Published in final edited form as:

Cancer. 2013 February 1; 119(3): 612–620. doi:10.1002/cncr.27759.

Cost analysis of a patient navigation system to increase screening colonoscopy adherence among urban minorities

Lina Jandorf, MA^{a,*}, Lauren M. Stossel, BA^a, Julia L. Cooperman, MEd^a, Joshua Graff Zivin, PhD^b, Uri Ladabaum, MD, MS^c, Diana Hall, MPH^a, Linda D. Thélémaque, MPH^a, William Redd, PhD^a, and Steven H. Itzkowitz, MD^a

^aMount Sinai School of Medicine, One Gustave L. Levy Place, New York, NY 10029-6574

^bUniversity of California, San Diego, 9500 Gilman Dr. 0519 La Jolla, CA 92093

^cStanford University, Palo Alto, CA 94143-0358

Abstract

Background—Patient navigation (PN) is being increasingly used to help patients complete screening colonoscopy (SC) to prevent colorectal cancer. At our large urban academic medical center with an open access endoscopy system, we previously demonstrated that PN programs produced a colonoscopy completion rate of 78.5% in a cohort of 503 patients (predominantly African Americans and Latinos with public health insurance). Very little is known about the direct costs of implementing PN programs. The aim of this study was to perform a detailed cost analysis of our PN programs from an institutional perspective.

Methods—In two randomized controlled trials, average-risk patients referred for SC by primary care providers were recruited for PN between May 2008 and May 2010. Patients were randomized to one of four PN groups. The cost of PN and net income to the institution were determined in a cost analysis.

Results—Among 395 colonoscopy completers, 53.4% underwent SC alone, 30.1% underwent colonoscopy with biopsy, and 16.5% underwent snare polypectomy. Accounting for the average contribution margins of each procedure type, the total revenue was \$95,266.00. The total cost of PN was \$14,027.30. Net income was \$81,238.70. In a model sample of 1000 patients, we compared net incomes for our completion rate ($\approx 80\%$), our historical PN program ($\approx 65\%$), and the national average ($\approx 50\%$). Our current PN program generated additional net incomes of \$35,035.50 and \$44,956.00, respectively.

Conclusion—PN among minority patients with mostly public health insurance generated additional income to the institution, due mainly to increased colonoscopy completion rates.

Keywords

cost analysis; patient navigation; screening colonoscopy; racial disparities; colorectal cancer screening

*Corresponding Author: Lina Jandorf, lina.jandorf@mssm.edu, Icahn Medical Institute, 1425 Madison Avenue, Box 1130, New York, NY 10029, Tel: 212-659-5506, Fax: 212-849-2566.

Authors have no financial disclosures to report.

Background

Colorectal cancer (CRC) is one of the most prevalent, yet preventable, cancers in the United States (U.S.),¹ as screening effectively reduces its incidence and mortality.^{2–4} Colonoscopy is increasingly used as the primary screening modality in the U.S.; it has been recommended by the American Cancer Society (ACS),¹ other national authorities in cancer prevention,^{5,6} and the New York City Department of Health and Mental Hygiene.⁷ It is publicized in the media and utilized annually by 10 to 12 million people.^{5,8,9}

CRC screening rates among minorities are lower than those of non-Hispanic whites.^{10–13} Disparities in screening contribute to disparities in CRC incidence and mortality.^{14–18} Interventions to increase screening colonoscopy (SC) rates among minority populations have become an important aspect of cancer prevention efforts from systems-based and psychological perspectives. In Open Access Endoscopy (OAE),¹⁹ primary care physicians (PCPs) refer average-risk patients directly for SC, avoiding the inconvenience, delay, and cost of an interim office consult with a gastroenterologist prior to the procedure, thereby eliminating logistical barriers to SC.⁷ Patient Navigation (PN)²⁰ interventions target logistical, personal and sociocultural barriers to SC such as lack of education or low health-literacy, language barriers, medical mistrust, fatalism, and fear of the procedure.^{10;21–24} A patient navigator (PN) is a specially trained person within the health-care setting who helps a patient move through the system to obtain medical care.²⁵

Originally used to increase poor diagnostic follow-up rates among minorities,^{26–29} PN has expanded to preventive screening,^{30–33} our group being among the first in this trend. The structure of navigation programs depends on the needs of the target individuals and populations and the resources of the providers.³⁴ For example, PN can include cultural targeting, which incorporates a discussion of barriers specific to a particular population subgroup.³⁵ Culturally Targeted Patient Navigation (CTPN) interventions have increased health-promoting behaviors in a variety of settings,^{36–38} have been favored by patients over non-targeted interventions,³⁹ and have resulted in greater retention of knowledge over time than non-targeted interventions.^{40,41} Cultural tailoring, which incorporates individualized intervention messages,^{35,42} has also been effective at increasing health-promoting behaviors.^{43–46} Thus, PN programs can be crafted from elements of standard, targeted, and tailored models.

