香港專科
THE SPECIALISTS
日間醫療中心
DAY PROCEDURE CENTRE

Colonoscopy Result of The Specialists Surgery and Endoscopy Centre 2019-2021

Prepared By

Dr. Lam W.F., Mr. Leung K.Y., and Mr. Tsoi K.Y.

Table of Content

1. Introduction

The Specialists Surgery and Endoscopy Centre (**TSSEC**) had been providing day-case colonoscopy service to public since Jun 2006. We audit our colonoscopy result periodically as an assessment of performance of our colonoscopy centre and our endoscopists in order to keep up with international standard and to look for area for improvement, and reviewing the finding of colonoscopy especially on adenoma detection rate and colorectal cancer rates in our series. In year 2020, TSSEC published a report analysed the colonoscopy result from 2006 to 2018. To follow the last analysis, colonoscopy result from 2019 to 2021 were analysed and compared with the result of our last audit.

1.1. Survey Objective

The objectives of the survey are to gauge the performance of TSSEC on colonoscopy and patients' health situation of lower digestive system:

1. The frequency of procedure from 2019 to 2021 (section 3.1)
2. The qualities of bowel preparation (section 3.2)
3. The caecal and ileal intubation rate (section 3.3)
4. The morbidity and mortality rate (section 3.4)
5. The perforation rate (section 3.4)
6. The post-polypectomy bleeding rate (section 3.4)
7. The polyp detection rate (section 3.5)
8. The adenoma detection rate (section 3.6)
9. The sessile serrated adenoma/lesion detection rate (section 3.7)
10. The cancer detection rate (section 3.8)

2. Methodology & Samples

2.1. Survey Period

The period of the study was from 1 January 2019 to 31 December 2021.

2.2. Sample Frame

All colonoscopy cases performed inside TSSEC within the survey period were included in the report.

Full list of patients conducted colonoscopy examination in TSSEC in the survey period were exported from our endoscopy reporting system. A total of 17,940 cases were exported. After screening, 41 cases belonged to suspected post-polypectomy bleeding cases while 20 cases were sigmoidoscopy cases, which both of them were not included for analysis. Hence, a total of 17,879 cases were included for analysis. Among these cases, the 8 cases that failed due to poor bowel preparation were only included in the analyses of colonoscopy procedure caseload (Section 3.1) and bowel preparation quality (Section 3.2), but excluded from other analyses (Sections 3.3 through 3.8) as complete examinations were not performed in these cases.

2.3. Methodology

This study is a retrospective study for all colonoscopy cases done in TSSEC between 2019 and 2021.

All information was gathered from three main sources:

1. Colonoscopy report prepared by TSSEC after procedure
2. Colonoscopy diagram drafted by clinical staff in TSSEC during procedure
3. Histopathology report prepared by 3rd party laboratory (only for cases that had specimen sent to laboratory)

For colonoscopy report, they were exported directly from our endoscopy reporting system to reduce typo mistake. For the other two sources, hardcopy records were reviewed and inputted by our research assistants. Data processing and analysis was done by TSSEC using excel and SPSS. International standards from American Society for Gastrointestinal Endoscopy (ASGE)[1] and European Society for Gastrointestinal Endoscopy (ESGE)[2] were used as a reference for comparison with our performance.

[1] ASGE.(2014). Quality indicators for GI endoscopic procedures - complete set. https://www.asge.org/docs/default-source/education/practice_guidelines/doc-2014_quality_in_endoscopy_set.pdf

[2] ESGE.(2019). Performance measures for small-bowel endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. https://www.esge.com/performance-measures-for-small-bowel-endoscopy/

3. Survey Result

3.1. Colonoscopy Procedure Caseload from 2019 to 2021

The total number of colonoscopy procedures performed from 2019 to 2021 was 17,879.

Table 3.1.1 Number of colonoscopy procedures from 2019 to 2021 (N=17879)

Year	No. of procedure	Annual change	Percentage change
2019	6008	-112 (1)	-1.8%
2020	4943	-1065	-17.7%
2021	6928	+1985	+40.2%
Total	17879		

(1) 6120 colonoscopy procedures done in 2018

Proportion of female patients increased generally over the past few years. It was 56.2% in year 2019 and that increased to 59.1% in year 2021.

Table 3.1.2 Number of colonoscopy procedures from 2019 to 2021 by gender (N=17879)

	Male		Female	
Year	No. of procedure	Percentage	No. of procedure	Percentage
2019	2634	43.8%	3374	56.2%
2020	2127	43.0%	2816	57.0%
2021	2837	40.9%	4091	59.1%
Total	7598	42.5%	10281	57.5%

Note: Chi-square test showed that two variables are dependent ($p<0.001$)

There were total 6 endoscopists performed colonoscopy in TSSEC from 2019 to 2021. During this period, 31.7% of the cases were conducted by Dr. B, followed by Dr. C (22.4%) and Dr. A (19.4%). The no. of colonoscopy done by different endoscopies was obviously different mainly because certain endoscopists joined or leave our centre at different time during this study period.

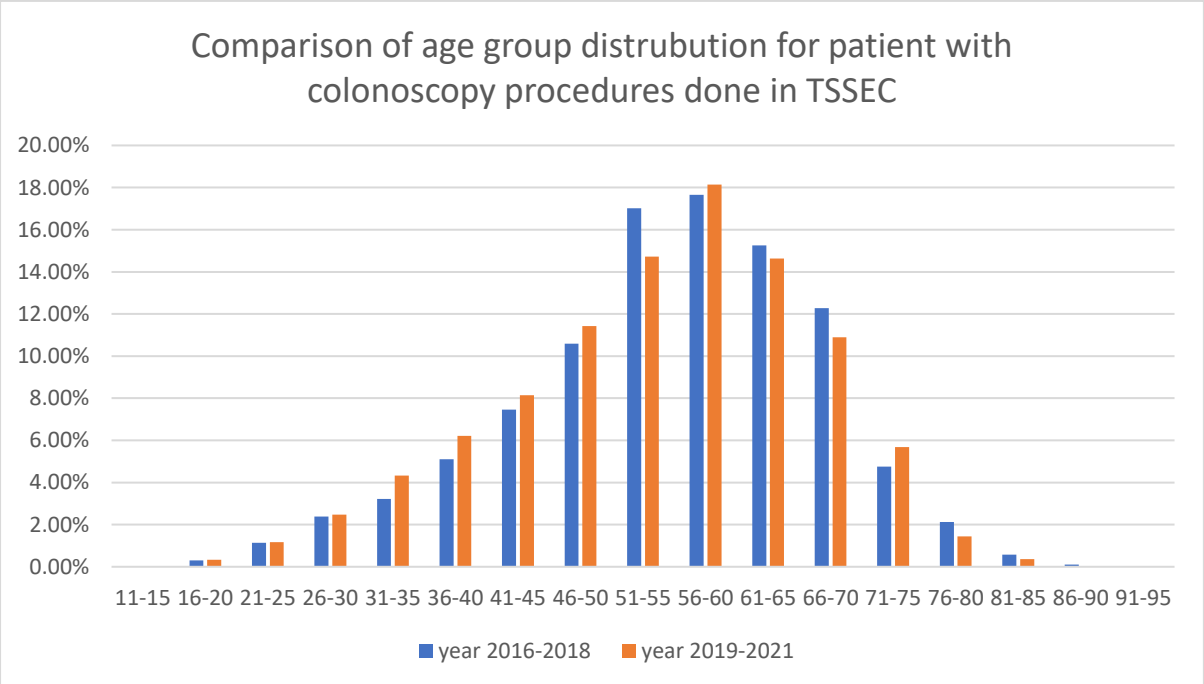
Table 3.1.3 Number of colonoscopy procedures from 2019 to 2021 by endoscopist (N=17879)

