

COLONOSCOPY SCREENING IN THE US ASTRONAUT CORPS

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Background

- Historically, colonoscopy screenings for astronauts have been conducted to ensure that astronauts are in good health for space missions.
- This data has been identified as being useful for determining appropriate occupational surveillance targets and requirements.
- Colonoscopies in the astronaut corps can be used for:
 - Assessing overall colon health
 - A point of reference for future tests in current and former astronauts
 - Following-up and tracking rates of colorectal cancer and polyps.
 - Comparison to military and other terrestrial populations.
- In 2003, medical screening requirements for the active astronaut corps changed to require less frequent colonoscopies.
- Polyp removal during a colonoscopy is an intervention that prevents the polyp from potentially developing into cancer and decreases the individual's risk for colon cancer.

Purpose

The objective of this study is to evaluate the possible effect of increased follow-up times between colonoscopies on the number and severity of polyps identified during the procedures among both current and former NASA astronauts.

Methods

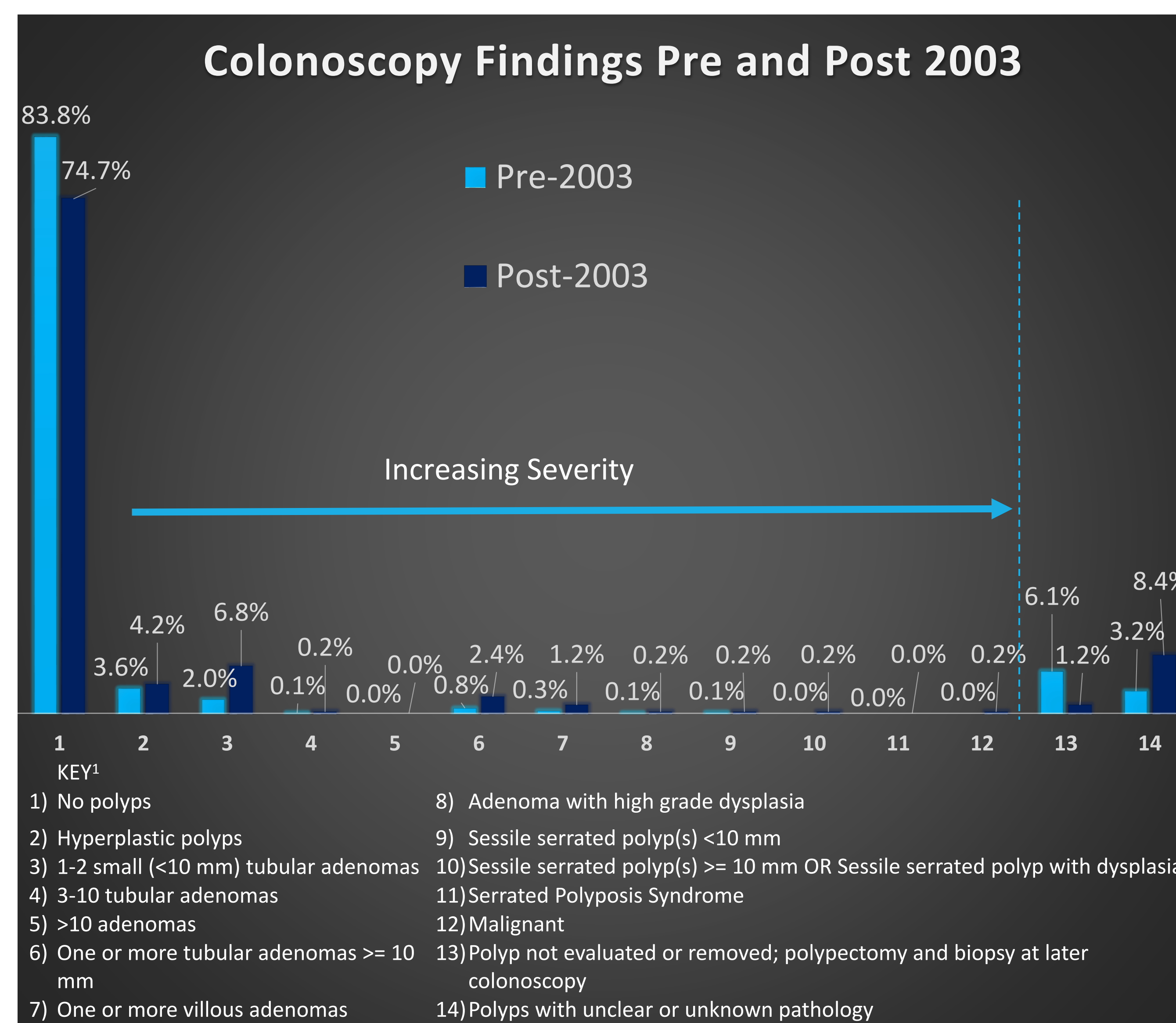
- A retrospective study of all NASA astronauts, current and former, was conducted by review of the JSC Clinic Electronic Medical Record and Lifetime Surveillance of Astronaut Health (LSAH) database for colonoscopy screening procedures and pathology reports.
- The screening procedures included in the study varied, ranging from proctoscopy to proctosigmoidoscopy to colonoscopy, which are used to examine the colon to the rectum, sigmoid, or cecum respectively.
- The timeframe of interest: selection into the Astronaut Corps through May 2015 or death.
- For each colonoscopy report, the following data were captured:
 - date of procedure
 - age at time of procedure
 - findings of procedure (grouped according to US Multi-Society Task Force on Colorectal Cancer guidelines)¹
 - calculated follow up interval
- The population consisted of 338 astronauts: 52 females, 286 males. Of these, 56 were deceased, and 11 astronauts had no record of any colonoscopies.