We previously reported³¹ that implementing PN in the context of OAE at an urban academic hospital serving minority patients increased adherence to SC from 40.0% to 66.4%, with “adherence” defined as a patient completing a colonoscopy. Two other studies^{32,33} within OAE systems targeting comparable populations in NYC reported that PN programs increased SC rates. To date, however, little is known about the costs and benefits associated with such programs, prompting some experts to call for analysis of this issue.^{47,48}

In 2008, we began new PN programs. A cohort of African Americans received CTPN as part of a National Cancer Institute-funded (NCI) randomized controlled trial (RCT) comparing the efficacy of professional navigators (trained health educators) versus community-based peer navigators (lay individuals over age 50 from East Harlem who had undergone colonoscopy and who we trained to conduct PN). Other patients, predominantly of Latino background, received one of two types of non-targeted PN in a separate RCT funded by Mount Sinai School of Medicine comparing the efficacy of two navigation scripts. Overall, there were four types of PN.

While the primary aim of both RCTs was to determine the effect of PN on SC adherence, a secondary aim was to assess the economic impact of PN from an institutional perspective. We hypothesized that PN would increase hospital net income because the higher volume of

SC would increase hospital revenue. We further hypothesized that the cost of PN would be small compared to the increase in income to the institution. We herein report the findings of a cost analysis of our PN programs.

Methods

Study Setting and Recruitment

In two IRB-approved RCTs, primary care patients referred for SC by their PCPs were recruited during a scheduled, non-acute visit at Mount Sinai's primary care clinic between May 2008 and May 2010. To avoid confusion, PCPs were educated about eligibility criteria for one "colonoscopy and patient navigation study" and ordered SC using an electronic medical record in which criteria for OAE were delineated. PCPs explained the study to potentially eligible patients. Research assistants were stationed in the clinic and worked directly with medical assistants. Interested patients were introduced to research assistants in the waiting room immediately following their physician visit to discuss the study further and sign informed consent if they were interested in receiving navigation services.

Patients 50 years and older without active gastrointestinal symptoms, significant comorbidities, or a history of inflammatory bowel disease or CRC were eligible. Patients must not have undergone colonoscopy for at least five years or have been up to date with other forms of CRC screening (e.g., FOBT, flexible sigmoidoscopy). After recruitment, nurses in the Division of Gastroenterology (GI) reviewed referrals via electronic medical record review to confirm medical eligibility and evaluate for contraindications to colonoscopy or sedation.

Subsequently, the Project Coordinator randomized African American participants selected for the NCI study to CTPN by either a professional health educator (Pro-PN) or a community-based peer navigator (Peer-PN). All other participants were assigned to a Pro-PN and randomized in a separate RCT to receive non-targeted PN with or without discussions about personal barriers.

Intervention Protocols

The overall structure of all four interventions was identical. Participants received three scripted phone calls: a scheduling call, a call two weeks before the colonoscopy, and a final call three days before the procedure. Following the first call, written instructions for the bowel preparation and a reminder postcard with the colonoscopy date were mailed. The content of the scripts and the ethnic identity of PNs varied, as follows:

For the two CTPN groups (Peer-PN and Pro-PN), all navigators were African American to maintain ethnic concordance. Each call included information about how CRC impacts African Americans. During the scheduling call, PNs made SC appointments, asked patients about their concerns, and provided information about the preparation and the procedure. PNs subsequently contacted participants two weeks and three days prior to the procedure to remind them of their appointments, confirm receipt of mailed information, review the bowel preparation instructions, assess transportation needs, and provide education and support. Peer-PNs were also able to discuss their own colonoscopy experience.