Endoscopist	2019		2020		2021		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	1580	26.3%	973	19.7%	912	13.2%	3465	19.4%
Dr. B	1891	31.5%	1688	34.1%	2086	30.1%	5665	31.7%
Dr. C	1201	20.0%	1198	24.2%	1604	23.2%	4003	22.4%
Dr. D	791	13.1%	739	15.0%	1246	18.0%	2776	15.5%
Dr. E	545	9.1%	345	7.0%	0	0.0%	890	5.0%
Dr. H	0	0.0%	0	0.0%	1080	15.6%	1080	6.0%
Total	6008	100.0%	4943	100.0%	6928	100.0%	17879	100.0%

The majority age group conducted colonoscopy procedure from 2019 to 2021 was "age 56-60" (18.1%). Compared with year 2016 to 2018, the percentage of patient with age group "age 31-35" and "age 36-40" increased by 1.1%. On the other hand, the percentage of patient with age group "age 51-55" and "age 66-70" decreased 2.3% and 1.4% respectively.

The percentage of patient in age group 56-60 in 2019-2021 was the highest among the 3 study periods.

Graph 3.1.1 Age group distribution comparison

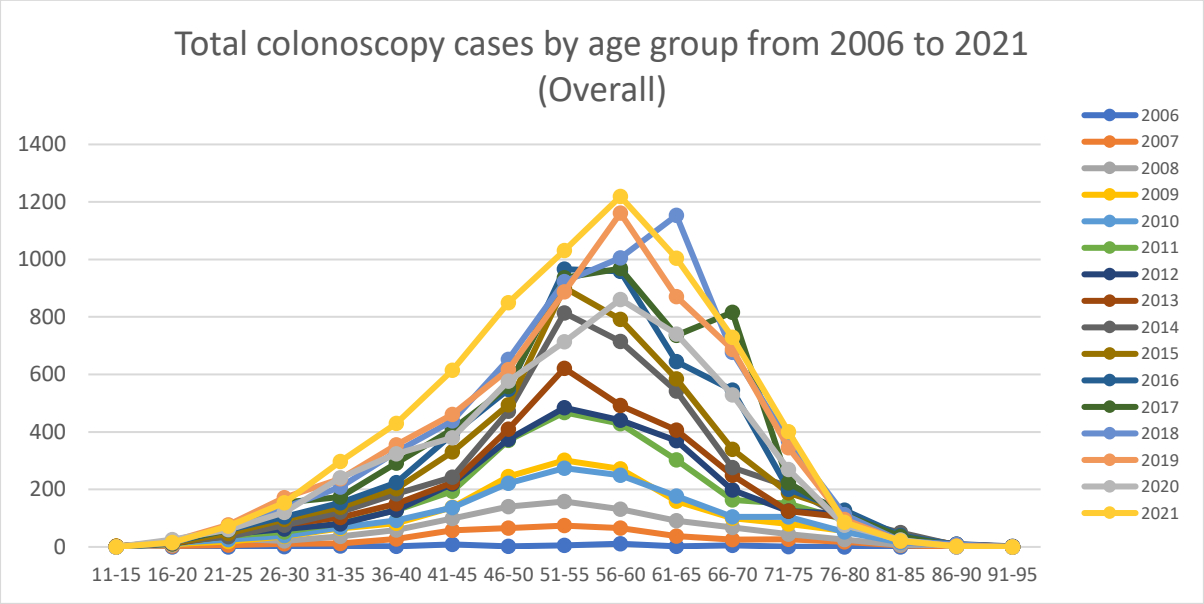


Note: Levene's test for equal variance showed the variance age for current study was higher than that of the previous ($p<0.001$), T-test for equality of means showed that the mean age for current study was lower than that of the previous ($p<0.001$)

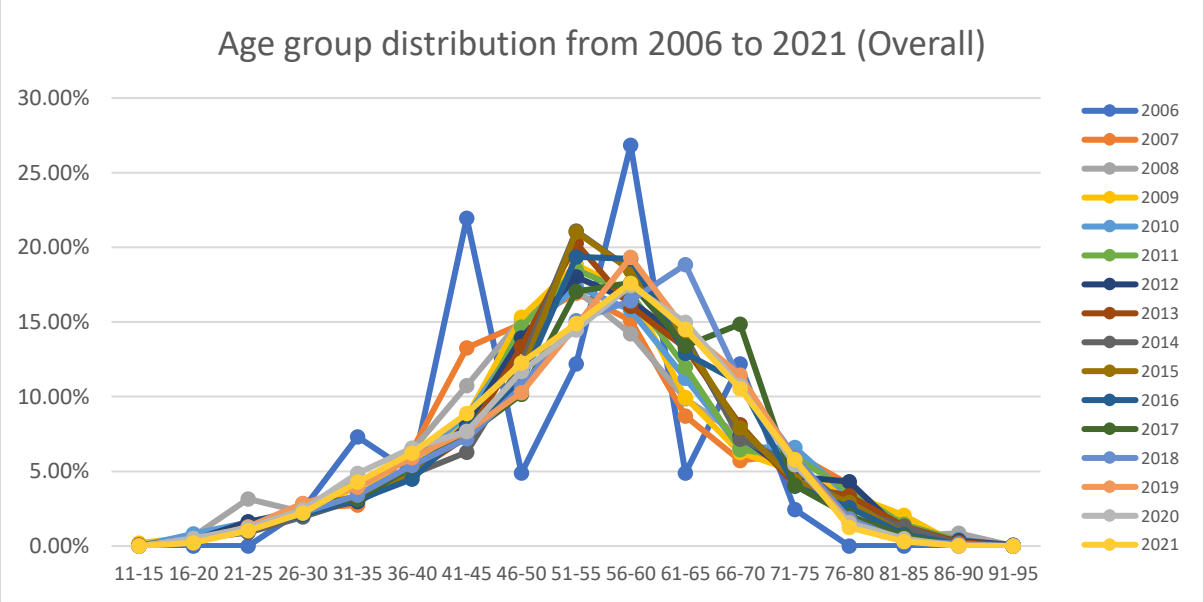
Table 3.1.4 Number of colonoscopy procedures from 2019 to 2021 by age group (N=17879)

