity and unmet need over multiple years, by region – base case.....	40

List of Figures

		<i>Page</i>
2-1	Colorado Regions.....	7
4-1	Estimated number of people needing CRC screening and follow-up.....	22

1.0 Introduction

This report represents the final report of the Colorado Survey of Endoscopic Capacity (Colorado SECAP)—a study which was conducted to assess the current capacity of the Colorado health care system to conduct colorectal cancer (CRC) screening and follow-up examinations for average-risk persons 50 years of age and older. Data for the study were obtained from a survey sent to all health care facilities known to have purchased flexible sigmoidoscopes and colonoscopes between 1996 and 2003 based on lists provided by major endoscopic equipment manufacturers. The survey obtained information regarding the number of colorectal cancer screening and follow-up examinations currently being performed, as well as the maximum number of screening and follow-up examinations that could be performed in the event of widespread screening. The study then compared the actual numbers of endoscopic procedures currently being performed and the maximum number currently possible with the number of procedures needed for the eligible population, based on the demographic composition of the population of Colorado and current rates of screening. Estimates are provided for each of seven sub-state regions, as well as for the state overall. The results of the study provide valuable information to determine whether or not the capacity can meet the potential need for colorectal cancer screening and follow-up procedures.

In this report we summarize the methods and findings from the study. The study methods—the objectives of the study, survey design and administration, and statistical techniques—are described in Section 2. In Section 3 we estimate the current capacity for colorectal cancer screening and follow-up examinations. This includes a discussion of the number of colorectal cancer screening and follow-up procedures that are currently being performed, the maximum number of procedures that could be performed in the event of widespread screening and the characteristics of the medical facilities and providers that currently perform colorectal cancer screening and follow-up examinations. In Section 4 we estimate the size of the unscreened average-risk population 50 years of age and older and the tests needed to screen them. Finally, in Section 5 we compare the potential volume with the unmet need for colorectal cancer screening and follow-up examinations in order to assess the capacity of the health care system to provide the necessary colorectal cancer screening and follow-up examinations.

2.0 Study Methods

2.1 Objectives of the Study

The primary goal of the study was to determine the capacity of the Colorado health care system to provide endoscopic colorectal cancer screening and follow-up to all appropriate persons. Specifically, the objectives of the study were to:

- Describe the health care provider and facility characteristics of those providers who are performing screening and follow-up examinations;
- Estimate the number of colorectal cancer screening and follow-up examinations currently being performed by facilities that own sigmoidoscopes and colonoscopes and the maximum number of screening and follow-up examinations that could be performed in the event of widespread screening;
- Determine the unmet need for colorectal cancer screening and follow-up examinations among average risk individuals 50 years of age and older; and
- For the state overall, as well as for seven sub-state regions, compare the number of procedures that could be performed with the need for colorectal cancer screening and follow-up examinations in order to assess the current capacity of the health care system to provide the necessary colorectal cancer screening and follow-up examinations.

To obtain information on the current capacity of Colorado facilities to conduct colorectal cancer screening and follow-up examinations, a survey was administered to all health care facilities known to have purchased flexible sigmoidoscopes and colonoscopes between 1996 and 2003. This included single-specialty and multi-specialty physician practices, single-specialty and multi-specialty ambulatory endoscopy/surgery centers, hospitals, medical clinics, and managed care organizations. In addition, to estimate the unmet need for colorectal cancer screening and follow-up examinations, a forecasting model was developed and used to: (1) estimate the number of average-risk people 50 years of age and older who have not been screened for colorectal cancer; (2) describe the socio-demographic characteristics of the unscreened population; and (3) estimate the annual number of procedures required to satisfy the unmet need for endoscopic colorectal cancer screening and follow-up tests.

2.2 Survey Design and Administration

All facilities in Colorado that are known to have purchased lower gastrointestinal (GI) endoscopic equipment between 1996 and 2003 were surveyed to obtain information regarding the number of screening and follow-up procedures that are currently being performed, the maximum number of procedures that could be performed in the event of widespread screening, and the characteristics of the practices and the providers performing screening and follow-up procedures (including non-physician providers). Data were obtained in both a national and state survey:

- **National Survey of Endoscopic Capacity.** In the spring of 2002, the national Survey of Endoscopic Capacity was administered to a stratified random sample of 1,800 facilities throughout the U.S. that perform lower GI endoscopic procedures. A total of 15 Colorado facilities completed mail surveys as part of the national Survey of Endoscopic Capacity.
- **Colorado Survey of Endoscopic Capacity.** In the fall of 2004, all Colorado facilities that were not surveyed in the national survey were contacted and asked to participate in the Colorado State Survey of Endoscopic Capacity. A total of 85 Colorado facilities completed mail surveys as part of the Colorado Survey of Endoscopic Capacity.

All facilities that perform endoscopy were identified based upon data provided by endoscopic equipment manufacturers and an ambulatory surgery center management company. Facilities were contacted by telephone to verify their eligibility and to obtain the name and address of the person in charge of endoscopy at the facility. The survey was sent to the physician identified in the screening telephone call using established survey administration procedures to maximize response rates among busy physicians.

In this section we provide a detailed description of the survey design and administration. In particular, we describe (1) development of the survey instrument, (2) identification of the eligible facilities that perform endoscopy, (3) data collection procedures, (4) region definitions, and (5) survey response rate.

2.2.1 Development of the survey instrument

Two survey instruments were developed for use in the study: a telephone screening questionnaire and a self-administered survey. The purpose of the screening questionnaire was to confirm that the facility was eligible for inclusion in the study (lower endoscopy being performed for colorectal cancer screening in adults) and to obtain the name and address of the physician in charge of endoscopy at the facility. The self-administered questionnaire was then sent by Federal Express to the physician identified during the telephone screening call. The self-administered survey was designed to obtain information regarding:

- The numbers of flexible sigmoidoscopies and colonoscopies currently being performed and the types of providers performing the procedures (including the numbers of procedures performed by non-physician endoscopists)
- The maximum numbers of flexible sigmoidoscopies and colonoscopies that could be performed with no other investment of resources
- Step(s) that would be taken if the need for screening flexible sigmoidoscopy and colonoscopy were to exceed their current capacity to perform these procedures
- Number and type of endoscopes owned by the facility
- Percentage of procedures that are for screening
- Percentage of procedures that are incomplete
- Room time for flexible sigmoidoscopies and colonoscopies

- Waiting times for flexible sigmoidoscopy and colonoscopy appointments
- Action taken if polyps are found on sigmoidoscopy (for various sizes of polyps)

In developing the questionnaire used in the national survey, input was sought from providers similar to the individuals who would be selected to participate in the survey. The survey instrument was also pre-tested at nine facilities that perform colorectal cancer screening and follow-up examinations. In addition to pre-testing the mail survey, the telephone screening call was also pre-tested and was found to be a successful way of identifying the appropriate respondent for the mail survey, the person who would be most able to describe endoscopy volume for the entire practice, even in large hospital settings.

Following the pretest, the screening call script was shortened and minor revisions were made to the mail survey questionnaire to clarify confusing terminology (e.g., health care provider, non-physician provider, follow-up colonoscopy). Questions were also reordered to improve skip logic. The final SECAP questionnaire, which was approved by OMB and the CDC and Battelle IRBs, was used to survey approximately 1,800 facilities in the National SECAP study.

Following analysis of the national SECAP data, a few modifications were made to the instrument for the State SECAP study. For example, the classification of facility type was simplified and questions regarding reimbursement for procedures were deleted. Modifications to the survey instrument for the State SECAP were minimal, allowing us to combine data from the two surveys for analysis.

2.2.2 Identification of the eligible facilities that perform endoscopy

All Colorado medical practice sites that perform colorectal cancer screening and follow-up in adults using flexible endoscopic equipment (sigmoidoscopes and colonoscopes) were considered to be eligible for participation in the study. The names and addresses of these medical practice sites were obtained from endoscopic equipment manufacturers and a practice management company for ambulatory surgery centers. Four major endoscopic equipment manufacturers, Olympus America, Inc., Fujinon, Inc., Pentax Precision Instrument Corporation, and Welch Allyn, Inc. provided names and addresses of facilities purchasing endoscopic equipment from January 1, 1996 through December 31, 2003. (Welch Allyn, Inc. was no longer in the business of distributing sigmoidoscopes and colonoscopes after December 2000). In addition, AmSurg, a practice management company for ambulatory surgery centers, provided a list of single- and multi-specialty ambulatory endoscopy/surgery centers in the United States as of December 2000 and December 2003.

Preparation of the state SECAP facility file involved standardizing the files, merging the files, and removing duplicates or ineligible cases (e.g., veterinarians, pediatric hospitals, moving and storage companies).

2.2.3 Data collection procedures

The target population for the survey included all facility settings where flexible sigmoidoscopy or colonoscopy is used to detect colorectal cancer in adults.

Telephone screening calls

Current telephone numbers for the facilities were obtained electronically from a phone match program or by searching Internet phone directories and facility websites. Both the facility address and name were used to search for phone numbers, to ensure that medical facilities that changed names or moved were not missed. Facilities that could not be found by either facility address or name were presumed to be out of business.

A telephone screening call was made to (1) verify that the facility was eligible for inclusion in the study, and (2) to obtain the name and address of the physician in charge of endoscopy. Not all facilities that purchased equipment were still performing lower endoscopy at the time of the screening call. To insure that new facilities opening since 2003 were not missed, those facilities no longer performing lower endoscopy were asked if the doctors at the facility now perform the procedures somewhere else, and if so, the name and address of the other location. These new locations were crosschecked against the facility file, and if determined to be unique, added to the facility file as new cases. As a result, one physician practice was added to the original Colorado facility file.

The script of the telephone screening call is provided in Appendix A. The telephone interviewers used a computer-assisted version of this script that prompted them to ask for additional information depending upon the previously recorded answers. For example, the script varied depending upon whether the facility was a hospital, ambulatory surgery center, or physician office.

In hospital settings, endoscopic procedures are sometimes performed in a number of different departments within the hospital (as well as at satellite clinics). Therefore, in contacting hospitals, we directed our telephone screening call to the charge nurse in the endoscopy suite, assuming he/she would be familiar with all sites in the hospital. The charge nurse was asked to identify all locations within the hospital and all satellite clinics where sigmoidoscopies and colonoscopies are performed. These additional departments and satellite clinics were also cross-checked against the respondent facility file and added if they were unique. These new departments and satellite clinics were then called and the name and address of the physician in charge of endoscopy in that department or clinic was obtained. As a result, one hospital department was added to the original Colorado facility file.

Conduct of the mail survey

Following the initial screening call, a survey packet was sent to the physician identified during the call. The packet included (1) the survey questionnaire with an ID number, (2) a personal cover letter, signed by the Director of the Division of Cancer Prevention and Control at CDC, emphasizing the importance of the study, (3) a postage-paid return envelope addressed to Battelle, and (4) a payment of \$40 as an incentive for the respondent's participation in the study. The letter provided the name and telephone number of the Battelle Task Leader to call with questions about the study. The letter also included the name and telephone number of a person to call with questions regarding Human Subjects protection. The survey packet was sent via Federal Express. The cover letter and survey questionnaire are provided in Appendix B.

Follow-up procedures

Within two weeks of the initial mailing, a thank-you/reminder postcard was sent to each respondent to encourage survey completion. The postcard included a toll-free number to call if the respondent had any questions regarding the survey or needed to have another copy of the survey mailed. Two weeks after mailing the postcard reminder, a telephone call was placed to respondents who had not returned a completed questionnaire. This call served as a reminder, and allowed the opportunity to answer any questions that were delaying completion of the survey. A second telephone call was made when a completed survey was not received within two weeks following the first follow-up telephone call. A third (and final) telephone call was made when a completed survey was not received within two weeks following the second follow-up telephone call.¹ When each completed survey was received, a thank you letter was sent to the respondent acknowledging participation in the study.

Tracking system

A management information system developed for the National SECAP study (and modified for the Colorado SECAP study) was used to monitor data collection activities. The database stored all background data known about each respondent. In addition, the database contained the dates of screening and follow-up telephone calls, the dates that questionnaires and other survey materials were mailed, and the dates that completed questionnaires were received. Mailing labels and personalized letters were generated from this system. Follow-up reminder dates were computed by the tracking system to ensure timely mailing of necessary follow-up materials and reminder phone calls. The management information system was also used to generate weekly reports summarizing the status of the data collection activity.

2.2.4 Region Definitions

In addition to estimating the current capacity and unmet need for colorectal cancer screening and follow-up examinations at the state level, we also compared current capacity and unmet need by the regions of the state as shown in Figure 2-1. The number of eligible facilities in each of the regions is listed in Table 2-1. Appendix C provides a list of the specific counties that are included in each of the seven regions.

¹ Follow-up for the facilities surveyed in the national SECAP was done at three-week, rather than two-week, intervals.

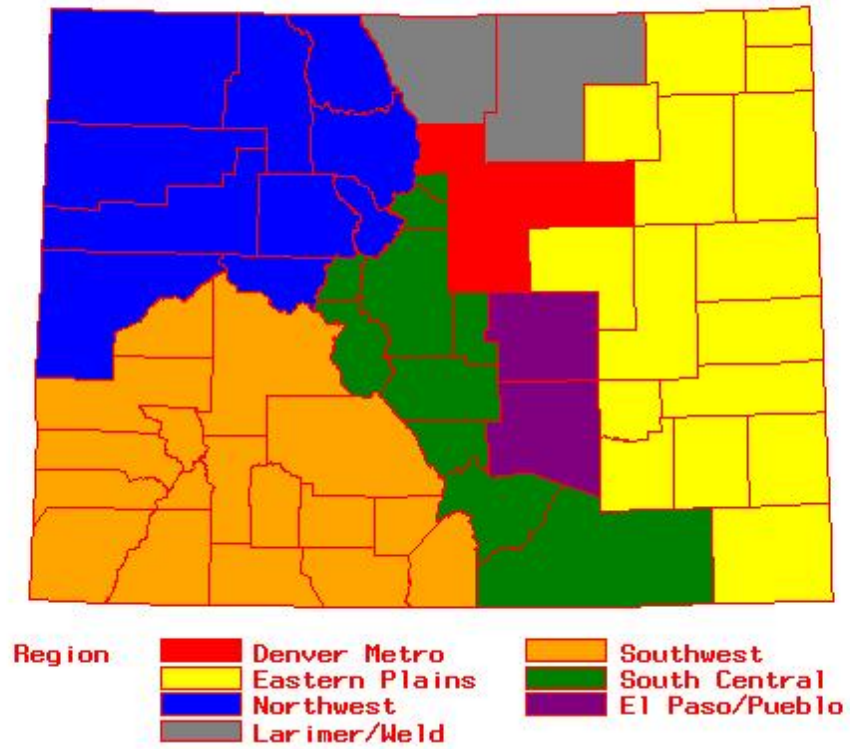


Figure 2-1: Colorado Regions

Table 2-1

Number of eligible facilities, by region and survey administration			
	National SECAP 2002	Colorado SECAP 2005	Total
Region			
Denver Metro	10	41	51
Southwest	1	8	9
Eastern Plains	2	9	11
South Central Mountain	1	5	6
Northwest	2	10	12
El Paso/Pueblo	4	10	14
Larimer/Weld	2	11	13
Total	22	94	116

2.2.5 Survey response rate

Of the 116 Colorado facilities that were identified as eligible for inclusion in the study, a total of 100 facilities (86.2%) returned completed questionnaires. The numbers of surveys received and the response rates achieved in the national and Colorado SECAP are shown in Table 2-2 for the seven regions. Survey respondents completing the survey on behalf of their facility included 29 (29%) physicians, 56 (56%) nurses and 15 (15%) other.