For non-targeted PN groups, Pro-PNs were randomly assigned (language concordance was maintained). During the scheduling call, the PN made an SC appointment and provided information about the preparation and the procedure. Two weeks and three days before the colonoscopy, PNs called to remind patients of their appointments, confirm receipt of mailed information, review bowel preparation instructions, and assess transportation needs. The only difference between the groups was that one script also included a discussion about the

importance of CRC screening and asked about patients' concerns. The different protocols in navigation, which are not the focus of this paper, were designed to assess the efficacy of different formats for PN. Since all of our PN programs have additional elements beyond basic PN and share the key characteristics described above, it was instructive to analyze all of the data together.

Calculation of Costs

Appointment outcomes were categorized based on whether or not participants eventually completed a colonoscopy. Each completed colonoscopy was categorized as: SC alone, colonoscopy with biopsy, or colonoscopy with snare polypectomy. The average number of colonoscopy appointments per patient and the average number of minutes spent on navigation for each appointment were calculated for completer and non-completer groups. Navigators recorded the number of minutes spent on each call in a call log. Calls that were attempted but not completed were assigned a value of one minute. Instances of inadequate bowel preparation (defined by the endoscopist) were recorded as additional appointment outcomes.

Direct costs of navigation (both personnel and supplies) were calculated for all randomized participants. Personnel costs included the salaries of the Pro-PNs based upon a \$50,000.00/year full time equivalency (FTE) salary with benefits, or the hourly stipend for the Peer-PNs, including time spent in training. These costs amounted to \$26.00/hour for Pro-PNs and \$15.00/hour for Peer-PNs. Because Pro-PNs were full-time employees with other responsibilities (e.g., research assistants in the primary care clinics), only the time spent performing navigation activities was included. Supply costs included printed materials mailed to participants, paper, and postage costs. Other costs funded by the study during the course of the navigation process were categorized as "add-on" costs. For instance, in some cases the bowel preparation was paid for by the study, some participants required car service to and/or from their colonoscopy appointments, some participants required a Pro-PN escort, and some mailings were sent by express courier. These costs were calculated based on average dollar amounts spent by the study for each add-on cost.

Using data from Mount Sinai's business office, we obtained the contribution margin from each colonoscopy procedure completed by our study participants in 2010. The contribution margin was determined by subtracting the direct cost of each colonoscopy procedure from the revenue generated by that procedure. These included direct patient costs (e.g., allocations for nurse and endoscopy assistant staffing, supplies, room time), program costs (e.g., funds to support faculty teaching and administrative efforts), and support services (e.g., housekeeping, laundry, medical records). All colonoscopies were performed by full-time attending gastroenterologists (without GI fellow involvement). Professional fees for these procedures were not included in the present cost analysis as they were collected independently from the institution and thus did not affect institutional revenue. The revenue generated from each procedure was obtained according to each participant's insurance carrier at the time of the procedure. The contribution margins for each SC completed in 2010 were organized by procedure type and averaged to obtain Average Contribution Margins (ACM) for SC, colonoscopy with biopsy, and colonoscopy with snare polypectomy.

The net income generated was calculated using an algorithm accounting for the cost of navigation, the cost of "add-ons", and the average procedure net income for each type of colonoscopy procedure. This analysis was performed using SPSS 19.0 software. To place our results into perspective, we modeled costs and revenues based on incremental colonoscopy completion rates of 80%, 65%, and 50% in three samples of 1000 patients that closely approximate: our current PN program completion rate, our historical non-targeted

PN program completion rate,³¹ and the national screening colonoscopy adherence rate, respectively. Since we have conducted PN routinely at Mount Sinai since 2003, we are unable to compare our findings to an internal non-navigated control group. Instead, we used data from the 2008 National Health Interview Survey (NHIS) as reported by Klabunde et al.¹³ Finally, we calculated the percent effort required for a dedicated patient navigator based on institutional data.