	2006-2015		2016-2018		2019-2021		2016-2018 Vs 2006-2015	2019-2021 Vs 2016-2018
Age Group	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	Percentage change	Percentage change
age 11 - 15	9	0.04%	2	0.01%	1	0.01%	-0.03%	-0.01%
age 16 - 20	98	0.47%	50	0.30%	60	0.34%	-0.17%	0.03%
age 21 - 25	282	1.34%	189	1.14%	209	1.17%	-0.20%	0.03%
age 26 - 30	471	2.24%	397	2.39%	444	2.48%	0.15%	0.09%
age 31 - 35	707	3.37%	535	3.22%	776	4.34%	-0.14%	1.12%
age 36 - 40	1056	5.03%	847	5.10%	1109	6.20%	0.07%	1.10%
age 41 - 45	1651	7.86%	1239	7.46%	1456	8.14%	-0.40%	0.68%
age 46 - 50	2794	13.30%	1758	10.59%	2043	11.43%	-2.72%	0.84%
age 51 - 55	4101	19.53%	2825	17.01%	2633	14.73%	-2.51%	-2.29%
age 56 - 60	3597	17.13%	2932	17.66%	3242	18.13%	0.53%	0.47%
age 61 - 65	2671	12.72%	2533	15.26%	2615	14.63%	2.54%	-0.63%
age 66 - 70	1527	7.27%	2038	12.27%	1947	10.89%	5.00%	-1.38%
age 71 - 75	1054	5.02%	791	4.76%	1016	5.68%	-0.25%	0.92%
age 76 - 80	687	3.27%	352	2.12%	257	1.44%	-1.15%	-0.68%
age 81 - 85	244	1.16%	97	0.58%	66	0.37%	-0.58%	-0.22%
age 86 - 90	51	0.24%	18	0.11%	5	0.03%	-0.13%	-0.08%
age 91 - 95	3	0.01%	1	0.01%	0	0.00%	-0.01%	-0.01%
Total	21003	100.0%	16604	100.0%	17879	100.0%		

Graph 3.1.2 Number of colonoscopy cases by age group from 2006 to 2021 (Overall)

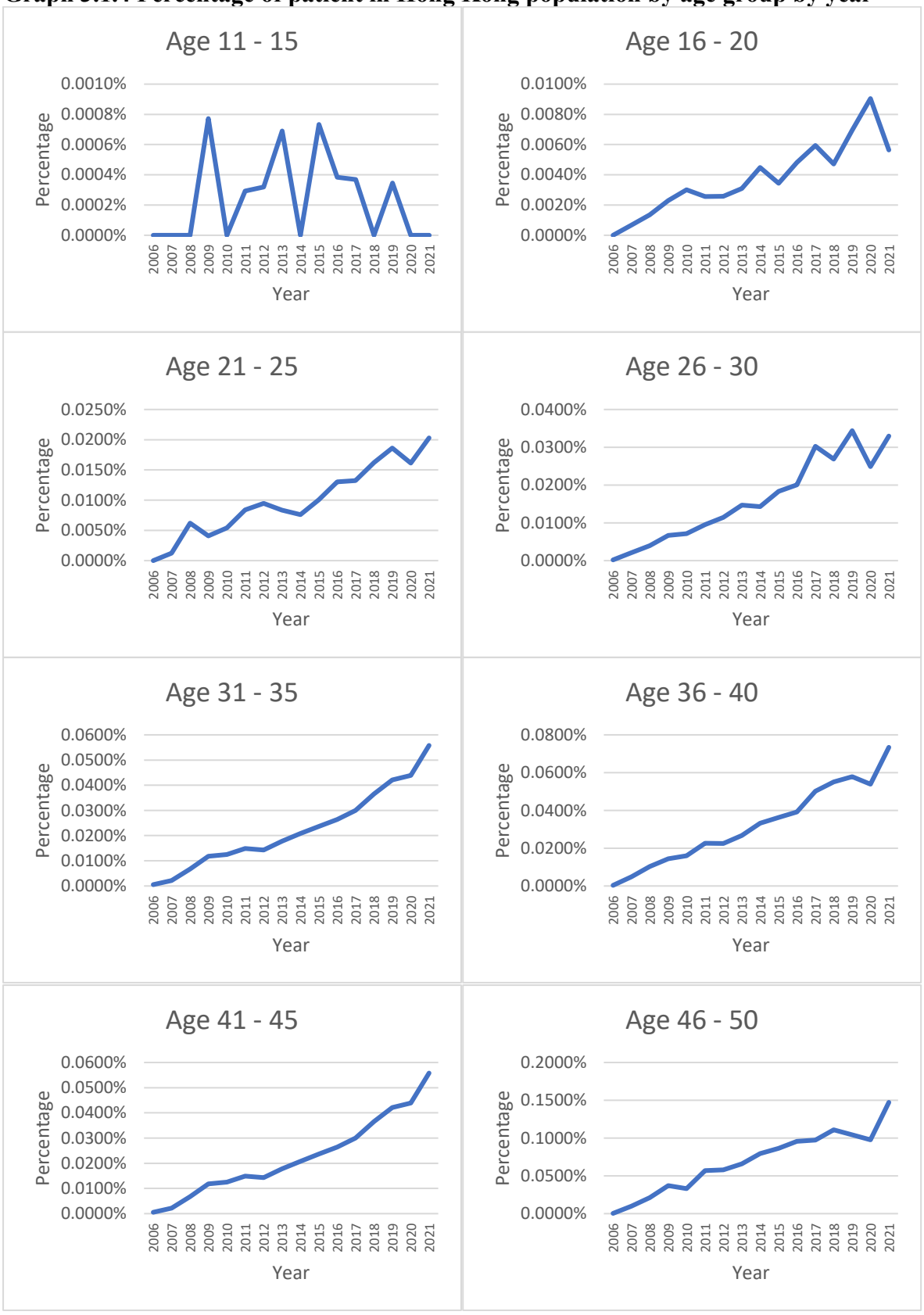


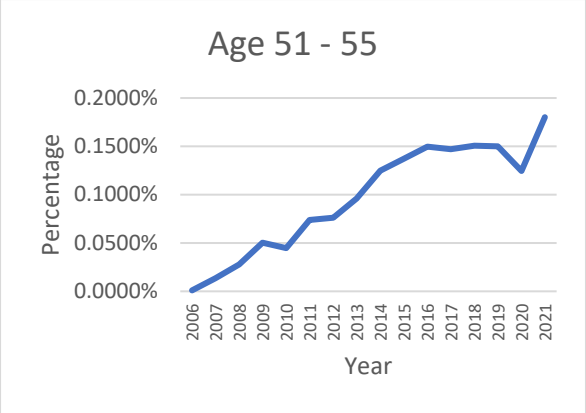
Graph 3.1.3 Age group distribution for colonoscopy cases from 2006 to 2021 (Overall)