Table 2-2

Surveys and response rate, by region and survey administration					
	National SECAP 2002		Colorado SECAP 2005		Total
Region					
Denver Metro	5	(50%)	37	(90%)	42 (82%)
Southwest	1	(100%)	8	(100%)	9 (100%)
Eastern Plains	1	(50%)	8	(89%)	9 (81%)
South Central Mountain	1	(100%)	4	(80%)	5 (83%)
Northwest	1	(50%)	9	(90%)	10 (83%)
El Paso/Pueblo	4	(100%)	9	(90%)	13 (93%)
Larimer/Weld	2	(100%)	10	(91%)	12 (92%)
Total	15	(68%)	85	(90%)	100 (86%)

2.3 Analysis techniques

The survey data were analyzed using standard univariate and bivariate descriptive statistics (e.g., means, frequencies, cross-tabulations). Survey weights were calculated to adjust for non-response. The survey weight was calculated as the ratio of the number of eligible facilities in each of the seven regions to the number of completed surveys in that area. Because the survey data were weighted to produce state estimates, the data were analyzed using Stata 9.0—a software package which adjusts for the sample weights (StataCorp, 2005).

In the sections below we describe the procedure used to classify facilities for the analysis and the procedure used to impute missing data on the key variables.

2.3.1 Definition of practice specialty

Information on the type of facility (e.g., physician practice, ambulatory endoscopy/surgery center, hospital) was obtained during the telephone screening call, as well as on the mail survey. However, based on the responses given on the mail survey and after comparing the survey responses with the information obtained during the screening call, we concluded that the use of this classification of facility type is problematic. It is not uncommon, for example, for an ambulatory endoscopy/surgery center to be affiliated with a hospital or a physician practice. Similarly, lower GI endoscopic procedures often are performed in endoscopy centers or outpatient clinics affiliated with hospitals. This made it difficult to clearly define facilities as hospitals versus practices versus ambulatory endoscopy centers. Therefore, instead of classifying facilities based on the commonly used definition of facility type, we decided instead to classify facilities based on the specialty of the physicians that perform the flexible sigmoidoscopy and colonoscopy procedures at the facilities.

For this analysis, facilities were classified as one of four practice types based on the specialty of the physicians that perform the flexible sigmoidoscopy and colonoscopy procedures at the facility. These practice specialties include: (1) gastroenterology practices, (2) primary care practices, (3) surgical practices, and (4) mixed practices. Responses to the mail survey questions 14 and 27 provided data for the following classification:

- If 75% or more of the procedures are performed by gastroenterologists, the facility was classified as a **gastroenterology practice**.
- If 75% or more of the procedures are performed by family practitioners, general practitioners and/or internists, the facility was classified as a **primary care practice**.
- If 75% or more of the procedures are performed by colorectal and/or general surgeons, the facility was classified as a **surgical practice**.
- If there is no dominant physician specialty or if the dominant physician specialty for flexible sigmoidoscopy is different than that for colonoscopy, the facility was classified as a **mixed practice**.

Residents, fellows, and non-physician endoscopists were not considered in determining the practice specialty. If a facility only performs one of the procedures, we classified it based on that one procedure. If the survey was missing information for one of the procedures, the information for the other procedure was used to classify the practice site. It should be noted that this definition of practice type is based on the dominant physician specialty performing lower GI endoscopic procedures at the facility, rather than the dominant physician specialty for all medical procedures.

2.3.2 Imputation of missing data

For the estimation of endoscopic capacity, two questions are critical to the analysis. These critical items included: (1) the number of procedures currently being performed and (2) the maximum number of procedures that could be performed. A small number of surveys were missing information regarding the number of procedures currently being performed: one facility was missing information on the number of flexible sigmoidoscopies currently being performed, and one facility was missing information on the number of colonoscopies currently being performed. With respect to the maximum number of procedures that could be performed, among facilities that perform flexible sigmoidoscopy, 9 were missing the maximum number of procedures that could be performed. Among facilities that indicated that they perform colonoscopy, the maximum number of procedures that could be performed was missing for 7 facilities.²

We used two variables to stratify facilities before imputing missing values: (1) whether the facility was located in a rural or urban area; and (2) practice specialty (gastroenterology, primary care, surgery, or mixed specialties) performing the procedures at that facility.³ In the National SECAP, these two variables were found to be closely associated with the number of procedures performed. Thus, all facilities were stratified into 8 cells based on an urban/rural and practice specialty classification.⁴ If a survey indicated that the facility performs flexible sigmoidoscopy or colonoscopy, but the total number of procedures performed was missing, we imputed an estimate of current volume. The imputation method, a variation of the hot deck method, is described below:

1. For the first survey with missing information for current volume, a volume estimate was randomly selected from among all surveys with reported values from the same cell.
2. The process was repeated for each subsequent survey with missing information (excluding any surveys that were previously selected to generate imputed values).

² If the number of flexible sigmoidoscopies performed each week and the number of colonoscopies performed each week were both missing, then the case was treated as a refusal.

³ The type of physicians performing the procedures, or practice specialty, is defined in 2.3.1.

⁴ For imputation purposes, we used a dichotomous urban/rural classification based on a ZIP code version of the rural-urban commuting area (RUCA) coding scheme. To yield a rural-urban dichotomy, RUCA codes 1 (urban core census tract) to 3 (census tract weakly tied to urban core) were considered to be urban and codes 4 (large town census tract) to 10 (isolated small rural census tract) were considered to be rural.

A slightly different procedure was used to impute the maximum number of flexible sigmoidoscopies or colonoscopies that could be performed:

1. All facilities were stratified into 16 cells based on an urban/rural classification, practice specialty (gastroenterology, primary care, surgical, or mixed as defined in section 2.3.1) and the number of procedures currently being performed (e.g., less than the median number of procedures for the cell, equal to or greater than the median number of procedures for the cell). These three variables together are highly associated with potential volume.
2. For the first survey with missing information for potential volume, we randomly selected a ratio of potential to current volume from among all surveys with valid estimates for both potential and current volume from the same cell.
3. This ratio was then multiplied by the current volume to provide an imputed value of potential volume.
4. The process was repeated for each subsequent survey with missing information (excluding any surveys that were previously selected to generate imputed values).

3.0 Current Capacity for Colorectal Cancer Screening and Follow-up

In this section we present survey data from Colorado facilities regarding the types of physicians and practices currently performing lower GI endoscopic procedures, the number of screening and follow-up procedures that are currently being performed, the maximum number of screening and follow-up procedures that could be performed, and the measures that facilities would take to meet an increased need for colorectal screening and follow-up procedures. In addition we present data on scheduling procedures – room time allocated and waiting time for an appointment, as well as data on treating polyps. The analyses, which provide information separately for flexible sigmoidoscopies and colonoscopies, compare Colorado data with national data from the national SECAP study⁵. Tables showing differences by the seven regions of Colorado are presented in a supplemental appendix.

3.1 Characteristics of providers and practices performing endoscopy

The survey asked each facility to report the total number of flexible sigmoidoscopies and colonoscopies performed by all providers in the practice in a typical week, as well as the percentage of flexible sigmoidoscopies and colonoscopies performed by various types of providers. The responses to these questions (weighted for facility non-response) were used to calculate the percentages of all flexible sigmoidoscopies and colonoscopies performed in Colorado by provider specialty. The percentages of procedures that are performed by gastroenterologists, primary care providers (e.g., general practitioner, internist, family practitioner), and surgeons (e.g., general surgeons, colorectal surgeons) are summarized in Table 3-1. The percentages of procedures that are performed by residents and fellows (with a supervising physician in attendance), non-physician providers (nurse practitioners, physician assistants, registered nurses, or licensed practical nurses), and other providers are also shown in the table.

- Primary care physicians perform 18.2% of flexible sigmoidoscopies and 3.1% of colonoscopies in Colorado.
- Gastroenterologists perform 35.9% of the flexible sigmoidoscopies and 85.1% of the colonoscopies.
- Surgeons perform 2.8% of the flexible sigmoidoscopies and 10.1% of the colonoscopies.
- Non-physician endoscopists perform 41.8% of the flexible sigmoidoscopies but do not perform colonoscopies. One facility accounts for the high percentage of non-physician endoscopists, in this case nurse practitioners, who perform flexible sigmoidoscopies.
- Residents and fellows perform less than 5% of the procedures in Colorado.

⁵ Between 2000 and 2003, the most recent years of the National Health Interview Survey (NCHS 2004), the use of colonoscopy (without FOBT) increased from 65% to 80% of the screening tests, while the use of flexible sigmoidoscopy (without FOBT) declined 35% to 20%. Thus comparisons of state and national data may reflect the trend between 2002 and 2005 towards greater use of colonoscopy as a screening test, as well as differences due to population demographics and geography.

Table 3-1

Percentage of all flexible sigmoidoscopies and colonoscopies performed by physician specialty for Colorado and the Nation (standard errors in parentheses)				
	Flexible Sigmoidoscopy		Colonoscopy	
	Colorado 2005	Nation 2002	Colorado 2005	Nation 2002
Gastroenterologist	35.9 (6.6)	43.7 (3.3)	85.1 (1.1)	82.5 (1.1)
Primary Care Provider	18.2 (3.5)	24.9 (2.4)	3.1 (0.5)	2.0 (0.3)
General practitioner	4.0 (0.9)	1.8 (0.4)	0.6 (0.2)	0.2 (0.1)
Internist	5.7 (1.4)	13.3 (1.7)	2.2 (0.5)	1.0 (0.2)
Family practitioner	8.5 (1.7)	9.8 (1.2)	0.3 (0.1)	0.8 (0.2)
Surgeon	2.8 (0.6)	20.5 (3.2)	10.1 (0.8)	10.8 (0.8)
General surgeon	2.1 (0.5)	5.1 (0.6)	7.0 (0.4)	7.2 (0.5)
Colorectal surgeon	0.7 (0.2)	15.4 (3.3)	3.2 (0.6)	3.5 (0.5)
Resident with supervising physician in attendance	1.1 (0.4)	1.4 (0.6)	0.3 (0.1)	0.2 (0.1)
Fellow with supervising physician in attendance	0.2 (0.1)	2.5 (0.6)	1.3 (0.5)	4.3 (1.2)
Non-Physician Endoscopist*	41.8 (10.1)	6.1 (2.1)	0.0 (NA)	<0.1(<0.1)
Other	0.0 (NA)	0.7 (0.6)	0.0 (NA)	0.1 (0.1)
Number of facilities	79	1002	76	936

* Non-physician endoscopists include nurse practitioners, physician assistants, registered nurses, and licensed practical nurses.

We classified the facilities that completed surveys by practice specialty, then weighted the distribution to account for non-respondents. The estimated number of eligible facilities by practice specialty in the seven regions is shown in Table 3-2. (Decimal numbers are due to estimating practice specialty for survey non-respondents). The table also shows the number of facilities as a percent of the total for Colorado as compared with the national distribution.

We estimate that Colorado has 43 gastroenterology practices, 27 primary care practices, 13 surgical practices, and 33 mixed practices that perform lower GI endoscopy.

Table 3-2

Urban/rural and regional breakdown of facilities by practice specialty - Colorado					
	Gastroenterology Practices	Primary Care Practices	Surgical Practices	Mixed Practices	Total
Urban/rural (Number of Facilities)					
Urban	35.9	21.1	1.2	23.6	81.7
Rural	6.8	5.8	12.1	9.6	34.3
Region (Number of Facilities)					
Denver Metro	21.9	14.6	0	14.6	51
Southwest	2	1	6	0	9
Eastern Plains	0	2.4	3.7	4.9	11
South Central Mountain	3.6	1.2	0	1.2	6
Northwest	1.2	1.2	3.6	6	12
El Paso/Pueblo	9.7	0	0	4.3	14
Larimer/ Weld	4.3	6.5	0	2.2	13
Total (Number of Facilities)					
	42.7	26.9	13.3	33.1	116
Percentage of Total Facilities					
Colorado 2005	36.8	23.2	11.4	28.6	100.0
Nation 2002	46.3	20.0	12.0	21.6	100.0

The percentage of all flexible sigmoidoscopies and colonoscopies performed by physician and practice specialty are given in Table 3-3. This table shows that the classification of practice specialty accurately describes the type of physicians who are performing the procedures, except for the gastroenterology facilities where most of the flexible sigmoidoscopies are performed by non-physician specialists. In gastroenterology practices, 98.4% of colonoscopies are performed by gastroenterologists. In primary care practices, primary care physicians – general practitioners, internists, or family practitioners – perform 100% of both flexible sigmoidoscopies and colonoscopies. In surgical practices, 99.7% of the flexible sigmoidoscopies and 99.4% of the colonoscopies are performed by surgeons. In surgical practices, general surgeons perform over 99% of the flexible sigmoidoscopies and colonoscopies. In mixed practices, there is no dominant physician specialty performing the procedures; flexible sigmoidoscopies are done by primary care physicians, non-physician endoscopists, gastroenterologists, and surgeons. In mixed practices gastroenterologists perform 71.3% of the colonoscopies with surgeons (both general and colorectal) performing most of the rest.