Results

Participant Characteristics

Over a 24-month period, 749 patients were referred to the study by their PCPs (Figure 1). We successfully enrolled 700 participants (93.5% acceptance rate). Ultimately, 96 (13.7%) participants were not randomized due to various reasons; most were deemed medically ineligible for OAE and were referred for further medical evaluation. The remaining 604 (86.3%) participants were randomized to receive PN. Among the randomized participants, 101 (16.7%) were not included in final navigation groups. Of these participants, 85 (14.1%) received some navigation services but did not schedule a colonoscopy because they refused colonoscopy (6.3%), were unreachable (4.0%), were reached once but were subsequently unreachable after multiple attempts (“passive refusers,” 3.6%), or were ineligible due to lack of insurance coverage (0.2%). An additional 15 (2.5%) were deemed ineligible due to medical illness. One participant (0.2%) passed away. The remaining 503 (83.3%) participants received all navigation services and were scheduled for SC. Of these, 342 (68.0%) were female, 233 (46.3%) were African American, 230 (45.7%) were Latino, 380 (75.5%) were age 50–64, and 219 (43.5%) had an annual household income of \$10,000.00 or less (Table 1). The majority of participants was insured by Medicaid (52.7%) or Medicare (26.8%), while the remaining 20.5% were covered by private insurance or self-pay. Of the 503 patients in the navigation groups, 395 (78.5%) participants completed colonoscopy whereas 108 (21.5%) did not (non-completers).

Navigation Costs

The cost of navigation services for all four randomization groups was based on supply costs, training costs, and navigator salaries. The number of minutes spent with each participant was totaled. Among the 503 participants receiving PN, 765 colonoscopy appointments were made. Of all appointments scheduled, completers accounted for 559 (73.1%) and non-completers for 206 (26.9%). The average navigation time was 38 minutes per appointment for completers versus 29 minutes for non-completers ($p<0.001$). On average, non-completers missed four times more reminder phone calls than completers ($p<0.001$), therefore reducing the overall navigation time spent. As shown in Table 2, the average cost of PN for a patient who completed colonoscopy was \$23.90 and was \$20.26 for a patient who did not. Add-on costs were incurred relatively infrequently: \$4.93 per completer and \$1.14 per non-completer. The total cost of navigation for a completer was \$28.83 and was \$21.40 for a non-completer. The 395 completers incurred a total of \$11,387.85 in navigation and add-on costs, while the 108 non-completers incurred a total of \$2,311.20. The resulting weighted average cost of navigation per participant in the program (regardless of completion status) was \$27.23. The 101 participants who were randomized but did not complete navigation due to the reasons listed above were each assigned an average cost associated with 5 minutes of navigation (\$3.25), resulting in a total cost of \$328.25. The total cost of navigation for all randomized participants was \$14,027.30.

Average Contribution Margins from Colonoscopy

All completers underwent colonoscopy. Some also required biopsies or snare polypectomies. As shown in Table 3, 211 (53.4%) completers received an SC without

biopsy. The ACM for an SC is \$335.00, resulting in a total contribution margin of \$70,685.00. One or more biopsies were taken from 119 (30.1%) completers. At an ACM of \$194.00, this resulted in a total contribution margin of \$23,086.00. The remaining 65 (16.5%) underwent snare polypectomy. The ACM for a colonoscopy with snare polypectomy is \$23.00, for a total contribution margin of \$1,495.00. Equipment costs result in a relatively low ACM for snare procedures. The 395 completers accounted for an overall total contribution margin of \$95,266.00. After deducting the cost of navigation (\$14,027.30 for all randomized participants), the total net income generated by the entire PN program was \$81,238.70 for this two-year period.

Net Income in Perspective

Because PN has become standard practice in Mount Sinai's primary care clinic, we can no longer compare our findings to an internal control group. Therefore, to put the net income received from PN in context, we compared our findings to a similar patient population at our own institution who received PN³¹ ("Historical PN") but without additional elements (such as cultural targeting). We also compared our findings to the screening rate of the general population, presuming that the vast majority of this group has never received patient navigation.¹³ Table 4 represents our model of the net costs and income received from three samples of 1000 patients receiving navigation services with completion rates at 80%, 65%, and 50% (representing the current study, historical PN, and the national average, respectively). We used a weighted ACM of \$241.00 per colonoscopy based on the number of participants in the current study who completed each type of colonoscopy procedure. Navigation cost values for the historical PN group were assumed to be the same as for the current PN groups. The net incomes were: \$165,456.00 at the 80% completion level, \$130,420.50 at the 65% completion level, and \$120,500.00 at the 50% completion level. Thus, our current PN model was \$35,035.50 more profitable than our historical PN model and \$44,956.00 more profitable than the national average.