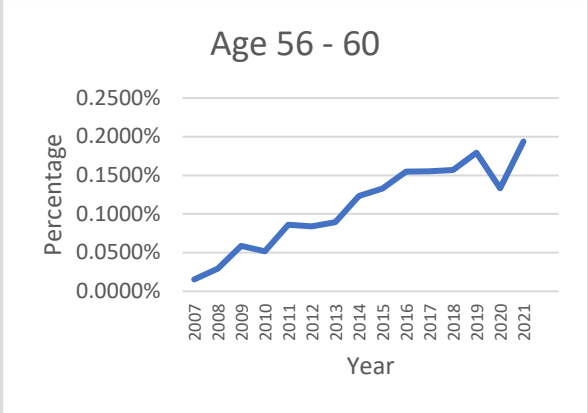


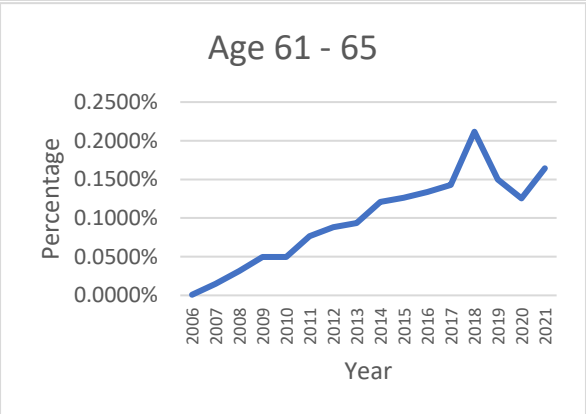
When compared with the entire HK population, the ratio of patient from age 31 to 60 who had colonoscopy in our centre reached the highest in year 2021.

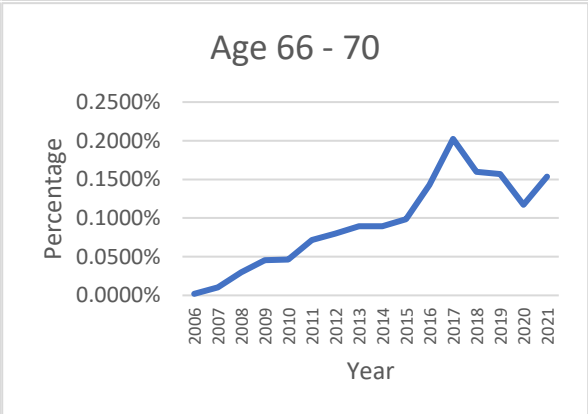
Graph 3.1.4 Percentage of patient in Hong Kong population by age group by year

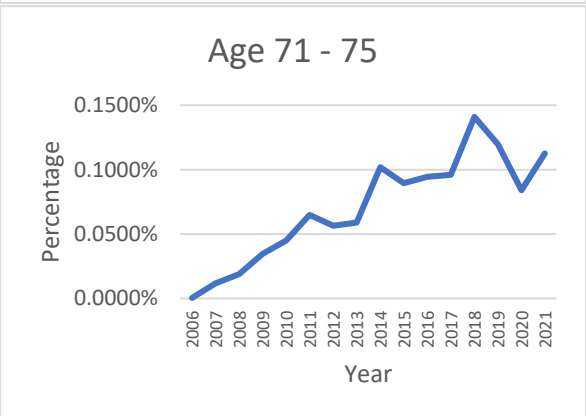


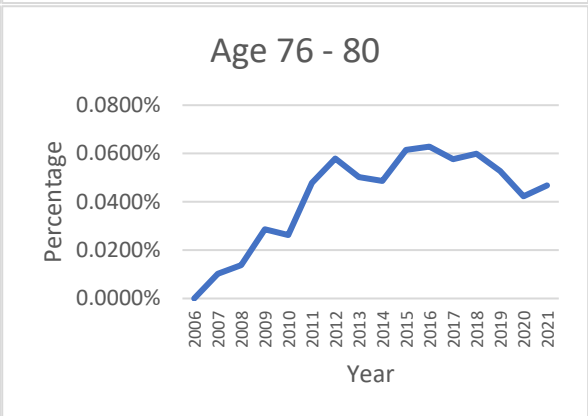

Age 51 - 55
Percentage
0.2000%
0.1500%
0.1000%
0.0500%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year

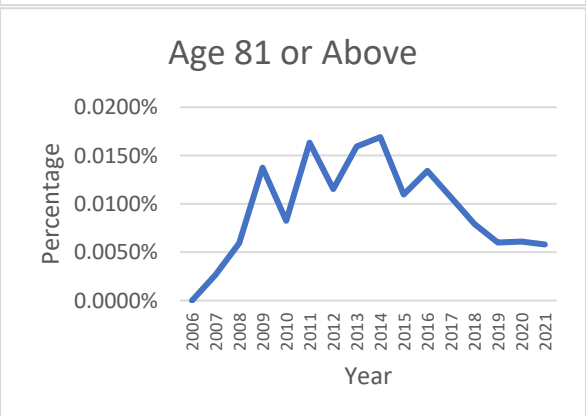

Age 56 - 60
Percentage
0.2500%
0.2000%
0.1500%
0.1000%
0.0500%
0.0000%
2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year


Age 61 - 65
Percentage
0.2500%
0.2000%
0.1500%
0.1000%
0.0500%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year


Age 66 - 70
Percentage
0.2500%
0.2000%
0.1500%
0.1000%
0.0500%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year


Age 71 - 75
Percentage
0.1500%
0.1000%
0.0500%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year


Age 76 - 80
Percentage
0.0800%
0.0600%
0.0400%
0.0200%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year


Age 81 or Above
Percentage
0.0200%
0.0150%
0.0100%
0.0050%
0.0000%
2006 2007 2008 2009 2010 2011 2012 2013 2014 2015 2016 2017 2018 2019 2020 2021
Year

3.2. The Qualities of Bowel Preparation

It is to clean and empty the colon and rectum for colonoscopy examination, which include a series of communication between our staff and patient involved on diet and drug adjustment, choice of bowel preparation solution, timing and method of solution consumption and precaution. A satisfactory bowel preparation helped doctor to view the lining and interior structure of the colon clearly and so thoroughly examined it and is a part of quality of colonoscopy examination. It also assessed efficiency of our staff communication and the appropriateness of our work flow on bowel preparation to our patient. According to the ESGE guideline in 2019, the target standard for percentage of patients receiving bowel preparation instruction appropriately was 95%. We defined our classification "Good" to "Satisfactory after irrigation" as receiving appropriate bowel preparation while "Fair" and "poor" as non-appropriate bowel preparation.

Reference table of TSSEC classification to ESGE classification on bowel preparation standard:

TSSEC classification	ESGE classification
(i) Good - Almost no irrigation with full assessment (ii) Normal - Minimal irrigation with full assessment (iii) Satisfactory - Little irrigation with full assessment. (iv) Satisfactory after irrigation - Moderate irrigation to achieve full assessment.	Receive bowel preparation instruction ***appropriately***
(v) Fair - Taking long time and copious irrigation to achieve full assessment. (vi) Poor - Cannot have completed assessment nor be cleared up with irrigation; abandoned procedure was needed.	Receive bowel preparation instruction ***inappropriately***

In TSSEC, 99.9% of the patients having colonoscopy procedures conducted from 2019 to 2021 receiving bowel preparation instruction appropriately. Among the 16 cases with poor bowel preparation, 8 cases were failed. Of these, 7 cases were rescheduled and successfully completed colonoscopies.