Table 3-3

Percentage of all flexible sigmoidoscopies and colonoscopies performed, by physician specialty, by practice specialty for Colorado (standard errors in parentheses)				
	Gastroenterology Practices	Primary Care Practices	Surgical Practices	Mixed Practices
Flexible sigmoidoscopy				
Gastroenterologist	44.8 (10.6)	0.0 (NA)	0.0 (NA)	16.4 (1.0)
Primary Care Provider	0.4 (0.2)	100.0 (0.0)	0.3 (0.1)	54.9 (4.5)
General practitioner	0.3 (0.1)	<0.1 (<0.1)	0.3 (0.1)	24.8 (3.0)
Internist	0.1 (<0.1)	32.1 (6.9)	0.0 (NA)	17.3 (2.6)
Family practitioner	<0.1 (<0.1)	67.9 (6.9)	0.0 (NA)	12.8 (2.6)
Surgeon	0.2 (<0.1)	0.0 (NA)	99.7 (0.1)	13.1 (2.7)
General surgeon	0.2 (<0.1)	0.0 (NA)	99.7 (0.1)	8.2 (2.6)
Colorectal surgeon	<0.1 (<0.1)	0.0 (NA)	0.0 (NA)	4.9 (1.0)
Resident	0.1 (<0.1)	0.0 (NA)	0.0 (NA)	6.7 (2.2)
Fellow	0.0 (NA)	0.0 (NA)	0.0 (NA)	1.4 (0.5)
Non-physician endoscopist	54.5 (10.8)	0.0 (NA)	0.0 (NA)	7.5 (2.9)
Other	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)
Colonoscopy				
Gastroenterologist	98.4 (0.3)	0.0 (NA)	0.0 (NA)	71.3 (2.3)
Primary Care Provider	0.0 (NA)	100.0 (NA)	0.6 (0.1)	8.9 (1.6)
General practitioner	0.0 (NA)	37.8 (12.2)	0.4 (<0.1)	1.6 (0.6)
Internist	0.0 (NA)	0.0 (NA)	0.2 (0.1)	7.2 (1.5)
Family practitioner	0.0 (NA)	62.2 (12.2)	0.0 (NA)	0.1 (<0.1)
Surgeon	0.7 (0.1)	0.0 (NA)	99.4 (0.1)	16.4 (1.7)
General surgeon	0.6 (0.1)	0.0 (NA)	99.4 (0.1)	5.9 (0.7)
Colorectal surgeon	<0.1 (<0.1)	0.0 (NA)	0.0 (NA)	10.5 (1.8)
Resident	0.5 (0.2)	0.0 (NA)	0.0 (NA)	0.0 (NA)
Fellow	0.5 (0.2)	0.0 (NA)	0.0 (NA)	3.4 (1.4)
Non-physician endoscopist	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)
Other	0.0 (NA)	0.0 (NA)	0.0 (NA)	0.0 (NA)

The survey asked the respondent to report the number of different types of sigmoidoscopes and colonoscopes owned by the practice. The mean and total number of colonoscopes and flexible sigmoidoscopes (e.g., 60 cm sigmoidoscopes, 30 cm sigmoidoscopes, and other types of lower endoscopes) are shown by region in Table 3-4.

Table 3-4

Type of lower GI equipment owned, by region (standard errors in parentheses)				
	Colonoscopes	Flexible sigmoidoscopes 60cm	Flexible sigmoidoscopes 30cm	Other
Mean per Facility				
Denver Metro	11.2 (1.5)	1.2 (0.3)	0.2 (<0.1)	0.2 (<0.1)
Southwest	3.1 (0.0)	0.0 (NA)	0.0 (NA)	0.0 (NA)
Eastern Plains	1.8 (0.2)	0.3 (0.1)	0.3 (0.1)	0.3 (0.1)
South Central Mountain	5.8 (0.6)	1.0 (0.2)	0.0 (NA)	0.0 (NA)
Northwest	3.2 (0.5)	0.2 (0.1)	0.0 (NA)	0.0 (NA)
El Paso/Pueblo	9.0 (0.3)	1.0 (0.1)	0.2 (<0.1)	0.0 (NA)
Larimer/Weld	6.3 (0.4)	0.0 (NA)	1.0 (0.3)	1.0 (0.3)
Total in Region*				
Denver Metro	572.7(75.0)	61.2(15.9)	10.2 (2.3)	10.2 (2.3)
Southwest	28.1 (0.0)	0.0 (NA)	0.0 (NA)	0.0 (NA)
Eastern Plains	19.6 (1.7)	3.7 (1.1)	3.7 (1.1)	3.7 (1.1)
South Central Mountain	34.5 (3.8)	6.0 (1.0)	0.0 (NA)	0.0 (NA)
Northwest	38.7 (5.8)	2.7 (0.7)	0.0 (NA)	0.0 (NA)
El Paso/Pueblo	126.0 (3.8)	14.0 (2.0)	2.5 (0.7)	0.0 (NA)
Larimer/Weld	81.3 (4.7)	0.0 (NA)	13.0 (3.6)	13.0 (3.6)

*Missing values replaced by means

3.2 Number and type of procedures performed

The survey collected information on the number of flexible sigmoidoscopies and colonoscopies performed per week, the percentage of procedures that are performed for screening, the percentage of procedures that are incomplete, and the maximum number of procedures that could be performed per week with no other investment of resources. The responses to these questions – for Colorado as well as nationally – are summarized in Table 3-5.

- Of the 116 Colorado facilities that perform lower GI endoscopy, 84.3% perform flexible sigmoidoscopy and 76.8% perform colonoscopy.
- Currently Colorado facilities that do flexible sigmoidoscopy perform a mean of 6.2 procedures per week, with approximately half being performed for screening. These facilities report, on average, that they could do 37.9 flexible sigmoidoscopies per week if need increased.

- Colorado facilities that perform colonoscopy currently do an average of 39.7 colonoscopies per week, about half for screening purposes. These facilities report that they could possibly do an average of 77.1 colonoscopies per week, if needed.
- Colorado facilities could perform six times the number of flexible sigmoidoscopies and almost twice the number of colonoscopies as they are currently performing.

Table 3-5

Procedures currently being performed in Colorado and the nation				
(standard errors in parentheses)				
	Flexible sigmoidoscopy		Colonoscopy	
	Colorado 2005	Nation 2002	Colorado 2005	Nation 2002
Percent of practices that perform the procedure	84.3 (1.2)	82.7 (1.1)	76.8 (1.5)	76.1 (1.2)
Mean number of procedures performed per week per facility *	6.2 (1.0)	8.9 (0.6)	39.7 (1.1)	49.8 (3.7)
Percent of procedures performed for screening*	54.0 (1.7)	53.9 (1.2)	55.5 (1.1)	46.7 (0.9)
Percent of procedures that are incomplete*	6.5 (0.7)	8.7 (0.5)	3.0 (0.2)	6.7 (0.5)
Mean number of procedures possible per week per facility*	37.9 (3.1)	30.5 (1.7)	77.1 (2.9)	78.5 (4.0)

*Among those practices that perform the procedure

3.3 Measures to address increased need

In addition to asking facilities to estimate the maximum number of procedures that they could perform per week with no other investment of resources, the survey asked what step(s) facilities would take if the need for screening flexible sigmoidoscopy and colonoscopy were to exceed their current capacity to perform these procedures. Respondents were instructed to answer ‘yes’ or ‘no’ to a number of response choices. These response choices, along with the percentage of respondents who answered ‘yes’, are shown in Table 3-6.

Table 3-6

Measures to address increased need for flexible sigmoidoscopy and colonoscopy, in Colorado and the nation (standard errors in parentheses)				
	Flexible Sigmoidoscopy		Colonoscopy	
	Colorado 2005	Nation 2002	Colorado 2005	Nation 2002
Increase proportion of work day allocated to procedures	60.0 (2.0)	67.6 (1.5)	73.8 (1.9)	78.0 (1.4)
Increase physician staff	27.2 (1.9)	30.0 (1.5)	50.5 (2.0)	55.8 (1.6)
Increase nursing staff to assist with procedures	53.8 (2.2)	53.2 (1.6)	82.4 (1.4)	76.0 (1.4)
Increase/hire non-physician endoscopists to do procedures	13.7 (1.5)	15.7 (1.2)	5.1 (0.9)	5.3 (0.8)
Establish a larger screening unit/more procedure rooms	27.9 (2.0)	39.9 (1.6)	44.9 (2.1)	63.9 (1.6)
Purchase more equipment	60.0 (2.1)	61.9 (1.6)	72.5 (2.0)	74.6 (1.5)
Refer patient to other practices	27.6 (1.9)	24.4 (1.4)	11.9 (1.5)	14.3 (1.2)
Other	5.0 (1.0)	8.4 (0.9)	3.9 (0.9)	4.5 (0.7)

- In order to meet increased need for flexible sigmoidoscopies sixty percent of the facilities in Colorado report that they would increase the proportion of the work day allocated to procedures and purchase more equipment. About half of Colorado facilities report they would increase nursing staff to assist with procedures in response to increased need for flexible sigmoidoscopies.
- To increase capacity to perform colonoscopies, facilities in Colorado were most likely to report that they would increase nursing staff, increase the proportion of the work day allocated to procedures, and purchase more equipment. In addition, approximately half of the facilities indicated that they would increase physician staff and establish more procedure rooms if the demand for colonoscopies were to exceed their capacity to provide the procedure.

- Hiring non-physician endoscopists and referring patients to other practices are options chosen for flexible sigmoidoscopy more than for colonoscopy. Even for flexible sigmoidoscopy, only about 14% of Colorado facilities would hire non-physician endoscopists.

3.4 Scheduling procedures

The survey collected information about the room time typically scheduled for each procedure and the typical waiting time for an appointment. The waiting time for an appointment reflects the current capacity to conduct colorectal cancer screening in a timely manner. The percentage of respondents in Colorado and the nation choosing each response category are shown in Tables 3-7 and 3-8.

- As shown in Table 3-7, most facilities in Colorado schedule less than 30 minutes for a flexible sigmoidoscopy, and schedule 30-45 minutes for a colonoscopy.
- As shown in Table 3-8, more than 80% of Colorado facilities are able to schedule patients for flexible sigmoidoscopy within a month, and no facilities report that patients wait more than 3 months. For colonoscopy, 68% of the facilities are able to schedule patients within a month. Less than 3% of Colorado facilities report that patients wait more than 3 months for a colonoscopy.

Table 3-7

Amount of room time typically scheduled for flexible sigmoidoscopy and colonoscopy, in Colorado and the nation				
(standard errors in parentheses)				
	Flexible Sigmoidoscopy		Colonoscopy	
	Colorado 2005	Nation 2002	Colorado 2005	Nation 2002
Less than 30 minutes	64.7 (2.0)	61.5 (1.6)	15.7 (1.5)	4.1 (0.6)
30 - 45 minutes	31.5 (1.9)	36.0 (1.6)	68.0 (2.0)	72.2 (1.5)
More than 45 minutes	3.8 (0.9)	2.5 (0.5)	16.4 (1.6)	23.8 (1.4)

*Among those practices that perform the procedure

Table 3-8

Typical waiting time for various endoscopy procedures for Colorado and the nation (standard errors in parentheses)		
	Colorado 2005	Nation 2002
Screening flexible sigmoidoscopy*		
Within one month	83.5 (1.6)	73.1 (1.4)
1 – 3 months	16.5 (1.6)	23.0 (1.4)
4 – 6 months	0.0 (NA)	2.6 (0.5)
More than 6 months	0.0 (NA)	1.3 (0.4)
Screening colonoscopy*		
Within one month	68.0 (1.9)	66.9 (1.5)
1 – 3 months	29.2 (1.9)	28.1 (1.5)
4 – 6 months	1.4 (0.6)	3.6 (0.6)
More than 6 months	1.4 (0.6)	1.3 (0.4)
Follow-up colonoscopy in original practice*		
Within one month	93.1 (1.2)	89.5 (1.0)
1 – 3 months	6.9 (1.2)	10.0 (1.0)
4 – 6 months	0.0 (NA)	0.6 (0.2)
More than 6 months	0.0 (NA)	0.0 (NA)
Follow-up colonoscopy in referral site**		
Within one month	70.9 (2.8)	72.5 (2.1)
1 – 3 months	26.7 (2.7)	25.0 (2.0)
4 – 6 months	2.5 (1.0)	2.4 (0.7)
More than 6 months	0.0 (NA)	0.1 (0.1)
Do not refer	45.3 (2.1)	46.2 (1.7)

* Among those practices that perform procedure

** Among practices that refer for colonoscopy

3.5 Action taken if a polyp is identified on sigmoidoscopy

For those facilities that perform flexible sigmoidoscopy, respondents were asked whether the practice routinely performs biopsies during a flexible sigmoidoscopy. About half (52.2%) of the Colorado facilities perform biopsies during a screening flexible sigmoidoscopy. For those facilities that perform biopsies, respondents were asked to choose one of the following to describe what action they typically take if a lesion is identified: (1) a biopsy would be performed during the sigmoidoscopy; (2) a colonoscopy with biopsy would be scheduled; (3) sigmoidoscopy would be concluded and routine colorectal screening would be resumed; or (4) something else would be done. Respondents were instructed to pick only one response. Table 3-9 shows the percentage of Colorado facilities choosing each option for those facilities that report they do biopsies during a screening flexible sigmoidoscopy.

- For polyps less than 5mm, 82% of Colorado facilities would perform a biopsy during the sigmoidoscopy.
- For polyps .5-1cm, 60% of Colorado facilities would perform a biopsy during the sigmoidoscopy. Most of the remaining facilities (37%) would schedule a colonoscopy with biopsy.
- For polyps greater than 1 cm., about half of Colorado facilities (58%) would schedule a colonoscopy with biopsy. Most of the remaining facilities (39%) would biopsy during the sigmoidoscopy.
- For multiple polyps, 62% of Colorado facilities would schedule a colonoscopy with biopsy, and 32% would biopsy during sigmoidoscopy.

Table 3-9

Action taken if lesions of various sizes are identified during a screening sigmoidoscopy in a healthy, average-risk patient* (standard errors in parentheses)				
	Polyp < 5 mm	Polyp 0.5 – 1 cm	Polyp > 1 cm	Multiple polyps
Perform biopsy during sigmoidoscopy	82.1 (1.8)	60.1 (2.4)	39.0 (3.9)	32.0 (2.4)
Schedule colonoscopy with biopsy	11.9 (1.5)	36.8 (2.4)	57.7 (4.0)	62.2 (2.4)
Conclude sigmoidoscopy and resume routine CRC screening schedule	3.2 (0.8)	0.0 (NA)	0.0 (NA)	2.8 (0.8)
Other	2.8 (0.8)	3.1 (0.8)	3.3 (1.4)	3.0 (3.0)

*Among facilities that perform flexible sigmoidoscopies, 52.2% report that they routinely biopsy.