To determine how realistic hiring a dedicated navigator might be, we found that it would be feasible to hire a dedicated navigator on a part-time basis. Using our institution's data of a 37.5 hour work-week, a \$50,000/year FTE salary with benefits, an average 51.5 minutes spent per patient (equivalent to .858 hours/patient, from an unpublished manuscript), and a hypothetical volume of 1000 patients per year, we found that a navigator would only need to be hired at 44% effort (.44 FTE) (858 navigation hours / 1950 full-time hours/year) to complete the navigation volume at a cost of \$21,999.12/year (equivalent to \$25.64/hour). With a few thousand dollars of add-ins, the hypothetical cost for the institution could increase to approximately \$25,000.00 total. The PN position, at \$25,000.00/year, if implemented in an environment with a 50% screening adherence rate and using the ACM of \$241.00 for a colonoscopy (as modeled in Table 4), would still generate a profit of \$95,500.00. At an 80% adherence rate, the profit would increase to \$167,800.00. The cost of employing a part-time navigator would be more than covered by the increased profit to the institution.

Discussion

Unlike other cancer screening tests such as Pap smears, mammograms and Prostate-Specific Antigen (PSA) tests, colonoscopy is a complex, invasive test, associated with a variety of administrative and personal barriers. PN is an increasingly popular strategy to enhance colonoscopy completion rates. We³¹ and others^{32,33} have demonstrated that colonoscopy rates can increase considerably when a programmatic effort is implemented to make scheduling of procedures (e.g., OAE) and patient understanding and adherence to the procedures (e.g., PN) available.

Building upon our previous work with a single patient navigator, we have been studying whether utilizing peers as navigators and creating a more focused, culturally targeted approach would further enhance SC rates among our predominantly minority patient population. The expansion of our program raised the question: is PN a sound financial investment?

We herein report that implementing PN programs at our institution led to an SC adherence rate of 78.5%. The 395 completed colonoscopies brought in a total contribution margin of \$95,266.00 over a two-year period. The resulting net income after deducting \$14,027.30 (the cost of PN) was \$81,238.70. We conclude, therefore, that among a predominantly minority population of low socioeconomic status, most of whom were covered by public health insurance, PN programs still generate a profit for the institution. Through use of models, we also found a favorable comparison of our current PN program to our institution's first PN program and to the general population. Finally, we demonstrated that the cost of hiring a part-time dedicated navigator would likely be covered by the increase in profit to the institution.

Our study has several limitations. First, our increase in screening adherence cannot be attributed solely to the PN programs. Data from the NHIS demonstrates that SC rates have been increasing over time.¹³ In NYC, the percentage of adults over age 50 who have had a colonoscopy in the last 10 years increased from 61.7% in 2007⁴⁹ to 67.5% in 2010.⁵⁰ In East Harlem (our study setting), 62.3% of residents were adherent to screening colonoscopy.⁵⁰ Nevertheless, our completion rate of 78.5% represents a substantial increase in adherence even beyond this upward trend. Second, it is likely that some participants would have completed screening regardless of navigation but it was not possible to determine that size of that group. Because of this, we calculated costs and profits based on all colonoscopies completed. Third, we analyzed SC adherence from four types of PN at our institution as part of one data set. We conducted our analysis based on the assumption that any effects of variations between the four PN protocols were small and that the cost analysis would not be significantly impacted by these differences. Fourth, because PN has become standard practice at our institution, it was not possible to have a non-navigated control group (see Kazarian et al.⁵¹ for a retrospective review of a vulnerable non-navigated population in an OAE system). Thus, data from the comparison groups were collected in different years and differ along some demographic parameters. For instance, the general population has a higher percentage of non-Latino whites than our patient population. Given that screening rates are generally higher among this group than among minorities,^{11,14} the national average may overestimate adherence to SC. Fifth, we made the supposition that PN programs are not widely implemented on a national level. It is possible that they are more common than we assume. Sixth, this analysis is based on ACMs from SC at an urban academic center where the majority of patients (79.5%) are covered by public insurance. Therefore, our results may not be generalizable to other settings where the insurance mix differs. If anything, we would expect the financial balance sheet to be more favorable in environments with more private insurance. Moreover, because our increase in hospital net income was based on improving adherence rates, we would propose that any institution performing SC would likely derive financial benefit from implementing a PN program with a part-time dedicated navigator. Finally, the present analysis is not a cost-effectiveness analysis. It does not take into consideration the costs involved in rescheduling "no-shows" and patients who had inadequate bowel preps, or the costs of pathology. We previously reported that patient navigation substantially reduces the no-show and poor-prep rates.³¹ These issues, along with the cost value of the colonoscopy findings and the cost related to the professional fees, will be the subject of a future cost-effectiveness analysis.