Table 3.2.1 The quality of bowel preparation by procedure year (N=17879)

Quality of bowel preparation	2019		2020		2021		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Good	3	0.05%	3	0.06%	0	0.0%	6	0.03%
Normal	0	0.00%	0	0.00%	0	0.0%	0	0.00%
Satisfactory	2	0.03%	2	0.04%	2	0.03%	6	0.03%
Satisfactory After Irrigation	5996	99.80%	4932	99.78%	6917	99.84%	17845	99.81%
Subtotal: Appropriate bowel preparation	6001	99.88%	4937	99.88%	6919	99.87%	17857	99.88%
Fair	3	0.05%	1	0.02%	2	0.03%	6	0.03%
Poor	4	0.07%	5	0.10%	7	0.10%	16	0.09%
Subtotal: Inappropriate bowel preparation	7	0.12%	6	0.12%	9	0.13%	22	0.12%
Total	6008	100.0%	4943	100.0%	6928	100%	17879	100.0%

Note: Two-way ANOVA show no significant difference of appropriate bowel preparations between years (p=0.230)

3.3. The Caecal Intubation Rate

The caecal intubation rate is the rate that a colonoscopy assessment reached caecum (proximal end of colon), which is an indication of complete assessment of colon or a successful colonoscopy, is one of the assessment criteria of endoscopist's technical competency. It was suggested by the guidelines from ASGE in 2014 that it should be over 90%. Cancer obstruction is usually excluded in view of a quality assessment.

3.3.1. The Caecal Intubation Rate

Overall, the success rate of caecal intubation was 99.4%, only 107 out of 17,871 cases were failed (see table 3.3.1.1). The success rate increased to 99.9% when it excluded cancer obstruction cases (see table 3.3.1.3). For the cancer cases, the endoscopy could pass through cancer to reach caecum in 70.7% of cases (see table 3.3.1.2). Excluding cancer obstruction cases, the endoscopy could reach the caecum in 99.9% of cases. There were 10 out of 16 failed cases (after excluding cancer obstruction) that scope could not be negotiated through stricture.

Table 3.3.1.1 The caecal intubation rate (Overall) (N=17871)

	No. of procedure	Percentage
Fail	107	0.6%
Success	17764	99.4%
Total	17871	100.0%

Table 3.3.1.2 The caecal intubation rate (Cancer cases only) (N=311)

	No. of procedure	Percentage
Fail	91	29.3%
Success	220	70.7%
Total	311	100.0%

Table 3.3.1.3 The caecal intubation rate (Excluding cancer obstruction cases) (N=17560)

	No. of procedure	Percentage
Fail	16(1)	0.1%
Success	17544	99.9%
Total	17560(2)	100.0%

(1) Overall no. of procedure fails to reach caecum (N=107) deducted cancer obstruction cases (N=91)
(2) Total cases (N=17871) deducted cancer obstruction cases (N=311)

When we analysed the data by endoscopist, all endoscopists has success rate of over 99% except Dr. E.

Table 3.3.1.4 The caecal intubation rate by endoscopist (Overall) (N=17871)

	Fail		Success		
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	Total
Dr. A	10	0.3%	3453	99.7%	3463
Dr. B	18	0.3%	5645	99.7%	5663
Dr. C	31	0.8%	3972	99.2%	4003
Dr. D	21	0.8%	2753	99.2%	2774
Dr. E	19	2.2%	870	97.8%	889
Dr. H	7	0.6%	1072	99.4%	1079
Total	107	0.6%	17764	99.4%	17871

Note: Two-way ANOVA show significant difference between endoscopists ($p<0.001$), Tukey's post hoc test showed significant difference for Dr. E vs other endoscopists ($p < 0.001$).

Table 3.3.1.5 The caecal intubation rate by endoscopist (Excluding cancer obstruction cases) (N=17560)

	Fail		Success		
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure
Dr. A	1	0.03%	3424	99.97%	3425
Dr. B	4	0.07%	5592	99.93%	5596
Dr. C	6	0.15%	3929	99.85%	3935
Dr. D	1	0.04%	2692	99.96%	2693
Dr. E	2	0.23%	851	99.77%	853
Dr. H	2	0.19%	1056	99.81%	1058
Total	16	0.09%	17544	99.91%	17560

Note: Two-way ANOVA show significant difference between endoscopists ($p=0.017$), Tukey's post hoc test showed significant difference for Dr. C vs Dr. A, Dr. B and Dr. D respectively ($p=0.024$~0.060)

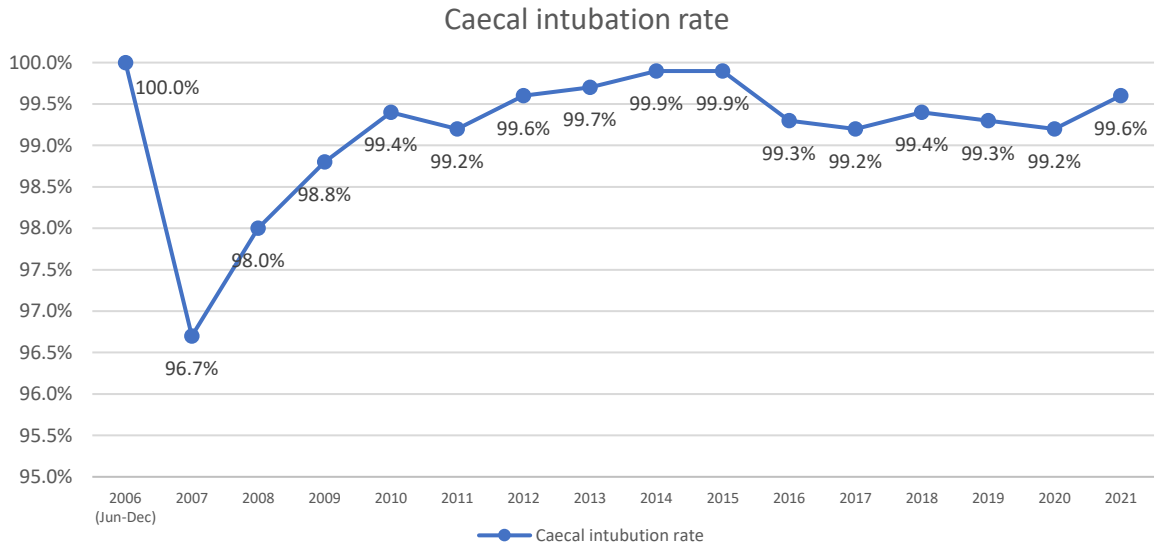
The caecal intubation rate for year between 2019 and 2021 ranged from 99.2% to 99.6%. Result shown that all our TSSEC endoscopists had caecal intubation rate over 99.0% since year 2009, which higher than the target standard (90.0%) suggested by ASGE in 2014.