4.0 Unmet Need for Screening and Follow-up Procedures

In this section we describe the forecasting model that was used to estimate the unmet need for colorectal cancer screening and follow-up examinations. The model (1) estimates the number of average-risk people 50 years of age and older who have not been screened for colorectal cancer according to current guidelines; (2) describes the socio-demographic characteristics of the unscreened population; and (3) estimates the annual number of procedures required to satisfy the unmet need for endoscopic colorectal cancer screening and follow-up tests. We begin by describing the methods and data sources used in developing the forecasting model. We conclude with a summary of the number of colorectal cancer screening and follow-up procedures that are required to satisfy the current unmet need.

4.1 Development of the forecasting model

A forecasting model—based on the demographic characteristics of the population of Colorado—was developed and used to estimate the current unmet need for colorectal cancer screening and follow-up procedures (i.e., the number of people who currently have not been screened for colorectal cancer according to current guidelines). An overview of the forecasting model is provided in Figure 4-1.

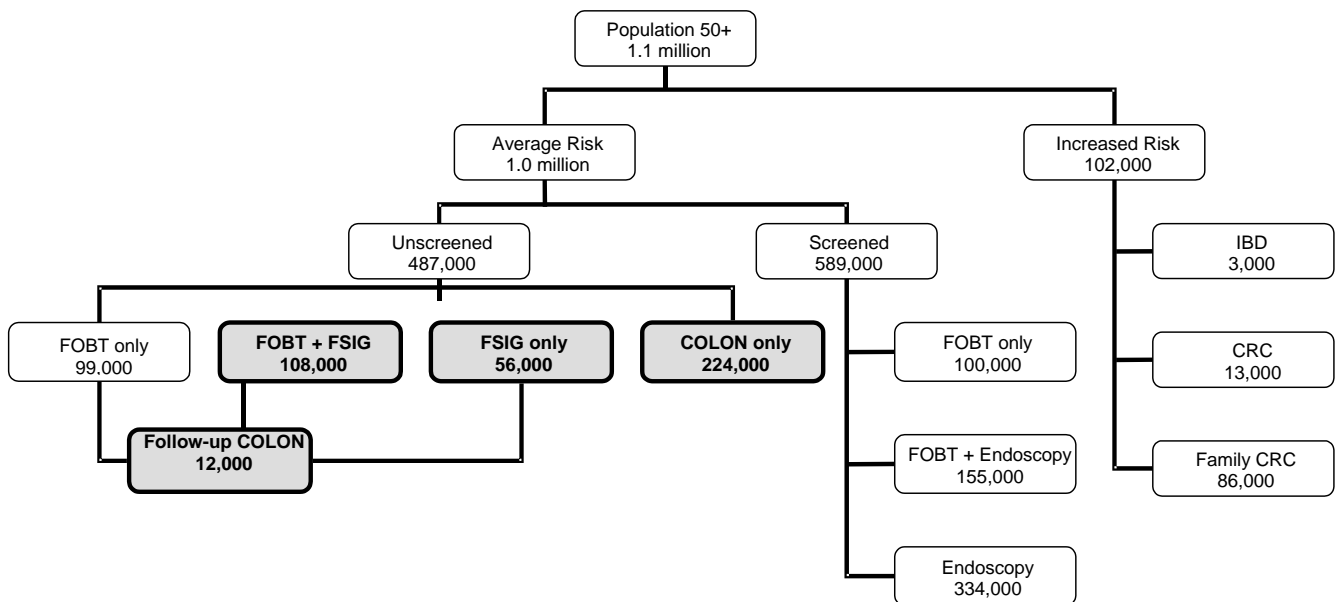


Figure 4-1: Estimated number of people needing CRC screening and follow-up

The model begins with the number of people 50 years of age and older. The population at increased risk—those with inflammatory bowel disease (IBD), a history of colorectal cancer, or a family history of colorectal cancer—was estimated and subtracted from the total number of people 50 years of age and older to determine the size of the average-risk population. Data from the Colorado Behavioral Risk Factor Surveillance Survey (BRFSS) were analyzed to estimate colorectal cancer screening rates among average-risk people 50 years of age and older. These screening rates were then applied to the average-risk population to estimate the number of individuals who have been screened according to current guidelines and the number who have not been screened for colorectal cancer. The data used and the assumptions made in developing the forecasting model are described below.

4.1.1 Population estimates

The total number of people in Colorado 50 years of age and older in 2004—stratified by gender, race, region, and age—was obtained from the National Center for Health Statistics (National Center for Health Statistics, 2005). Insurance status and income level by gender, race, and age were estimated using data from the March Current Population Surveys for 2004 and 2005 (U.S. Department of Commerce, 2004, 2005).

To determine the size of the population at average risk for colorectal cancer, we first estimated the number of individuals at increased risk for colorectal cancer. These include people with inflammatory bowel disease, a history of colorectal cancer, or a family history of colorectal cancer. We did not attempt to measure the size of the population currently receiving post-polypectomy surveillance colonoscopies. Sources of information regarding the numbers of individuals at increased risk for colorectal cancer are described below.

- **Inflammatory bowel disease.** An estimate of the number of individuals with IBD was obtained from the National Institute of Diabetes and Digestive and Kidney Diseases (NIDDK) website.⁶ We assumed that the prevalence of IBD does not vary by state, age (among those 20 years of age and older), race/ethnicity or gender, and that the mortality rate for those with IBD is the same as the general population. We used the national prevalence rate to estimate the number of individuals age 50 and older in Colorado who have IBD. Approximately 3,000 persons 50 years of age and older with IBD were thus estimated to be at increased risk due to IBD.
- **History of colorectal cancer.** The Colorado Department of Public Health and Environment provided prevalence data for colorectal cancer stratified by age, race, gender and region. Based on this, we estimated that approximately 13,000 persons 50 years of age and older have a history of colorectal cancer.
- **Family history of colorectal cancer.** An estimate of the number of individuals with a family history of colorectal cancer stratified by age, race, ethnicity, and gender was obtained by analyzing data from the 2000 National Health Interview Survey (NHIS). Persons with a personal history of colorectal cancer were excluded from analysis. A person was considered to have a family history of colorectal cancer if he or she had a

⁶ NIDDK, <http://digestive.nidk.nih.gov/statistics/statistics.htm>

parent, sibling or child who had been diagnosed with colorectal cancer at any age. These estimates were divided by the national population count to estimate a prevalence rate for family history of colorectal cancer. Applying these national prevalence rates to the Colorado population, we estimated that approximately 86,000 persons 50 years of age and older have a family history of colorectal cancer.

The population at increased risk—those with IBD, a history of colorectal cancer, or a family history of colorectal cancer—was subtracted from the total number of people 50 years of age and older to determine the size of the average-risk population.

4.1.2 Estimating the unmet need for colorectal cancer screening

Information on the characteristics of individuals who have been screened for colorectal cancer based on current screening guidelines, as reported in the Colorado BRFSS for 2002 and 2004, were used to estimate the characteristics of persons who have not been screened. Multivariate, multinomial logistic regression was used to determine the relationship between various socio-demographic characteristics (e.g., age, sex, race, income level, health insurance status, region of the state) and the probability that an individual has been screened with FOBT in the past year, endoscopy (flexible sigmoidoscopy, colonoscopy) in the past ten years, both FOBT in the past year and endoscopy in the past ten years, or none of the above.

Because BRFSS does not distinguish between sigmoidoscopy and colonoscopy use, we included all endoscopies performed within the past 10 years to fully capture colonoscopy use according to recommended guidelines. In order to separate our estimates for endoscopy in general into either sigmoidoscopy or colonoscopy, we assumed that the proportions were the same as the estimates from the 2003 National Health Interview Survey for average risk people.

To account for the sampling weights in our analysis, we used Stata 9.0 (StataCorp, 2005) for the logistic regression. The coefficients and standard errors for the logistic regression analysis are shown in Appendix D.

The logistic regression coefficients were used to estimate the proportion of average-risk individuals who have been screened according to current guidelines:

- FOBT within the past year only,
- endoscopy within the past 10 years only, and
- FOBT within the past year and endoscopy within the past ten years.

These proportions were used to generate population counts of the number of average-risk people in Colorado 50 years of age and older that have been screened according to current colorectal cancer screening guidelines. By subtracting the number of individuals that have been screened from the total number of average-risk individuals, we produced an estimate of the size of the Colorado population currently in need of colorectal cancer screening and follow-up procedures.

4.1.3 Need for screening procedures in various screening scenarios

Next, we estimated the total number and type of procedures required to screen the average-risk population in need of colorectal cancer screening. We estimated the number of procedures required for a base case and for four alternative screening scenarios. These are described below:

- **Base case – current patterns.** In the base case, the use of screening tests is based on the current pattern of screening test use. The coefficients of the logistic regression analysis were applied to the characteristics of the unscreened average-risk population to predict the numbers of various screening tests (e.g., FOBT, endoscopy only, endoscopy plus FOBT) that will be required.
- **Option 1 – 100% FOBT.** Instead of using demographic characteristics to estimate the type of screening, this option assumes that all eligible unscreened individuals are screened with FOBT.
- **Option 2 – FOBT + sigmoidoscopy.** This option assumes that all eligible unscreened individuals are screened with FOBT, and those with a negative FOBT, are further screened with flexible sigmoidoscopy. Those with a positive FOBT would go on to diagnostic colonoscopy. For this option demographic characteristics are not used to estimate the type of screening tests.
- **Option 3 – 100% sigmoidoscopy.** This option assumes that all eligible unscreened individuals are screened with a flexible sigmoidoscopy. This assumption does not use the demographic characteristics to determine the type of screening tests.
- **Option 4 – 100% colonoscopy.** This option assumes that all eligible unscreened individuals are screened with a colonoscopy. This assumption does not use the demographic characteristics to determine the type of screening tests.

In addition, we estimated the number of procedures required for the base case and four options for a hypothetical program that targets low income people (e.g., those less than 250% of the poverty level) between 50 and 65 years of age, with no health insurance. The same method used to determine unmet need for the general population was used for this target population.

Need for follow-up procedures in each screening scenario

In the base case and all options, we assumed that all positive FOBT and flexible sigmoidoscopy screening tests are followed by a diagnostic colonoscopy. To estimate the number of persons who are likely to require diagnostic follow-up from initial screening tests proposed in each of these hypothetical programs, we applied positivity rates obtained in trials published in peer-reviewed literature (Allison, et al., 1996; Palitz, et al., 1997; Mandel et al., 1993; Levin et al., 1999; UK Flexible Sigmoidoscopy Screening Trial Investigators, 2002). The positivity rates in the model for unrehydrated FOBT and sigmoidoscopy are 2.5% and 5%, respectively. For individuals receiving both FOBT and sigmoidoscopy during a year, we assume a 6.25% positivity rate. This estimate assumes that half the positive cases identified through FOBT are not identified by sigmoidoscopy.

4.1.4 Sensitivity analyses

We performed sensitivity analysis on two important parameters that could not be fully evaluated in our forecasting model. These include the use of DCBE to screen for colorectal cancer and the number of follow-up procedures required for post-polypectomy surveillance colonoscopies.

Use of DCBE to screen for colorectal cancer

The 2002 and 2004 BRFSS included questions on the use of FOBT and endoscopy; however, information on the use of double contrast barium enema (DCBE) as a colorectal cancer screening test was not included in the BRFSS. The forecasting model base case and options assume that DCBE is not used for screening. As an alternative assumption, we estimated the number of procedures needed to screen the unscreened population assuming some screening is currently being performed with DCBE. It is estimated that 2.4 million DCBEs are performed nationwide for any indication in one year, a number which is based on a national survey of radiologists (Klabunde et. al., 2002). If we assume that all of the DCBEs are performed for CRC screening and DCBE is considered effective as a screening test for five years, then the number of unscreened people would be reduced by 12 million people nationwide. The proportion of these 12 million people who are average-risk and over age 50 is assumed to be the same as the proportion of average-risk individuals over age 50 that have been screened with either FOBT and/or endoscopy. The national proportion of the average risk population over age 50 who had DCBE was then applied to the number of average risk over age 50 individuals in Colorado to estimate the reduction in the unscreened population for Colorado due to DCBE.

Number of follow-up procedures required for post-polypectomy surveillance

The frequency with which individuals receive follow-up colonoscopies for post-polypectomy surveillance has a tremendous impact on the need for lower GI endoscopic procedures. It is not known the extent to which colonoscopies are currently being utilized for this purpose. The forecasting model base case and options estimates do not include any surveillance colonoscopies. As a sensitivity analysis, we assumed that persons requiring post-polypectomy surveillance colonoscopies following the identification of a polyp on screening colonoscopy would receive a follow-up colonoscopy at various intervals. These include one-year, three-year, and five-year intervals. This analysis allows us to assess the effect that frequency of post-polypectomy surveillance has on the number of follow-up procedures required by the unscreened population.

4.2 Forecasting Model Results

As shown in Figure 4-1, of the 1.0 million average-risk persons in Colorado 50 years of age and older, 589,000 people (55%) have been screened with FOBT and/or endoscopy—approximately 334,000 with endoscopy (flexible sigmoidoscopy or colonoscopy) only, 100,000 with FOBT only, and 155,000 with both FOBT and endoscopy at the intervals specified by current screening guidelines. The remaining 487,000 people represent the size of the average-risk population currently unscreened for colorectal cancer.

4.2.1 Characteristics of the unscreened population

The socio-demographic characteristics of the unscreened and screened average-risk persons are presented in Table 4-1. Approximately half (51%) of the average-risk individuals in need of colorectal cancer screening are women. Of the 487,000 people, approximately 353,000 (72%) are less than 65 years old and 134,000 are 65 years of age and older. With respect to income, 326,000 of the individuals who have not been screened have incomes greater than 250% of the poverty level, while 161,000 (33%) have incomes less than 250% of the poverty level. In terms of health insurance status, 410,000 of the 487,000 unscreened people have health insurance, whereas approximately 77,000 (16%) people do not have health insurance coverage. Of the 487,000 people, approximately 41,000 (8%) are aged 50-64, have incomes less than 250% of the poverty level and have no health insurance.