Because of a screening requirement change in 2003 to less frequent colonoscopies to align with recommended medical practices, analyses were conducted to determine if there were differences in polyp findings before vs after 2003. One-sided Wilcoxon rank sum tests were used to determine if there were statistically significant differences in occurrence of polyps between the two samples due to the different screening schedules. Because this is a retrospective study, there are limitations due to lack of follow up or record forwarding from some patients, which could cause underestimation of polyp rates and colon cancer rates. Other limitations include unclear or unreported pathologies of polyps, as well as the absence of a selection colonoscopy report or absence of any colonoscopy procedures in the patient charts. Review of records suggests that in the early stages of the space program, only positive findings were reported and procedures were not documented if results were normal, therefore there may have been more procedures performed pre-2003. The data presented is currently undergoing quality control audit, and based on that final review, results may change after final review.

Results

Astronaut Polyp Profile

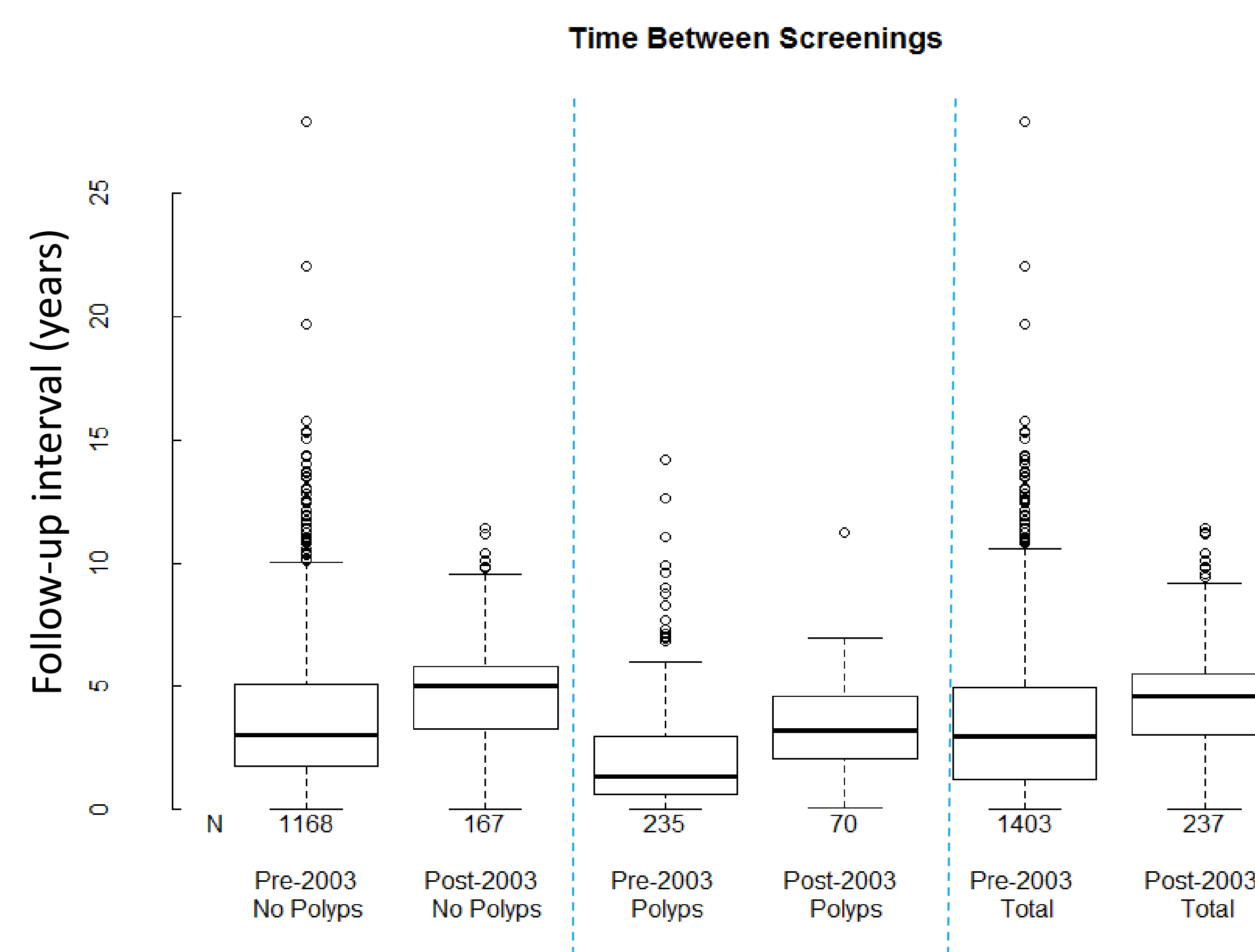
Group	Number	Percent
Astronauts who have had a polyp in their lifetime	135	39.9%
Astronauts who have never had a polyp	191	56.5%
Astronauts that developed colon cancer	1	0.3%
Astronauts who have no colonoscopy records	11	3.3%