Table 3.3.1.6 The caecal intubation rate by procedure year (Overall) (N=17871)

Year	Fail		Success		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
2019	43	0.7%	5964	99.3%	6007	100.0%
2020	39	0.8%	4899	99.2%	4938	100.0%
2021	25	0.4%	6901	99.6%	6926	100.0%
Total	107	0.6%	17764	99.4%	17871	100.0%

Note: Chi-square test showed that two variables are dependent ($p<0.001$)

Graph 3.3.1.1 The caecal intubation rate by procedure year (Overall)



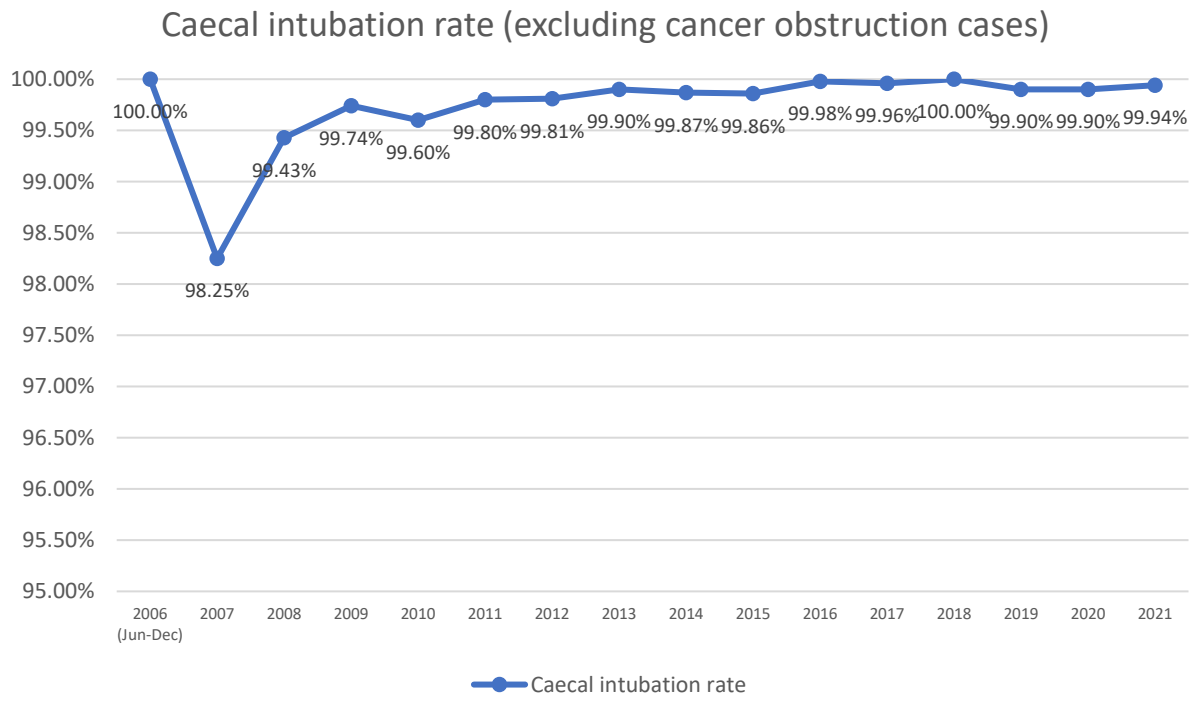
Cancer obstruction was one of the common reasons for failure in caecal intubation. However, failure due to obstructing cancer was not related to technical assessment. When cancer cases are ignored in our study, the fail rates were then largely reduced. 17 cases failed to reach caecum during the period.

Table 3.3.1.7 The caecal intubation rate by procedure year (Excluding cancer obstruction cases) (N=17560)

Year	Fail		Success		Total		Cancer obstruction case
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	
2019	6	0.10%	5886	99.90%	5892	100%	115
2020	5	0.10%	4825	99.90%	4830	100%	108
2021	5	0.06%	6833	99.94%	6838	100%	88
Total	16	0.10%	17544	99.90%	17560	100%	311

Note: Chi-square test showed that two variables are independent (p=0.705)

Graph 3.3.1.2 The caecal intubation rate by procedure year (Excluding cancer obstruction cases)



3.3.2. The Ileal Intubation Rate

The success rate of ileal intubation was 99.4%, only 113 out of 17,871 cases were failed to be advanced to Ileum (see table 3.3.2.1). The ileal intubation rate increased to be 99.9% when it excluded cancer obstruction cases (see table 3.3.2.3). For the cancer cases, the ileal intubation rate was 70.7% (see table 3.3.2.2). Excluding cancer obstruction cases, the endoscopy could reach the ileum in 99.9% of cases. There were 10 out of 16 failed cases that scope could not be negotiated through stricture.

Table 3.3.2.1 The ileal intubation rate (Overall) (N=17871)

	No. of procedure	Percentage
Fail	112	0.6%
Success	17759	99.4%
Total	17871	100.0%

Table 3.3.2.2 The ileal intubation rate (Cancer cases only) (N=311)

	No. of procedure	Percentage
Fail	91	29.3%
Success	220	70.7%
Total	311	100.0%

Table 3.3.2.3 The ileal intubation rate (Excluding cancer obstruction cases) (N=17560)

	No. of procedure	Percentage
Fail	21[(1)]	0.1%
Success	17539	99.9%
Total	17560[(2)]	100.0%

(1) Overall no. of procedure fails to reach ileum (N=112) deducted cancer obstruction cases (N=91)
(2) Total cases (N=17871) deducted cancer obstruction cases (N=311)

Table 3.3.2.4 The ileal intubation rate by endoscopist (Overall) (N=17871)

Endoscopist	Fail		Success		Total
	No. of procedure	Percentage	No. of procedure	Percentage	
Dr. A	10	0.3%	3453	99.7%	3463
Dr. B	20	0.4%	5643	99.6%	5663
Dr. C	32	0.8%	3971	99.2%	4003
Dr. D	23	0.8%	2751	99.2%	2774
Dr. E	20	2.2%	869	97.8%	889
Dr. H	7	0.6%	1072	99.4%	1079
Total	112	0.6%	17759	99.4%	17871

Note: Two-way ANOVA show significant difference between endoscopists ($p<0.001$), Tukey's post hoc test showed significant difference for Dr. E vs other endoscopists ($p=0.000$~0.001)

When we analysed the data by endoscopist, all endoscopists had ileal intubation rate of over 99% except Dr. E.

After we ignored cancer obstruction cases, all the endoscopists had the ileal intubation rate of over 99.7%.