Table 4-1

Socio-demographic characteristics of the average risk population for Colorado*			
	Unscreened Population	Screened Population	Total
Total	486,756	588,592	1,075,349
Gender			
Male	237,627	273,981	511,608
Female	249,129	314,611	563,741
Race/Ethnicity			
White NH	391,515	514,639	906,154
Hispanic	68,452	45,687	114,139
Other	26,789	28,266	55,056
Age			
<65 years	352,674	326,981	679,655
≥65 years	134,083	261,611	395,694
Family Income			
>250% of Poverty Level	325,677	411,976	737,652
≤250% of Poverty Level	161,080	176,617	337,696
Health Insurance			
Yes	409,729	561,599	971,329
No	77,027	26,993	104,020
Region			
Denver Metro	254,461	324,396	578,857
Southwest	33,982	30,719	64,701
Eastern Plains	22,975	20,562	43,537
South Central Mountain	22,082	22,688	44,771
Northwest	35,831	41,479	77,310
El Paso/Pueblo	71,597	88,395	159,992
Larimer/Weld	45,828	60,353	106,181
Age 50-64, <250% of Federal Poverty Level, No Health Insurance			
	40,652	12,443	53,095

* People ages 50 or older excluding those with family history of CRC, personal history of CRC or inflammatory bowel disease.

4.2.2 Total number of screening and follow-up procedures required

The total numbers of colorectal cancer screening and follow-up procedures required to satisfy the unmet need—for the base case and the four screening options—are shown in Table 4-2. The shaded boxes of Figure 4-1 also show the total number of procedures for the base case. Based on current screening patterns (the base case), approximately 207,000 FOBTs, 164,000 flexible sigmoidoscopies, and 224,000 screening colonoscopies are required. In addition, based on reported positivity rates for the various screening tests, approximately 12,000 diagnostic colonoscopies are required for the base case estimate.

Table 4-2

Number of screening and follow-up tests to Immediately satisfy unmet need for Colorado						
	FOBT	Flexible Sigmoid- oscopy	Screening Colonoscopy	Follow-up Colonoscopy Newly Screened	Total Colonoscopy	Total Endoscopy
Colorado average-risk population, 50 years or older						
Base Case						
Current patterns	206,883	164,379	223,898	11,934	235,833	400,212
Option 1						
100% FOBT	486,756	--	--	12,169	12,169	12,169
Option 2						
FOBT + sigmoidoscopy	486,756	474,587	--	29,966	29,966	504,553
Option 3						
100% sigmoidoscopy	--	486,756	--	24,338	24,338	511,094
Option 4						
100% colonoscopy	--	--	486,756	--	486,756	486,756
Colorado, 50-64 years old, <250% of poverty level, no insurance						
Base Case						
Current patterns	18,889	8,941	17,410	858	18,268	27,209
Option 1						
100% FOBT	40,652	--	--	1,016	1,016	1,016
Option 2						
FOBT + sigmoidoscopy	40,652	39,635	--	2,503	2,503	42,138
Option 3						
100% sigmoidoscopy	--	40,652	--	2,033	2,033	42,684
Option 4						
100% colonoscopy	--	--	40,652	--	40,652	40,652

FOBT = Fecal Occult Blood Test

Option 2 = FOBT performed first; sigmoidoscopy performed only if FOBT negative

Estimates of the number of screening and follow-up procedures that are required to satisfy the unmet need varies depending upon the screening tests used. If the unscreened population is screened with FOBT only (Option 1), a total of 12,000 colonoscopies are required to follow-up positive FOBTs. Option 2—in which people are screened with FOBT first, then if the test is negative, screened with flexible sigmoidoscopy—will require approximately 475,000 flexible sigmoidoscopies and 30,000 colonoscopies. Option 3, in which all average-risk people are screened with flexible sigmoidoscopy, will require that approximately 487,000 flexible sigmoidoscopies and 24,000 follow-up colonoscopies be performed. If everyone is screened with colonoscopy, approximately 487,000 colonoscopies would be needed.

The lower half of Table 4-2 focuses on the unscreened population less than 65 years of age, with no health insurance and with an annual income less than 250% of the poverty level. There are 53,000 low income people ages 50-64 with no health insurance; 41,000 of these people have not been screened. For all options, the total number of endoscopic procedures needed to screen low income people without health insurance coverage is approximately 8% of the number of procedures needed to screen the eligible population at large.

Estimated annual need for screening and follow-up procedures

It is unlikely that a screening program will be able to satisfy the unmet need for colorectal cancer screening and follow-up procedures in a single year. Therefore, we estimated the annual need for screening and follow-up procedures based on spreading the procedures over two years, three years, and four years. Estimates of the annual number of screening and follow-up tests required to satisfy the unmet need within these different timeframes are shown in Table 4-3 for the base case, as well as for each of the four screening options.

Based on current screening patterns (the base case), approximately 82,000 flexible sigmoidoscopies and 118,000 colonoscopies would be necessary each year to satisfy the unmet need within two years. If these procedures were spread out over four years instead of just two years, about half as many endoscopies would be necessary each year. The annual number of screening tests varies by option, with Option 4, all screening done by colonoscopy, requiring between 122,000 and 243,000 colonoscopies per year, depending upon which timeframe is chosen.

Table 4-3

Annual number of screening and follow-up endoscopies required to satisfy unmet need over multiple years						
	2 years		3 years		4 years	
	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy
Colorado average-risk population, 50 years or older						
Base Case						
Current patterns	82,189	117,916	54,793	78,611	41,095	58,958
Option 1						
100% FOBT	--	6,084	--	4,056	--	3,042
Option 2						
FOBT + sigmoidoscopy	237,294	14,983	158,196	9,989	118,647	7,491
Option 3						
100% sigmoidoscopy	243,378	12,169	162,252	8,113	121,689	6,084
Option 4						
100% colonoscopy	--	243,378	--	162,252	--	121,689

FOBT = Fecal Occult Blood Test

Option 2 = FOBT performed first; sigmoidoscopy performed only if FOBT negative

4.2.3 Sensitivity Analyses

Sensitivity analysis was used to evaluate the effect of two important model parameters on our estimates of the unmet need for colorectal cancer screening and follow-up procedures for the base case. These include the use of DCBE to screen for colorectal cancer, and the number of follow-up procedures required for post-polypectomy surveillance colonoscopies. Results of the sensitivity analyses are summarized in Table 4-4.

Table 4-4

Sensitivity analyses for Colorado – base case		
Model Parameters	Flexible Sigmoidoscopy	Colonoscopy
DCBEs		
Assume the 24,000 DCBEs estimated for average risk people are for screening, thereby reducing the unscreened average risk population over age 50 by 121,000 in Colorado	41,000 fewer	58,000 fewer
Post-polypectomy surveillance *		
Assume different intervals for surveillance		
Once a year	NA	43,000
Every 3 years	NA	14,000
Every 5 years	NA	9,000

* Annual number of colonoscopy procedures needed by people with clinically significant polyps identified by screening colonoscopies. Estimates are derived from the base case unscreened population utilizing colonoscopies.

Use of DCBE to screen for colorectal cancer

Because the BRFSS data did not obtain information on the use of DCBE as a screening test for colorectal cancer, we were unable to include estimates of the number of people who have been screened with DCBE in our forecasting model. To examine the potential impact that screening DCBE has on our estimates of unmet need, we used our national SECAP study estimate of the number of average-risk people 50 years of age or older who had a DCBE within the past five years.⁷ We assumed that these individuals screened with DCBE did not have another screening test, and that the estimated number for Colorado is proportionate to the population. There are approximately 1.0 million people in Colorado 50 years or older, about 1.3% of the 82.8 million people 50 years or older nationwide. Assuming this rate in Colorado, there would be a reduction of 121,000 unscreened average-risk people in Colorado, thereby reducing the number of screening flexible sigmoidoscopies required by 41,000 and the number of total colonoscopies required by 58,000.

Post-polypectomy surveillance

Finally, the number of colonoscopies that are currently being performed to follow-up polyps detected on colonoscopy is unknown and not counted in the estimates. As a sensitivity analysis, we assumed that persons requiring post-polypectomy surveillance colonoscopies following the identification of a polyp on screening colonoscopy receive a follow-up colonoscopy at intervals ranging from 1 to 5 years. As shown in Table 4-4, the frequency with which individuals receive

⁷ The national SECAP estimate is based on an estimate of 2.4 million DCBEs performed annually (Klabunde, et. al., 2002). After adjusting for the number of DCBEs done for individuals at high-risk or under age 50, we estimated 8.6 million average-risk people were screened with DCBE over the past five years.

follow-up colonoscopies for post-polypectomy surveillance has a tremendous impact on the need for lower GI endoscopic procedures. Post-polypectomy surveillance every year results in an additional need for 43,000 follow-up colonoscopies among the currently unscreened population. Extending the interval for post-polypectomy surveillance dramatically reduces the necessary number of colonoscopies required each year.

5.0 Comparison of Current Capacity and Unmet Need

In section 3 we presented data from the Colorado Survey of Endoscopic Capacity regarding the current capacity of the health care facilities to provide colorectal cancer screening and follow-up procedures. This included the average number of screening and follow-up procedures that are currently being performed per week, as well as the maximum number of procedures that could be performed per week with no other investment of resources. In Section 4 we estimated the need for colorectal cancer screening and follow-up examinations among average-risk individuals in Colorado 50 years of age and older who have not been screened for colorectal cancer based upon current guidelines. In this section we compare the capacity of the Colorado health care system to perform screening and follow-up endoscopic procedures with the estimate of unmet need to determine whether or not the current capacity is adequate to meet an increased need for colorectal cancer screening and follow-up tests.

5.1 Capacity for screening and follow-up procedures

The survey collected information regarding whether or not a facility performs flexible sigmoidoscopy and colonoscopy. Responses to these questions were used to estimate the total number of practices that currently perform endoscopies in Colorado. Table 5-1 shows the total number of practices that perform any endoscopy—as well as the number of practices that perform flexible sigmoidoscopy and colonoscopy—by region. Of the 116 facilities that perform endoscopy, 98 facilities (84%) perform flexible sigmoidoscopy and 90 (77%) perform colonoscopy.

Table 5-1

Estimated number of practices that provide endoscopies statewide, by region			
	Flexible sigmoidoscopy	Colonoscopy	Any endoscopy
Region			
Denver Metro	50	35	51
Southwest	6	8	9
Eastern Plains	9	10	11
South Central Mountain	5	6	6
Northwest	6	10	12
El Paso/Pueblo	11	14	14
Larimer/Weld	12	7	13
Total*	98	90	116

* Numbers may not sum to total due to weighting for nonresponse

For those facilities that perform flexible sigmoidoscopy and/or colonoscopy, the survey obtained information regarding the number of procedures performed per week and the maximum number of procedures that could be performed per week with no other investment of resources. The responses to these questions were used to estimate the current volume of flexible sigmoidoscopy and colonoscopy procedures performed in Colorado each year, as well as the potential number of procedures that could be performed each year. The annual current and potential volumes were calculated by multiplying the total number of facilities in each region sub-state area in Colorado that perform the procedure by the weekly mean procedural number per facility by the number of work weeks per year. We assumed a 46-week working year across all practice specialties and facility types to account for vacations, professional travel and non-procedural time. The results of this analysis, by region, are summarized in Table 5-2.

Table 5-2

Potential volume, current volume, and unused capacity for flexible sigmoidoscopy and colonoscopy, by region – annual number of procedures* (standard errors in parentheses)						
Region	Flexible Sigmoidoscopy			Colonoscopy		
	Potential Volume	Current Volume	Unused Capacity	Potential Volume	Current Volume	Unused Capacity
Denver Metro	106,911 (13,034)	21,927 (4,693)	84,984 (10,622)	173,610 (12,818)	96,354 (7,465)	77,256 (6,829)
Southwest**	6,963 NA	368 NA	6,595 NA	18,676 NA	7,958 NA	10,718 NA
Eastern Plains	6,972 (1,096)	1,103 (250)	5,869 (867)	9,108 (1,194)	2,614 (281)	6,494 (1,054)
South Central Mountain	1,932 (412)	178 (43)	1,754 (386)	14,628 (4,198)	3,422 (609)	11,206 (3,930)
Northwest	3,168 (532)	353 (89)	2,815 (477)	12,365 (1,361)	6,017 (798)	6,348 (741)
El Paso/Pueblo	37,740 (5,169)	2,626 (285)	35,115 (5,007)	66,464 (2,545)	35,370 (1,486)	31,094 (2,033)
Larimer/Weld	7,076 (661)	1,156 (74)	5,920 (660)	21,179 (2,717)	10,864 (1,263)	10,316 (1,493)
Total	170,762 (14,096)	27,710 (4,710)	143,051 (11,810)	316,030 (14,109)	162,599 (7,786)	153,430 (8,373)

*Assuming 46 work weeks per year

**100% response rate in this region

Approximately 28,000 flexible sigmoidoscopies and 163,000 colonoscopies are currently being performed in Colorado each year. With respect to the maximum number of procedures that could be performed, facilities indicated that approximately 171,000 flexible sigmoidoscopies and 316,000 colonoscopies could be performed each year. The unused capacity is the number of procedures available to screen the currently unscreened population. There is capacity to perform approximately 143,000 more flexible sigmoidoscopies and 153,000 more colonoscopies.

5.2 Comparison of capacity and unmet need

As was described in Section 4, we developed a forecasting model—based on the demographic characteristics of the population in Colorado—and used the model to estimate the current unmet need for colorectal cancer screening and follow-up procedures. In this section we compare the current capacity of the Colorado health care system to perform screening and follow-up endoscopic procedures with the estimate of unmet need to determine whether or not the current capacity is adequate to meet an increased need for colorectal cancer screening and follow-up tests.

Estimates of the number of screening and follow-up procedures that are required to satisfy the unmet need varies depending upon the screening tests used. Therefore, we estimated the number of procedures required for a base case and for the following four alternative screening scenarios:

- **Base case**—the use of screening tests is based on the current pattern of screening test use.
- **Option 1**—all unscreened individuals are screened with an FOBT.
- **Option 2**—all eligible unscreened individuals are first screened with an FOBT, and if the results are negative, then screened with a sigmoidoscopy.
- **Option 3**—all eligible unscreened individuals are screened with a sigmoidoscopy.
- **Option 4**—all eligible unscreened individuals are screened with a colonoscopy.

The upper section of Table 5-3 compares the unused capacity of endoscopic procedures with the number of colorectal cancer screening and follow-up procedures required by the currently unscreened population should they opt to be screened within a year. The lower section of Table 5-3 presents the same comparisons for individuals 50-64 years old, without health insurance and with income less than 250% of the poverty level. Comparisons are made for the base case, as well as for the four different screening options. The results vary considerably depending upon the screening options used.