Acknowledgments

Funding Sources: Supported by NCI R01 CA120658, the Doris Duke Charitable Foundation, and Mount Sinai School of Medicine

The authors wish to thank Jenessa Dieterle, RN and Lourdes Fontanez, RN for providing medical clearance of patients in the studies, Jodi Cohen for hospital financial information, and the many attending gastroenterologists who performed the colonoscopies for the studies.

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Figure 1.
Algorithm of patients in the current PN studies

Table 1

PN Participant Demographics

Demographics	Sample Size	Percentage
Number of Patients	503	100%
Gender		
<i>Male</i>	161	32.0%
<i>Female</i>	342	68.0%
Race/Ethnicity		
<i>African American</i>	233	46.3%
<i>Latino</i>	230	45.7%
<i>Other</i>	40	8.0%
Age		
<i>64</i>	380	75.5%
<i>65+</i>	123	24.5%
Household Income		
<i>\$10,000.00 or less</i>	219	43.5%
<i>More than \$10,000.00</i>	236	46.9%
Insurance		
<i>Medicaid</i>	265	52.7%
<i>Medicare</i>	135	26.8%
<i>Private</i>	99	19.7%
<i>Self-Pay</i>	4	0.8%
Final Colonoscopy Status		
<i>Complete</i>	395	78.5%
<i>Incomplete</i>	108	21.5%
Average # appointments/patient	1.48	--
Average # calls/appointment	7.28	--
Average # minutes/appointment	35.45	--

Table 2

Cost of PN

Expense	Cost		
	Completer	Non-Completer	No PN
Navigation per Participant	\$23.90	\$20.26	\$3.25
Add-ons per Participant	\$4.93	\$1.14	--
Total Per Participant	\$28.83	\$21.40	\$3.25
Total per Sample Size	(n = 395) \$11,387.85	(n = 108) \$2,311.20	(n = 101) \$328.25
Grand Total (n = 604)	\$14,027.30		

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Table 3

Net Income from Colonoscopy

	Screening Colonoscopy	Colonoscopy with Biopsy	Colonoscopy with Snare	Non-Completers	No PN	Row Total
Sample Size	211	119	65	108	101	604
Average Contribution Margin (ACM)	\$335.00	\$194.00	\$23.00	--	--	--
Total Contribution Margin (ACM × Sample Size)	\$70,685.00	\$23,086.00	\$1,495.00	--	--	\$95,266.00
PN ^a for Sample Size	-\$6,083.13	-\$3,430.77	-\$1,873.95	-\$2,311.20	-\$328.25	-\$14,027.30
Net Income	\$64,601.87	\$19,655.23	-\$378.95	-\$2,311.20	-\$328.25	\$81,238.70

^aPN cost values from Table 2, Row 5: "Total Per Participant"

Table 4

Incremental effects of PN on Net Income modeled on a theoretical cohort of 1000 patients

	PN (current study)	Historical PN (our institution)	National Average (assumed no PN)
Colonoscopy Completion Rate	≈80%	≈65%	≈50%
Theoretical Completers out of 1000	800	650	500
Average Contribution Margin ^a (ACM)	\$241.00	\$241.00	\$241.00
Total Contribution Margin (ACM × # of Completers)	\$192,800.00	\$156,650.00	\$120,500.00
PN ^b for Completers (\$28.83 × # of Completers)	−23,064.00	−\$18,739.50	--
PN ^b for Non-Completers (\$21.40 × # of Non-Completers)	−\$4,280.00	−\$7,490.00	--
Net Income	\$165,456.00	\$130,420.50	\$120,500.00
Additional Net Income of PN Sample Relative to Other Samples	--	+\$35,035.50	+\$44,956.00

^aWeighted ACM based on the number of participants who completed each type of colonoscopy procedure^bPN cost values from Table 2, Row 5: "Total Per Participant"