Table 3.3.2.5 The ileal intubation rate by endoscopist (Excluding cancer obstruction cases) (N=17560)

Endoscopist	Fail		Success		Total
	No. of procedure	Percentage	No. of procedure	Percentage	
Dr. A	1	0.03%	3424	99.97%	3425
Dr. B	6	0.11%	5590	99.89%	5596
Dr. C	7	0.18%	3928	99.82%	3935
Dr. D	3	0.11%	2690	99.89%	2693
Dr. E	2	0.23%	851	99.77%	853
Dr. H	2	0.19%	1056	99.81%	1058
Total	21	0.12%	17539	99.88%	17560

Note: Two-way ANOVA show significant difference between endoscopists ($p=0.015$), Tukey's post hoc test showed no significant differences for Dr. E vs other endoscopists ($p=0.707$~0.902), suggesting that Dr. E's higher failure rate was likely primarily due to the difficulty in managing cases with cancer obstructions

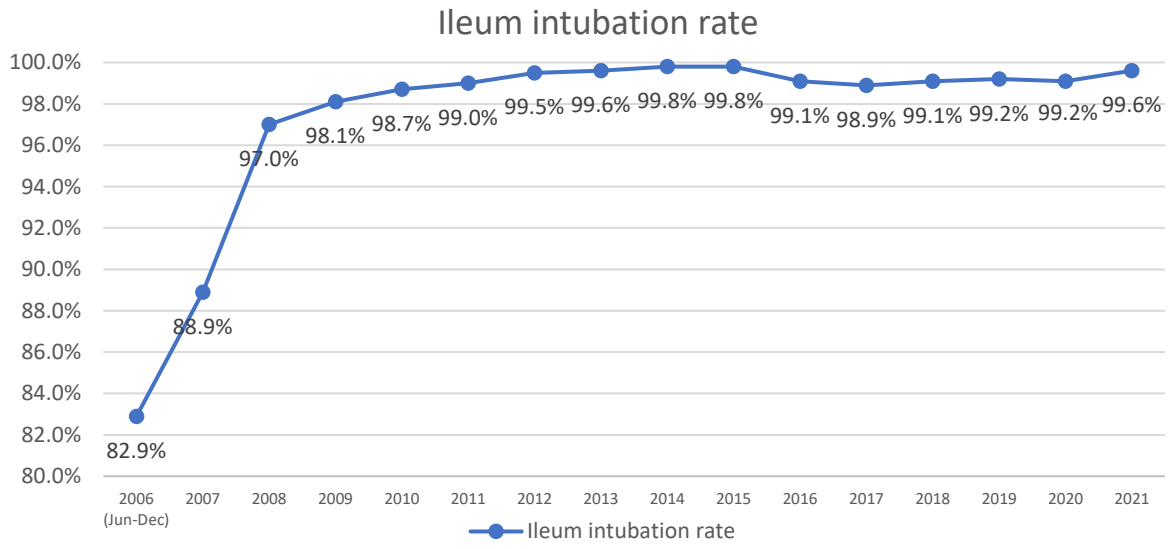
The ileum intubation rate for year between 2019 and 2021 ranged from 99.2% to 99.6%.

Table 3.3.2.6 The ileum intubation rate by procedure year (Overall) (N=17871)

Year	Fail		Success		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
2019	45	0.8%	5962	99.2%	6007	100.0%
2020	41	0.8%	4897	99.2%	4938	100.0%
2021	26	0.4%	6900	99.6%	6926	100.0%
Total	112	0.6%	17759	99.4%	17871	100.0%

Note: Chi-square test showed that two variables are independent (p=0.0568)

Graph 3.3.2.1 The ileum intubation rate by procedure year (Overall)



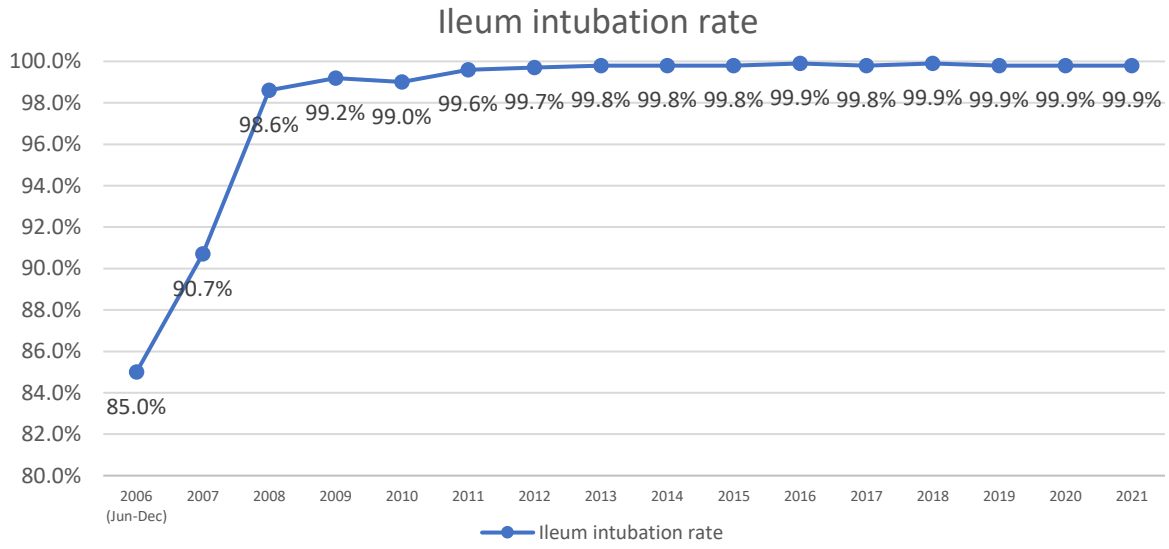
The overall ileum intubation rate increased slightly in 2019-2021 compare with the previous years. However, once the cancer cases were excluded, the ileum intubation rates were similar to the previous years (99.8% ~ 99.9%).

Table 3.3.2.7 The ileum intubation rate by procedure year (Excluding cancer obstruction cases) (N=17560)

Year	Fail		Success		Total		
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	Cancer obstruction case
2019	8	0.1%	5884	99.9%	5892	100%	115
2020	7	0.1%	4823	99.9%	4830	100%	108
2021	6	0.1%	6832	99.9%	6838	100%	88
Total	21	0.1%	17539	99.9%	17560	100%	311

Note: Chi-square test showed that two variables are independent (p=0.874)

Graph 3.3.2.2 The ileum intubation rate by procedure year (Excluding cancer obstruction cases)



3.4. The Morbidity and Operative Mortality Rate

3.4.1. The Operative Mortality Rate

The operative mortality rate describes the mortality happened during procedure or during stay in TSSEC related to our procedure and sedation or in surgery period.

The operative and in-centre mortality rate of TSSEC kept at zero from 2019 to 2021, which was the same as the previous study.

3.4.2. The Perforation Rate

Perforation during colonoscopy is a major complication which will causes peritonitis and put patient at risk. According to ASGE guideline in 2014, the perforation rate should be less than 0.1% as the quality indicator.

No perforation happened during 2019 and 2021 in our centre.

3.4.3. The Post-polypectomy Bleeding Rate

It describes another common complication after polypectomy. The post-polypectomy bleeding referred to the delay bleeding happened > 24 hours, usually at 7-9 days after polypectomy, as a result of submucosal vessel eroded through polypectomy wound. All polypectomy has a satisfactory hemostasis before end of procedure.

There were total of 41 colonoscopy procedures done due to suspect of post-polypectomy bleeding. 33 cases had post-polypectomy bleeding at one polypectomy site, and 3 cases had post-polypectomy bleeding at two polypectomy sites. Total of 39 polypectomy site bleeding in 36 colonoscopy procedures were recorded. The remaining 5 cases did not show any bleeding at polypectomy sites.

The post-polypectomy bleeding rate was 0.09% after each polypectomy or 0.20% after each colonoscopy procedure. All bleeding cases were controlled by endoscopic means.