Table 5-3

Comparison of unmet need and unused capacity - base case and options*				
	Flexible Sigmoidoscopy		Colonoscopy**	
	Unmet Need	Difference Between Unmet Need and Unused Capacity*	Unmet Need	Difference Between Unmet Need and Unused Capacity*
Colorado average-risk population, 50 years or older				
Base Case				
Current patterns	164,379	-21,328	235,833	-82,402
Option 1				
100% FOBT	--	143,051	12,169	141,261
Option 2				
FOBT + sigmoidoscopy	474,587	-331,536	29,966	123,464
Option 3				
100% sigmoidoscopy	486,756	-343,705	24,338	129,093
Option 4				
100% colonoscopy	--	143,051	486,756	-333,326
Colorado population, 50-64 years old, <250% of poverty level, no insurance				
Base Case				
Current patterns	8,941	134,110	18,268	135,163
Option 1				
100% FOBT	--	143,051	1,016	152,414
Option 2				
FOBT + sigmoidoscopy	39,635	103,416	2,503	150,928
Option 3				
100% sigmoidoscopy	40,652	102,400	2,033	151,398
Option 4				
100% colonoscopy	--	143,051	40,652	112,779

FOBT = Fecal Occult Blood Test

Option 2 = FOBT performed first; sigmoidoscopy performed only if FOBT negative

* Positive values imply excess capacity and negative values imply shortage

**Includes all necessary screening and diagnostic follow-up to positive FOBT and flexible sigmoidoscopy screening procedures, but does not include surveillance colonoscopies.

- The base case, reflecting current patterns of screening, results in a shortfall of 21,300 flexible sigmoidoscopies and 82,400 colonoscopies, if all necessary screening procedures are performed within one year.
- Current capacity is adequate to meet increased need for Option 1, in which everyone is screened with FOBT only, and colonoscopies are performed as follow-up to positive FOBT.

- Option 2, in which screening consists of an annual FOBT followed by a sigmoidoscopy if the FOBT results are negative, shows a shortfall of 332,000 flexible sigmoidoscopies but not a shortfall of colonoscopies.
- Option 3, in which everyone receives a screening sigmoidoscopy, results in the greatest deficit with 344,000 more sigmoidoscopies needed than could be performed in a year.
- Option 4, in which everyone receives a screening colonoscopy, would require 333,000 more colonoscopies than could be done within a year.
- The Base Case and all four options are achievable within one year for the special population of low income individuals without health insurance.

Similar comparisons by region are shown in Table 5-4 for the base case only. If necessary screening were attempted within a year, shortfalls of flexible sigmoidoscopies would occur in all regions except the El Paso/Pueblo region. Shortfalls of colonoscopies would occur in all regions except the South Central Mountain region.

Table 5-4

Comparison of unmet need and unused capacity for flexible sigmoidoscopy and colonoscopy, by region – base case*				
	Flexible Sigmoidoscopy		Colonoscopy	
	Unmet Need	Difference Between Unused Capacity and Unmet Need	Unmet Need	Difference Between Unused Capacity and Unmet Need
Regions				
Denver Metro	94,210	-9,226	113,488	-36,232
Southwest	9,041	-2,447	18,453	-7,735
Eastern Plains	6,881	-1,012	10,157	-3,664
South Central Mountain	4,373	-2,619	11,206	-1
Northwest	11,110	-8,295	19,489	-13,141
El Paso/Pueblo	23,636	11,478	38,602	-7,508
Larimer/Weld	15,127	-9,207	24,437	-14,121
Total	164,379	-21,328	235,833	-82,402

* Positive values imply excess capacity and negative values imply shortage

It is unlikely that all unscreened average-risk persons over age 50 would actually seek screening within one year, even if the unused capacity were adequate. Table 5-5 shows the difference between the unmet need and unused capacity for flexible sigmoidoscopy and colonoscopy if the currently unscreened individuals receive screening and follow-up over two-, three- or four-years, rather than in a single year. For the base case necessary screening could be achieved within two years. As shown in Table 5-3, necessary screening could be achieved in one year for Option 1

(100% FOBT). In the case of Options 2 and 3, the capacity for colonoscopy is sufficient within one year, but it would require four years to satisfy unmet need for flexible sigmoidoscopy. Option 4 (100% colonoscopy) would also require four years to satisfy unmet need.

Table 5-5

Difference between unused capacity and unmet need over multiple years – base case and options*						
	2 years		3 years		4 years	
	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy
Colorado average-risk population, 50 years or older						
Base Case						
Current patterns	60,862	35,514	88,258	74,819	101,956	94,472
Option 1						
100% FOBT	143,051	147,346	143,051	149,374	143,051	150,388
Option 2						
FOBT + sigmoidoscopy	-94,242	138,447	-15,145	143,442	24,404	145,939
Option 3						
100% sigmoidoscopy	-100,327	141,261	-19,201	145,318	21,362	147,346
Option 4						
100% colonoscopy	143,051	-89,948	143,051	-8,822	143,051	31,741

FOBT = Fecal Occult Blood Test

Option 2 = FOBT performed first; sigmoidoscopy performed only if FOBT negative

* Positive values imply excess capacity and negative values imply shortage

Similar comparisons for the base case are shown by region in Table 5-6. In the two-year time frame, there is adequate capacity for flexible sigmoidoscopy and colonoscopy in the Denver Metro, Southwest, Eastern Plains, and El Paso/Pueblo regions. For the three-year time frame, there is adequate capacity in all regions, except the Northwest, where there is a shortage of flexible sigmoidoscopies and colonoscopies. This shortage disappears in the four-year time frame.

5.3 Study Limitations

Approximately 28,000 flexible sigmoidoscopies and 163,000 colonoscopies are estimated to have been performed in Colorado in 2005. Based on the responses to the survey, 171,000 flexible sigmoidoscopies, or six times more than the current flexible sigmoidoscopy volume, and 316,000 colonoscopies, or almost twice the current colonoscopy volume, could be performed each year.

However, it is important to recognize there are a few limitations to these estimates. First, although the survey questions on potential volume asked about capacity “with no other investment of resources”, we can not be certain that respondents answered accordingly. Second,

the questions about the maximum number of flexible sigmoidoscopies and colonoscopies possible were asked independently. Unfortunately, we do not know whether the reported potential volumes for each procedure are both possible at the same time, or whether an increase in one procedure would preclude an increase in the other procedure. Given that some of the same resources – procedure rooms and personnel, for example – are sometimes used for both procedures, it is unlikely that 171,000 flexible sigmoidoscopies and 316,000 colonoscopies could be performed in a year.

The forecasting model also has some limitations. The model was designed to estimate the unmet need of the average risk population, since this represents the largest proportion of the population in need of colorectal cancer screening and the one we can most clearly define. However, our estimate of unmet need among the average risk population was based on a static, rather than a dynamic forecasting model. As a result, the model does not account for the aging of the population, the number of people moving in and out of the state over time or crossing state boundaries to be screened, and repeat procedures or post-polypectomy surveillance.

Lastly, because this model is based on current census, cancer prevalence and screening test prevalence data, results will quickly become outdated, and these estimates will need to be re-calculated periodically to maintain an accurate assessment of the size of the unscreened population.

Table 5-6

Difference between unused capacity and unmet need over multiple years, by region – base case*						
	2 years		3 years		4 years	
	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy	Flexible Sigmoidoscopy	Colonoscopy
Regions						
Denver Metro	37,879	20,512	53,581	39,427	61,431	48,884
Southwest	2,074	1,491	3,581	4,567	4,334	6,105
Eastern Plains	2,429	1,415	3,575	3,108	4,149	3,954
South Central						
Mountain	-433	5,602	296	7,470	660	8,404
Northwest	-2,740	-3,397	-888	-148	38	1,476
El Paso/Pueblo	23,296	11,793	27,236	18,226	29,205	21,443
Larimer/Weld	-1,643	-1,903	878	2,170	2,138	4,206
Total	60,862	35,514	88,258	74,819	101,956	94,472

* Positive values imply excess capacity and negative values imply shortage

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APPENDIX A
SCREENING TELEPHONE CALL SCRIPT

**Screening Telephone Call to Identify the Appropriate
Survey Respondent**

For each facility to be surveyed, a screening telephone call will be made to (1) confirm that the facility is eligible for inclusion in the study and (2) obtain the name and address of the individual who is most knowledgeable about the use of the endoscopic equipment. The questions to be asked during the screening call will vary by practice setting. The screening survey will be administered as a computer-assisted telephone interview. As a result, data entry will be performed as part of the interview process and the skip-logic will be electronic.

The following burden statement will be available to be read to the person responding to the call if they ask for this information.

Public reporting burden of this collection of information is estimated to average 20-30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Project Clearance Officer, 1600 Clifton Road, MS-24, Atlanta, GA 30333, ATTN: PRA (0920-0539). Do not send the completed form to this address.

Questions 1-4 will be asked of the individual who answers the phone at the practice site.

1. Hello, my name is (INTERVIEWER NAME). I am calling from the Battelle Centers for Public Health Research and Evaluation in Seattle, Washington. I am calling on behalf of the Centers for Disease Control and Prevention and the (Insert state name) Department of Public Health. They are conducting a statewide survey of facilities that perform endoscopy for the detection of colorectal cancer. Am I calling (CONFIRM NAME AND ADDRESS)?

IF YES, CONTINUE WITH QUESTION 2

**IF NO, RECORD NAME AND ADDRESS BELOW BEFORE
CONTINUING WITH QUESTION 2**

2. Does this practice perform flexible sigmoidoscopy or colonoscopy to detect colorectal cancer in adults?

- yes
- no
- don't know

If NO to question 2, conclude the interview by saying: “I’m sorry, but our study is focusing on practice sites that perform colorectal cancer screening in adults. Thank you very much for your time.”

If DON'T KNOW, ask to speak to someone who might know: “Is there someone else there who might know? May I speak with him/her?”

3. Are the flexible sigmoidoscopies or colonoscopies performed at this site or somewhere else?

- yes, performed at this site
- no, performed elsewhere
- don't know

If NO to question 3, conclude the interview by saying: “I’m sorry, but our study is focusing on practice sites that perform colorectal cancer screening in adults. Thank you very much for your time.”

If DON'T KNOW, ask to speak to someone who might know: “Is there someone else there who might know? May I speak with him/her?”

4. Can you please tell me which of the following best describes this practice site?

- Private Practice
- Ambulatory endoscopy or surgery center
- Hospital

IF THE PRACTICE SITE IS A HOSPITAL, THE INTERVIEWER WILL CONTINUE WITH PART A

IF THE PRACTICE SITE IS AN ANBULATORY ENDOSCOPY/SURGERY CENTER OR A PRIVATE PRACTICE, THE INTERVIEWER WILL CONTINUE WITH PART B

PART A—TO BE ASKED IF THE PRACTICE SITE IS A HOSPITAL

Please connect me with the Gastroenterology Department. *If the respondent indicates that the hospital does not have a Gastroenterology Department, ask to be connected to the department where sigmoidoscopy and/or colonoscopy are performed.*

QUESTIONS FOR THE HOSPITAL GASTROENTEROLOGY DEPARTMENT

When the interviewer reaches the Hospital Gastroenterology Department, read the following:

Hello, my name is (INTERVIEWER NAME) and I am calling from the Battelle Centers for Public Health Research and Evaluation in Seattle, Washington. I am calling on behalf of the Centers for Disease Control and Prevention and the (Insert state name) Department of Public Health. They are conducting a statewide survey of facilities that perform endoscopy for the detection of colorectal cancer. May I please speak with the charge nurse in the endoscopy suite? *If the charge nurse is not available, obtain a name and telephone number of the charge nurse to call at a later time.*

When the interviewer reaches the charge nurse, read the following:

5. Hello, my name is (INTERVIEWER NAME) and I am calling from the Battelle Centers for Public Health Research and Evaluation in Seattle, Washington. I am calling on behalf of the Centers for Disease Control and Prevention and the (Insert state name) Department of Public Health. They are conducting a statewide survey of facilities that perform endoscopy for the detection of colorectal cancer. Does this hospital perform flexible sigmoidoscopy or colonoscopy to detect colorectal cancer in adults?

- yes
- no

If NO to question 5, conclude the interview by saying: "I'm sorry, but our study is focusing on hospitals that perform colorectal cancer screening in adults. Thank you very much for your time."

6. I am trying to identify all the sites within this hospital where sigmoidoscopy and/or colonoscopy are performed to detect colorectal cancer in adults. As the charge nurse in the endoscopy suite, I thought you might best be able to help us identify these sites. Can you please tell me whether or not flexible sigmoidoscopy or colonoscopy are performed in the following divisions or departments in your hospital? I am only interested in departments that perform these procedures in adults. *(Read and record all that apply)*

- Gastroenterology department
- General surgery department
- Colorectal surgery department
- Family practice department
- General internal medicine department
- Operating room
- Satellite clinics (list all satellite clinics)

Other (specify) _____

7. We would like to send a survey to the person who knows the most about the numbers of flexible sigmoidoscopies and colonoscopies that are being performed in this department and who is performing these procedures. Most likely this is the physician who is in charge of endoscopy at this facility. Can you please tell me the name of that person? *If there is no physician in charge of endoscopy at the facility, ask if there is a nurse or an administrator who could provide this information. Confirm the spelling of the name, title, and specialty of the person (to determine if the cover letter and envelope should be addressed to Dr., Mr. or Ms.).*

Name: _____

Title: _____

Specialty: _____

8. What is the Federal Express address and telephone number for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 7)? *Be sure that the address includes the name of the practice site (e.g., name of the physician practice, hospital department, clinic, surgical center).*

Practice Site: _____

Address: _____

City, State, Zip Code: _____

Telephone Number: _____

9. Is the mailing address for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 7) the same as his/her Federal Express address? If not, what is his/her mailing address?

Address: _____

City, State, Zip Code: _____

Conclude the interview with the Gastroenterology Department charge nurse by saying: "That is all the information I need at the moment. Thank you very much for your time and assistance. You have been very helpful. Good-bye."