Mean Follow Up Intervals after Colonoscopy Pre and Post 2003

- One Sided Wilcoxon Rank Sum Test
- Null Hypothesis: The mean follow-up interval in each group (total, no polyps, polyp) after a colonoscopy post-2003 is not higher than the mean follow-up interval before 2003
- All three p-values were <.001. Therefore, we reject the null hypothesis. We conclude that in each group (no polyps, polyps, and total), the mean follow-up interval for the post-2003 subjects was greater than the pre-2003 subjects.

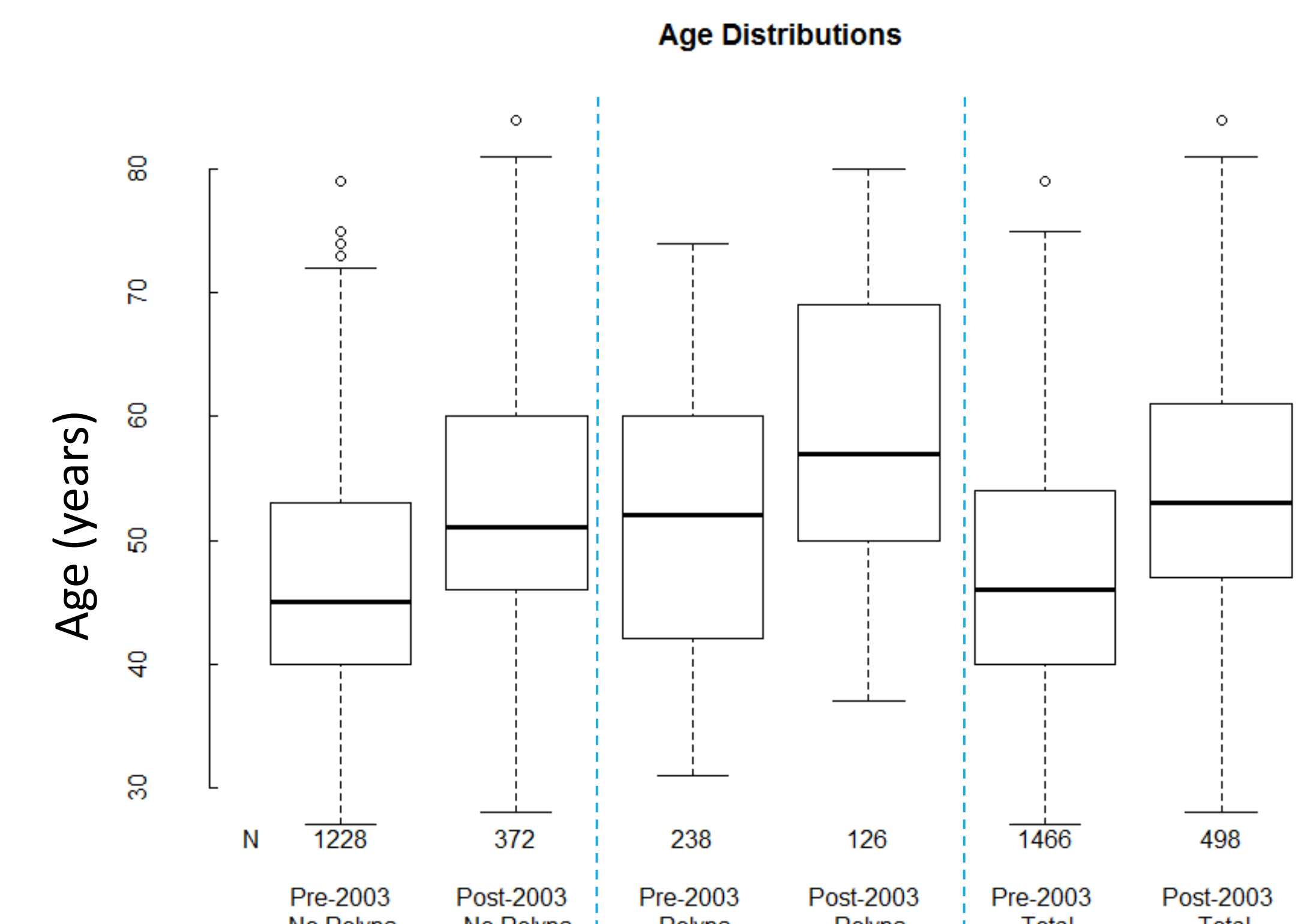
Group	Pre-2003	Post-2003
No Polyps	3.9 yrs	4.8 yrs
Polyps	2.2 yrs	3.3 yrs
Total	3.6 yrs	4.4 yrs



Mean Age at Colonoscopy Pre and Post 2003

- One Sided Wilcoxon Rank Sum Test
- Null Hypothesis: The mean age in each group (total, no polyps, polyp) of colonoscopy subjects after 2003 is not higher than the mean age of the subjects before 2003
- All three p-values were <.001. Therefore, we reject the null hypothesis. We conclude that in each group (no polyps, polyps, and total), the mean age of the post-2003 subjects was greater than the pre-2003 subjects.

Group	Pre-2003	Post-2003
No Polyps	46.5 yrs	53.0 yrs
Polyps	51.4 yrs	59.0 yrs
Total	47.3 yrs	54.6 yrs



Discussion

As expected, follow-up intervals between colonoscopies were longer after the screening requirement change than before the change. Colonoscopies performed after the requirement change tended to have a higher incidence and greater severity of polyps. From pre-2003 to post-2003 the percentage of colonoscopy procedures yielding no polyps decreased from 83.77% to 74.70%. Not only did post-2003 procedures yield more polyp findings, but the polyps recorded were more often of severe pathology. 3.62% of pre-2003 colonoscopy findings were polyps of the hyperplastic type (the least severe polyp type) and only 3.35% were of greater severity. Post-2003, 4.21% of findings were hyperplastic polyps while 11.44% were of greater severity. Further statistical analysis needs to be done to confirm that these differences are indeed significant. The increased follow-up times offer an explanation to the increased polyp severity, since longer times between screening give polyps more time to develop.

Upon the investigation of other possible contributing factors to these results, we also found that post-2003, the mean age at colonoscopy was significantly higher than pre-2003. This study included both active, management, and retired astronauts. The astronaut corps is an aging population; the increased average age of astronauts could also be a contributing factor to the results, since the risk of developing polyps increases with age. In addition, known risk factors for colon cancer such as smoking, alcohol consumption, exercise, diet, personal and family history were not included in this analysis. Further work is needed to characterize the incidence of polyps in the US astronaut corps.

References

- [1] Lieberman DE, Rex DK, Winawer SJ, et al. Guidelines for colonoscopy surveillance after screening and polypectomy: A consensus update by the US Multi-Society Task Force on Colorectal Cancer. *Gastroenterology* 2012;143(3):844-57