QUESTIONS FOR OTHER HOSPITAL SITES THAT PERFORM ENDOSCOPY

When the interviewer reaches a hospital department other than the Gastroenterology Department, read the following:

Hello, my name is (INTERVIEWER NAME) and I am calling from the Battelle Centers for Public Health Research and Evaluation in Seattle, Washington. I am calling on behalf of the Centers for Disease Control and Prevention and the (Insert state name) Department of Public Health. They are conducting a statewide survey of facilities that perform endoscopy for the detection of colorectal cancer. May I please speak with the charge nurse in the department/division/clinic? *If the charge nurse is not available, obtain a name and telephone number of the charge nurse to call at a later time.*

When the interviewer reaches the charge nurse, read the following:

10. Hello, my name is (INTERVIEWER NAME) and I am calling from the Battelle Centers for Public Health Research and Evaluation in Seattle, Washington. I am calling on behalf of the Centers for Disease Control and Prevention and the (Insert state name) Department of Public Health. They are conducting a statewide survey of facilities that perform endoscopy for the detection of colorectal cancer. Does [NAME OF THE HOSPITAL DEPARTMENT/DIVISION/ CLINIC] perform flexible sigmoidoscopy or colonoscopy to detect colorectal cancer in adults?

- yes
 no

If NO to question 10, conclude the interview by saying: "I'm sorry, but our study is focusing on hospital departments that perform colorectal cancer screening in adults. Thank you very much for your time."

11. We would like to send a survey to the person who knows the most about the numbers of flexible sigmoidoscopies and colonoscopies that are being performed and who are performing these procedures. Most likely this is the physician who is in charge of endoscopy at this facility. Can you please tell me the name of that person? *If there is no physician in charge of endoscopy at the facility, ask if there is a nurse or an administrator who could provide this information. Confirm the spelling of the name, title, and specialty of the person (to determine if the cover letter and envelope should be addressed to Dr., Mr. or Ms.).*

Name: _____

Title: _____

Specialty: _____

12. What is the Federal Express address and telephone number for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 11)? *Be sure that the address includes the name of the practice site (e.g., name of the hospital department, outpatient clinic, surgical center).*

Practice Site: _____

Address: _____

City, State, Zip Code: _____

Telephone Number: _____

13. Is the mailing address for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 11) the same as his/her Federal Express address? If not, what is his/her mailing address?

Address: _____

City, State, Zip Code: _____

Conclude the interview with the charge nurse by saying: "That is all the information I need at the moment. Thank you very much for your time and assistance. You have been very helpful. Good-bye."

**PART B—TO BE ASKED IF THE PRACTICE SITE IS AN AMBULATORY
ENDOSCOPY/SURGERY CENTER OR A PRIVATE PRACTICE**

14. We would like to send a survey to the person who knows the most about the numbers of flexible sigmoidoscopies and colonoscopies that are being performed and who is performing these procedures. Most likely this is the physician who is in charge of endoscopy at this facility. Can you please tell me the name of that person? *If there is no physician in charge of endoscopy at the facility, ask if there is a nurse or an administrator who could provide this information. Confirm the spelling of the name, title, and specialty of the person (to determine if the cover letter and envelope should be addressed to Dr., Mr. or Ms.).*

Name: _____

Title: _____

Specialty: _____

15. What is the Federal Express address and telephone number for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 14)? *Be sure that the address includes the name of the practice site (e.g., name of the physician practice, clinic, surgical center).*

Practice Site: _____

Address: _____

City, State, Zip Code: _____

Telephone Number: _____

16. Is the mailing address for Dr./Mr./Ms. (PERSON IDENTIFIED IN QUESTION 14) the same as his/her Federal Express address? If not, what is his/her mailing address?

Address: _____

City, State, Zip Code: _____

Conclude the interview by saying: “That is all the information I need at the moment. Thank you very much for your time and assistance. You have been very helpful. Good-bye.”

APPENDIX B

COLORADO SURVEY OF ENDOSCOPIC CAPACITY

COVER LETTER AND MAIL QUESTIONNAIRE

Dear :

We are requesting your participation in the Survey of Colorado Endoscopic Capacity (SECAP), a survey that is being conducted for the Centers for Disease Control and Prevention and the Colorado Department of Public Health and Environment. The purpose of this research study is to estimate the numbers of endoscopic procedures currently being performed to detect colorectal cancer and to describe the medical facilities in which these procedures are being performed. Data will be obtained by surveying medical practices that own flexible endoscopic equipment. Study results will be used to identify deficits in the current medical infrastructure for colorectal cancer screening and will provide critical baseline information for use in planning statewide initiatives to increase screening for colorectal cancer.

Colorectal cancer is the second leading cause of cancer-related deaths in the U.S. Although major professional organizations now recommend regular screening for colorectal cancer for average risk persons aged 50 and older, screening rates are unacceptably low. Little information is available regarding the capacity of the health care system to provide widespread screening and follow-up examinations.

All facilities in the state of Colorado that are known to own flexible sigmoidoscopes and colonoscopes, based upon lists provided by major endoscopic equipment manufacturers, are being asked to complete the survey. You were identified by your practice as the person most knowledgeable about the use of the endoscopic equipment at your facility. We are asking you to complete the enclosed questionnaire, requiring approximately 25 minutes of your time. If flexible sigmoidoscopy or colonoscopy is not done by any physician or non-physician endoscopist at the practice site identified above, or if the procedures are not done for the purposes of screening for colorectal cancer, please indicate this on the survey cover and return it in the postage paid envelope.

Please note that since we are surveying all facilities in the state, in completing the survey it is important that you report only those procedures that are performed at the location identified above. You can return the survey in the enclosed postage-paid return envelope. The CDC realizes that your time is extremely

valuable and we have enclosed a \$40 reimbursement in appreciation of your time and effort given to the study.

Your participation in the study is completely voluntary. Data collection will be managed by Battelle, Center for Public Health Research, a national survey and research organization with extensive experience in collection of health data. Data will be aggregated; no individual facility information will be presented in any report. Your responses will be kept private to the extent allowed by law. To protect your privacy, we will keep the records under a code number rather than by name. Records will be stored in locked files to which only study staff will have access.

Information linking you to the data you supply will be destroyed after data collection has been completed. Your name or any other personal identifiers will not appear when we present in oral or written presentation of study results.

If you have any questions regarding the study, please call Diane Manninen, Ph.D., Task Leader, Battelle, at 1-800-426-6762. If you have any questions regarding your rights as a study subject, please contact Margaret Pennybacker, Chairperson of the Battelle Institutional Review Board, at 1-877-810-9530, ext. 500.

Thank you in advance for your time and participation in this important research endeavor.

Sincerely,

Kevin Brady, M.P.H.
Acting Director
Division of Cancer Prevention and Control
National Center for Chronic Disease
Prevention and Health Promotion

CDC Survey of Colorado Endoscopic Capacity (SECAP)

Conducted for

Centers for Disease Control and Prevention
National Center for Chronic Disease Prevention and Health Promotion
Division of Cancer Prevention and Control
Atlanta, GA

and

Colorado Department of Public Health and Environment
Denver, CO

Public reporting burden of this collection of information is estimated to average 20-30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Project Clearance Officer, 1600 Clifton Road, MS-24, Atlanta, GA 30333, ATTN: PRA (0920-0590). Do not send the completed form to this address.

CDC Survey of Colorado Endoscopic Capacity (SECAP)

The Centers for Disease Control and Prevention (CDC) and the Colorado Department of Public Health and Environment are conducting a research study involving a statewide survey to determine the current capacity of the Colorado health care system to provide endoscopic colorectal cancer screening and follow-up examinations to all appropriate persons. The results of the survey will be used to identify deficits in the current medical infrastructure, as well as to provide critical baseline information for use in planning state initiatives aimed at increasing colorectal cancer screening.

All information that you provide will be kept private to the extent allowed by law, and CDC does not plan to disclose identifiable data to anyone but the researchers conducting the study. Responses will be reported only in summary form along with information from the other facilities that participate in the survey. No personal identifiers will be included in either oral or written presentation of the study results.

Participation in the study is voluntary. You are subject to no penalty if you choose not to provide all or any part of the requested information.

If you have any questions regarding the study, please call Diane Manninen, Ph.D., Task Leader, Battelle at 1-800-426-6762. If you have any questions regarding your rights as a study subject, please contact Margaret Pennybacker, Chairperson of the Battelle Institutional Review Board, at 1-877-810-9530, ext. 500.

When you have completed the survey, please return it in the enclosed postage-paid envelope to: CDC SECAP Study Office, Battelle Seattle Research Center, 1100 Dexter Avenue North, Suite 400, Seattle, WA 98109-3598.

Thank you for your participation in this important study.

Public reporting burden of this collection of information is estimated to average 20-30 minutes per response, including the time for reviewing instructions, searching existing data sources, gathering and maintaining the data needed, and completing and reviewing the collection of information. An agency may not conduct or sponsor, and a person is not required to respond to a collection of information unless it displays a currently valid OMB control number. Send comments regarding this burden estimate or any other aspect of this collection of information, including suggestions for reducing this burden to CDC, Project Clearance Officer, 1600 Clifton Road, MS-24, Atlanta, GA 30333, ATTN: PRA (0920-0590). Do not send the completed form to this address.

Section 1. Practice Site Characteristics

This section addresses practice site characteristics. In this survey, the term “practice site” is used to refer to the specific site identified in the cover letter. In a hospital setting, practice site refers to a specific department, division, clinic or endoscopy suite. In a non-hospital setting, practice site refers to a physician practice or ambulatory center. Responses should reflect only the procedures performed at the practice site, as identified in the cover letter.

If you are unable to respond to a specific question, please feel free to consult with others in your practice who may be more familiar with certain types of information.

1. Which of the following categories best describes the practice site identified in the cover letter? **(Circle one response)**

- Private practice.....1
- Ambulatory endoscopy/surgery center2
- Hospital3

If you answered ‘private practice’ or ‘ambulatory endoscopy/surgery center’ to Question 1, please skip to Question 5.
If you answered ‘hospital’ to Question 1, please continue with Question 2.

2. Please indicate whether or not flexible sigmoidoscopy and/or colonoscopy are performed at any of the following sites in this hospital? **(Circle 1 for yes or 2 for no)**

	YES ↓	NO ↓
a. Gastroenterology department	1	2
b. General surgery department	1	2
c. Colorectal surgery department	1	2
d. Family practice department	1	2
e. General internal medicine department	1	2
f. Operating room	1	2
g. Satellite clinic	1	2
h. Other (specify _____)	1	2

3. How many patient beds does your hospital contain?

--	--	--

Number of beds

4. Which of the following describes this location? **(Circle one response)**

- Gastroenterology department1
- General surgery department2
- Colorectal surgery department3
- Family practice department4
- General internal medicine department5
- Operating room6
- Satellite clinic7
- Other (specify)_____8

5. How many physicians (e.g., surgeons, medical doctors, and doctors of osteopathy) are in this practice site?

--	--	--

Number of physicians

6. What is the medical specialty of the physicians in this practice site? **(Please provide the total NUMBER for each medical specialty. Include doctors who have privileges as well as doctors employed by the practice site)**

- a. Family Practice

--	--	--
- b. General Practice

--	--	--
- c. Internal Medicine

--	--	--
- d. Gastroenterology

--	--	--
- e. General Surgery

--	--	--
- f. Colorectal Surgery

--	--	--
- g. Other Physicians

--	--	--

7. How many of the following physicians in this practice site perform flexible sigmoidoscopy and/or colonoscopy? **(Please provide a NUMBER, not a percentage)**

- a. Family Practice

--	--	--
- b. General Practice

--	--	--
- c. Internal Medicine

--	--	--
- d. Gastroenterology

--	--	--
- e. General Surgery

--	--	--
- f. Colorectal Surgery

--	--	--
- g. Other Physicians

--	--	--

8. Do interns, residents or fellows receive sigmoidoscopy or colonoscopy training in this practice site?

- yes1
- no2

9. How many of the following types of flexible sigmoidoscopes and colonoscopes does this practice site own?

- a. Colonoscopes, fiberoptic

--	--	--
- b. Colonoscopes, with video

--	--	--
- c. Flexible sigmoidoscopes, 70 cm, fiberoptic

--	--	--
- d. Flexible sigmoidoscopes, 70 cm, with video

--	--	--
- e. Flexible sigmoidoscopes, 60 cm, fiberoptic

--	--	--
- f. Flexible sigmoidoscopes, 60 cm, with video

--	--	--
- g. Flexible sigmoidoscopes, 30 cm, fiberoptic

--	--	--
- h. Flexible sigmoidoscopes, 30 cm, with video

--	--	--
- i. Other lower endoscopes (**specify type**_____)

--	--	--

10. During a typical week, approximately how many patients are seen at this practice site for any reason, including for procedures? **(Circle one response)**

- 75 or fewer1
- 76-1502
- 151-3003
- 301-5004
- 501 or more5

Section 2. Flexible Sigmoidoscopy

In this section we ask about flexible sigmoidoscopies performed at this practice site for colorectal cancer screening or follow-up. We use the term screening to refer to the routine, periodic use of a testing procedure intended to detect cancer or pre-cancerous lesions at an earlier stage than is possible through clinical detection or incidental discovery. Colorectal cancer screening is used in individuals who have no signs or symptoms of possible cancer (i.e., abdominal pain or tenderness, change in bowel habits, bleeding, anemia, an abdominal or rectal mass, evidence of bowel obstruction, or weight loss) and have not had a neoplastic lesion previously diagnosed.

If you are unable to provide exact responses, please provide your best estimate. If you are unable to answer certain questions (e.g., questions regarding appointment availability or reimbursement rate), please feel free to consult with others in your practice who may be more familiar with this type of information.

11. Are any flexible sigmoidoscopies performed at this site?

- yes1
- no.....2 ➔ **SKIP TO QUESTION 24**

12. During a typical week, how many flexible sigmoidoscopies are performed at this practice site? **(Please provide your best estimate, including both screening and diagnostic examinations)**

Total number of sigmoidoscopies per week

13. Approximately what **percentage** of all flexible sigmoidoscopies are performed for colorectal cancer screening? **(Please provide your best estimate)**

Percent performed for colorectal cancer screening %

14. Of the total number of flexible sigmoidoscopies performed during a typical week in this practice, what **percentage** is performed by the following types of practitioners? (**Please provide your best estimate**)

- a. General practitioner %
- b. Internist %
- c. Family practitioner %
- d. Gastroenterologist %
- e. General surgeon %
- f. Colorectal surgeon %
- g. Resident with supervising physician in attendance %
- h. Fellow with supervising physician in attendance %
- i. Non-physician endoscopist %
- j. Other (Specify): _____ %

15. How much room-time is scheduled for a flexible sigmoidoscopy? (**Circle one response**)

- 15-30 minutes.....1
- 30 minutes-45 minutes.....2
- More than 45 minutes3

16. In this practice site, approximately what **percentage** of flexible sigmoidoscopies performed in a week are incomplete?

%

17. What is the most common reason for an incomplete flexible sigmoidoscopy? (**Circle one response**)

- Poor bowel preparation.....1
- Patient discomfort or pain.....2
- Patient anatomy.....3
- Other (Specify _____)....4

18. If a flexible sigmoidoscopy is incomplete because of poor bowel preparation, patient discomfort or pain, or patient anatomy, what would be your next step?
(Circle one number for each column)

	Reason for Incomplete Procedure		
	a. Poor bowel preparation	b. Patient discomfort or pain	c. Patient anatomy
Repeat the flexible sigmoidoscopy at a later date.....	1	1	1
Refer the patient to another practice for sigmoidoscopy	2	2	2
Perform a colonoscopy	3	3	3
Refer the patient to another practice for colonoscopy	4	4	4
Order a double contrast barium enema	5	5	5
Other (Specify _____)	6	6	6

19. Does this practice site routinely perform biopsies during a screening flexible sigmoidoscopy?

- yes1
- no.....2 ➔ **SKIP TO QUESTION 21**

20. What action do you typically take if a lesion of the characteristics described below is identified during a screening flexible sigmoidoscopy in a healthy, average-risk patient? **(Circle one number for each column)**

	Lesion			
	a. Polyp <5mm	b. Polyp 0.5-1cm	c. Polyp >1cm	d. Multiple polyps
Perform the biopsy during the sigmoidoscopy	1	1	1	1
Conclude the sigmoidoscopy and schedule a colonoscopy with biopsy.....	2	2	2	2
Conclude the sigmoidoscopy with no further follow-up and resume a routine colorectal cancer screening schedule	3	3	3	3
Other (Specify _____)	4	4	4	4

21. If the demand for colorectal cancer screening were to increase substantially, what is the maximum number of flexible sigmoidoscopies that could be provided at this practice site per week with **no other investment of resources?** **(Please provide your best estimate)**

--	--	--

Maximum number per week

22. If the demand for screening flexible sigmoidoscopy were to exceed your current capacity to perform screening flexible sigmoidoscopy, what steps would your practice take to meet the increased demand? **(Circle 1 for yes or 2 for no for a-h)**

	YES	NO
	↓	↓
a. Increase proportion of the work day allocated to procedures	1	2
b. Increase physician staff.....	1	2
c. Increase nursing staff to assist with procedures.....	1	2
d. Increase/hire non-physician endoscopists to perform procedures	1	2
e. Establish a larger screening unit/more procedure rooms	1	2
f. Purchase more equipment	1	2
g. Refer patients to other practices.....	1	2

h. Other (Specify _____).....1 2

23. What is the typical waiting time for an appointment for a screening flexible sigmoidoscopy in your practice? **(Circle one response)**

- Within one month1
- 1-3 months2
- 4-6 months3
- More than six months.....4

Section 3. Colonoscopy

In this section we ask about colonoscopies performed at this practice site. We are inquiring about colonoscopies pertaining to colorectal cancer screening, including those performed for primary screening, those performed for the diagnosis of an abnormality identified through another screening procedure, and those performed for surveillance in a patient with a previously identified colorectal polyp or cancer.

If you are unable to provide exact responses, please provide your best estimate. If you are unable to answer certain questions (e.g., questions regarding appointment availability or reimbursement rate), please feel free to consult with others in your practice who may be more familiar with this type of information.

24. Are any colonoscopies performed at this site?

- yes1
- no.....2 ➡ **SKIP TO QUESTION 36**

25. During a typical week, how many colonoscopies are performed at this practice site? **(Please provide your best estimate, including both screening and diagnostic examinations)**

--	--	--

Total number of
colonoscopies per
 week

26. Approximately what **percentage** of all colonoscopies are performed for colorectal cancer screening? **(Please provide your best estimate)**

Percent performed for colorectal cancer screening

--	--	--

 %

27. Of the total number of colonoscopies performed during a typical week, what percentage is performed by the following types of practitioners? **(Please provide your best estimate)**

- a. General practitioner %
- b. Internist %
- c. Family practitioner %
- d. Gastroenterologist %
- e. General surgeon %
- f. Colorectal surgeon %
- g. Resident with supervising physician in attendance %
- h. Fellow with supervising physician in attendance %
- i. Non-physician endoscopist %
- j. Other (Specify): _____ %

28. How much room-time is scheduled for a colonoscopy? **(Circle one response)**

- Less than 30 minutes.....1
- 30 minutes-45 minutes.....2
- More than 45 minutes3

29. In this practice site, approximately what **percentage** of colonoscopies performed in a week are incomplete?

%

30. What is the most common reason for an incomplete colonoscopy? **(Circle one response)**

- Poor bowel preparation1
- Patient discomfort or pain.....2
- Patient anatomy.....3
- Other (Specify_____)....4

31. If a colonoscopy is incomplete because of poor bowel preparation, patient discomfort or pain, or patient anatomy, what would be your next step?

(Circle one number for each column)

	Reason for Incomplete Procedure		
	a. Poor bowel preparation	b. Patient discomfort or pain	c. Patient anatomy
Repeat the colonoscopy at a later date	1	1	1
Refer the patient to another practice for colonoscopy	2	2	2
Order a double contrast barium enema	3	3	3
Other (Specify_____)	4	4	4

32. If the demand for colorectal cancer screening and follow-up were to increase substantially, what is the maximum number of colonoscopies that could be provided at this practice site per week with **no other investment of resources?** **(Please provide your best estimate)**

--	--	--

Maximum number per week

33. If the demand for colonoscopies were to exceed your current capacity to perform colonoscopies, what steps would your practice take to meet that increased demand? **(Circle 1 for yes or 2 for no for a-h)**

YES	NO
↓	↓

- a. Increase proportion of the work day allocated to procedures1 2
- b. Increase physician staff.....1 2
- c. Increase nursing staff to assist with procedures.....1 2
- d. Increase/hire non-physician endoscopists to perform procedures1 2
- e. Establish a larger screening unit/more procedure rooms1 2
- f. Purchase more equipment1 2
- g. Refer patients to other practices.....1 2
- h. Other (Specify_____.).....1 2

34. What is the typical waiting time for an appointment for a screening colonoscopy at your practice site? **(Circle one response)**

- Within one month1
- 1-3 months2
- 4-6 months3
- More than six months.....4

35. What is the typical waiting time to have a colonoscopy performed at your practice site to follow-up on a problem identified in a screening procedure? **(Circle one response)**

- Within one month1
- 1-3 months2
- 4-6 months3
- More than six months.....4

36. What is the typical waiting time for a referral to another clinic for a colonoscopy to follow-up on a problem identified in a screening procedure? **(Circle one response)**

- Within one month1
- 1-3 months2
- 4-6 months3
- More than six months.....4
- Do not refer to another facility.....5

Section 4. Non-physician Endoscopists

This section focuses on the use of non-physician endoscopists to perform sigmoidoscopy or colonoscopy in this practice site. Non-physician endoscopists include nurse practitioners, physician assistants, registered nurses, and licensed practical nurses.

37. Does this practice site employ non-physician endoscopists (e.g., nurse practitioners, physician assistants, registered nurses, and licensed practical nurses) to perform sigmoidoscopy or colonoscopy?

- yes1
- no.....2 ➔ **SKIP TO QUESTION 42**

38. How many of the following non-physician endoscopists perform sigmoidoscopy or colonoscopy in this practice site?

- a. Licensed Practical Nurse

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- b. Registered Nurse

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- c. Nurse Practitioner

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- d. Physician Assistant

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39. When a non-physician endoscopist performs a flexible sigmoidoscopy, what level of supervision is provided? **(Circle one response)**

- A physician is present in the procedure room for the entire exam 1
- A physician is present in the procedure room when the flexible sigmoidoscopy is withdrawn only.....2
- The non-physician endoscopist is authorized to perform the exam in entirety, unsupervised by a physician, but . . .
 - A physician is “immediately available” in clinic.....3
 - A physician is “immediately available” in hospital.....4
 - A physician is “immediately available” by beeper/phone5
- The non-physician endoscopist is authorized to perform the exam in entirety, unsupervised by a physician6
- Non-physician endoscopists do not perform flexible sigmoidoscopy7
- Other (Specify): _____8

40. When a non-physician endoscopist performs a colonoscopy, what level of supervision is provided? **(Circle one response)**

- A physician is present in the procedure room for the entire exam1
- A physician is present in the procedure room when the colonoscope is withdrawn only2
- The non-physician endoscopist is authorized to perform the exam in entirety, unsupervised by a physician, but . . .
 - A physician is “immediately available” in clinic.....3
 - A physician is “immediately available” in hospital.....4
 - A physician is “immediately available” by beeper/phone5
- The non-physician endoscopist is authorized to perform the exam in entirety, unsupervised by a physician6
- Non-physician endoscopists do not perform colonoscopy7
- Other (Specify): _____8

41. When a non-physician endoscopist performs a flexible sigmoidoscopy or colonoscopy, to whom is the reimbursement assigned? **(Circle one response)**

- The non-physician endoscopist1
- The practice.....2
- A staff physician3
- The hospital.....4
- The practice does not receive reimbursement.....5
- Other (Specify _____).....6

Section 5. Patient, Practice and Respondent Characteristics

42. Approximately what percentage of patients seen at this practice site are female? **(Circle one response)**

- Less than 25%1
- 25-49%2
- 50-74%3
- 75-100%4

43. Approximately what percentage of patients seen at this practice site are 50 years of age or older? **(Circle one response)**

- Less than 25%1
- 25-49%2
- 50-74%3
- 75-100%4

44. Approximately what percentage of the patients seen at this practice site are:
(Circle one response for each row)

	None	<25%	25-49%	50-74%	75-100%
a. American Indian or Alaska Native	0	1	2	3	4
b. Asian	0	1	2	3	4
c. Black or African-American.....	0	1	2	3	4
d. Native Hawaiian or other Pacific Islander ...	0	1	2	3	4
e. Hispanic or Latino.....	0	1	2	3	4
f. White	0	1	2	3	4

45. Approximately what percentage of your patients are covered by:

- a. Medicare? %
- b. Medicaid? %
- c. Private fee-for-service? %
- d. Managed Care (including HMO, PPO, IPA and POS) Plans? %
- e. Medicare/ Medicaid/ Managed Care? %
- f. No insurance coverage? %

46. Please indicate whether or not your facility is one of the following types of medical facilities. **(Circle 1 for yes or 2 for no for a-d)**

YES	NO
↓	↓

- a. Staff model health maintenance organization.....1 2
- b. Group model health maintenance organization1 2
- c. Military hospital.....1 2
- d. Veterans Administration Medical Center1 2

47. What percentage of your patients travel from more than 50 miles away to have a sigmoidoscopy or colonoscopy at your facility?

%

Percentage of patients

48. What is your professional training? **(Circle one response)**

- MD1
- DO2
- Nurse endoscopist3 ➤ **SKIP TO QUESTION 51**
- Nurse4 ➤ **SKIP TO QUESTION 51**
- Other (Specify): _____5 ➤ **SKIP TO QUESTION 51**

49. What is your medical specialty? **(Circle all that apply)**

- Family Practice1
- General Practice2
- Internal Medicine3
- Gastroenterology4
- General Surgery5
- Colorectal Surgery6
- Other (Specify): _____7

50. In which specialty/sub-specialty have you completed residency or fellowship training?
(Circle all that apply)

- Family Practice1
- Internal Medicine2
- Gastroenterology3
- General Surgery4
- Colon Rectal Surgery5
- Other(Specify): _____6

51. Approximately what percentage of the physicians in this practice site are:
(Circle one response for each row)

	None	<25%	25-49%	50-74%	75-100%
a. American Indian or Alaska Native	0	1	2	3	4
b. Asian	0	1	2	3	4
c. Black or African-American.....	0	1	2	3	4
d. Native Hawaiian or other Pacific Islander ...	0	1	2	3	4
e. Hispanic or Latino.....	0	1	2	3	4
f. White.....	0	1	2	3	4

APPENDIX C

COUNTIES BY COLORADO REGIONS

1=Denver Metro	3=Eastern Plains	5=Northwest
Adams	Baca	Eagle
Arapahoe	Bent	Garfield
Boulder	Cheyenne	Grand
Denver	Crowley	Jackson
Douglas	Elbert	Mesa
Jefferson	Kiowa	Moffat
2=Southwest	Kit Carson	Pitkin
Alamosa	Lincoln	Rio Blanco
Archuleta	Logan	Routt
Conejos	Morgan	Summit
Costilla	Otero	6=El Paso/Pueblo
Delta	Phillips	El Paso
Dolores	Prowers	Pueblo
Gunnison	Sedgwick	7=Larimer/Weld
Hinsdale	Washington	Larimer
La Plata	Yuma	Weld
Mineral	4=South Central Mountain	
Montezuma	Chaffee	
Montrose	Clear Creek	
Ouray	Custer	
Rio Grande	Fremont	
Saguache	Gilpin	
San Juan	Huerfano	
San Miguel	Lake	
	Las Animas	
	Park	
	Teller	

APPENDIX D

Multinomial Logistic Regression Results for Colorado

	FOBT		Endoscopy		FOBT and Endoscopy	
	Coefficient	Standard Error	Coefficient	Standard Error	Coefficient	Standard Error
Male	-0.318	0.137	-0.030	0.097	-0.022	0.120
Hispanic	-0.491	0.254	-0.449	0.177	-0.942	0.265
Other Non-Hispanic	0.196	0.277	-0.048	0.186	-0.315	0.270
Ages 50 to 59	-0.427	0.196	-0.619	0.142	-0.884	0.183
Age 65 and older	0.107	0.201	0.124	0.139	0.356	0.180
<250% of Poverty Level	-0.438	0.192	-0.216	0.162	-0.225	0.161
Health Insurance	0.250	0.283	1.186	0.230	1.692	0.438
Region 2	-0.320	0.264	-0.191	0.170	-1.167	0.258
Region 3	-0.047	0.292	-0.462	0.238	-0.877	0.358
Region 4	0.245	0.268	-0.109	0.197	-1.614	0.377
Region 5	-0.332	0.230	0.069	0.158	-0.614	0.225
Region 6	-0.361	0.209	0.150	0.146	-0.359	0.173
Region 7	-0.254	0.250	0.199	0.159	-0.334	0.213
2002 BRFSS	0.194	0.132	-0.039	0.099	0.091	0.119
Income Missing	-0.251	0.200	-0.044	0.142	-0.480	0.194
Intercept	-1.193	0.326	-1.071	0.275	-2.034	0.443