Table 3.4.3.1 Post-polypectomy bleeding rate by total number of procedure (N=17871)

	No. of procedure	Percentage
With post-polypectomy bleeding	36	0.20%
Without post-polypectomy bleeding	17835	99.80 %
Total	17871	100.0%

Table 3.4.3.2 Post-polypectomy bleeding rate by total number of procedures with polypectomy (N=13189)

	No. of procedure	Percentage
With post-polypectomy bleeding	36	0.27%
Without post-polypectomy bleeding	13153	99.73 %
Total	13189	100.0%

Table 3.4.3.3 Post-polypectomy bleeding rate by total number of polypectomy sites (N=40952)

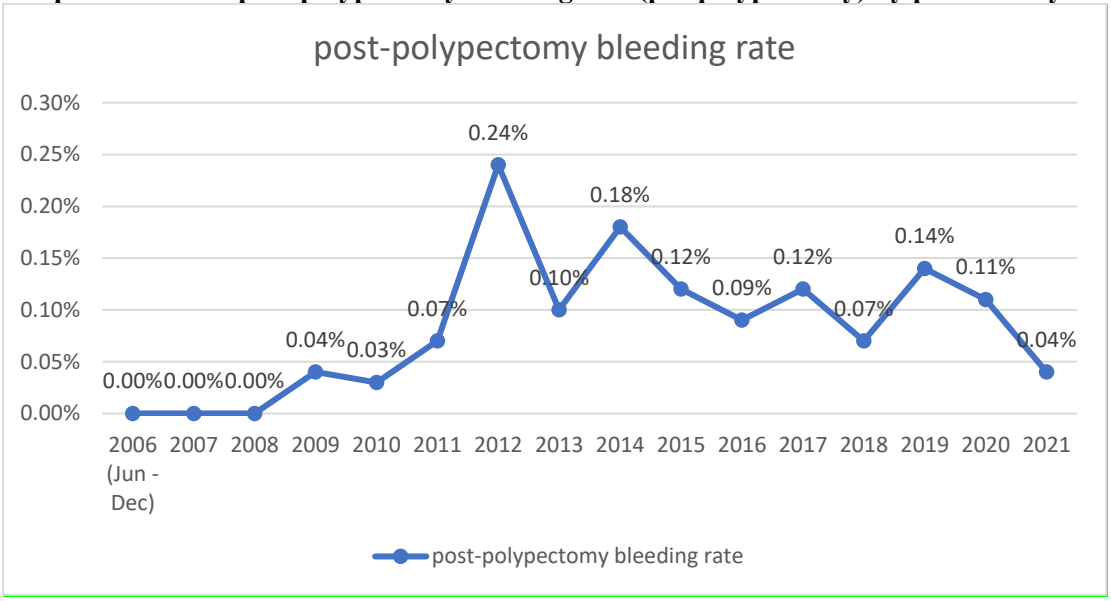
	No. of polypectomy site	Percentage
With bleeding	39	0.10%
Without bleeding	40913	99.90 %
Total	40952	100.0%

Table 3.4.3.4 The post-polypectomy bleeding rate (per polypectomy) by procedure year (N=40952)

	2019		2020		2021	
	No. of polypectomy site	Percentage	No. of polypectomy site	Percentage	No. of polypectomy site	Percentage
With bleeding	19	0.14%	13	0.11%	7	0.04%
Without bleeding	13366	99.86%	11670	99.89%	15877	99.96%
Total	13385	100.0%	11683	100.0%	15884	100.0%

Note: Two-way ANOVA show significant difference between procedure years (p=0.021), Tukey's post hoc test showed significant difference for 2019 vs 2021 (p=0.019)

Graph 3.4.3.1 The post-polypectomy bleeding rate (per polypectomy) by procedure year



Regarding the post-polypectomy bleeding rate of polypectomy sites, the rate decreased from 0.14% to 0.04% from 2019 to 2021.

Table 3.4.3.5 The post-polypectomy bleeding rate (per colonoscopy with or without polypectomy) by procedure year (N=55465)

Year	With bleeding		Without bleeding		Total
	No. of procedure	Percentage	No. of procedure	Percentage	
2006	0	0.00%	41	100.00%	41
2007	0	0.00%	437	100.00%	437
2008	0	0.00%	922	100.00%	922
2009	1	0.06%	1597	99.94%	1598
2010	1	0.06%	1576	99.94%	1577
2011	4	0.16%	2526	99.84%	2530
2012	15	0.56%	2671	99.44%	2686
2013	9	0.29%	3054	99.71%	3063
2014	24	0.62%	3824	99.38%	3848
2015	15	0.35%	4273	99.65%	4288
2016	12	0.24%	4977	99.76%	4989
2017	17	0.31%	5478	99.69%	5495
2018	11	0.18%	6109	99.82%	6120
2019	18	0.30%	5989	99.70%	6007
2020	13	0.26%	4925	99.74%	4938
2021	5	0.07%	6921	99.93%	6926
Total	145	0.26%	55320	99.74%	55465

The above table showed the rate of post-polypectomy bleeding per colonoscopy procedure since 2006. The average rate was 0.26%.

Table 3.4.3.6 The post-polypectomy bleeding rate (per colonoscopy with polypectomy) by procedure year (N=42201)

Year	With bleeding		Without bleeding		Total
	No. of procedure with polypectomy	Percentage	No. of procedure with polypectomy	Percentage	
2006	0	0.00%	21	100.00%	21
2007	0	0.00%	257	100.00%	257
2008	0	0.00%	569	100.00%	569
2009	1	0.11%	946	99.89%	947
2010	1	0.10%	1033	99.90%	1034
2011	4	0.22%	1816	99.78%	1820
2012	15	0.78%	1906	99.22%	1921
2013	9	0.37%	2409	99.63%	2418
2014	24	0.69%	3439	99.31%	3463
2015	15	0.43%	3492	99.57%	3507
2016	12	0.30%	3976	99.70%	3988
2017	17	0.39%	4301	99.61%	4318
2018	11	0.24%	4651	99.76%	4662
2019	18	0.41%	4368	99.59%	4386
2020	13	0.35%	3684	99.65%	3697
2021	5	0.10%	5188	99.90%	5193
Total	145	0.34%	42056	98.26%	42201

When the cases without polypectomy were ignored, the average rate of post-polypectomy bleeding was 0.34%.

Table 3.4.3.7 The post-polypectomy bleeding rate (per polypectomy) by endoscopist by year (N=40950)

		With post-polypectomy bleeding		Without post-polypectomy bleeding		
		No. of polypectomy site	Percentage	No. of polypectomy site	Percentage	Total
Dr. A	2019	6	0.18%	3358	99.82%	3364
	2020	3	0.12%	2406	99.88%	2409
	2021	1	0.06%	1769	99.94%	1770
	total	10	0.13%	7533	99.87%	7543
Dr. B	2019	4	0.10%	4082	99.90%	4086
	2020	4	0.13%	3194	99.87%	3198
	2021	3	0.08%	3798	99.92%	3801
	total	11	0.10%	11074	99.90%	11085
Dr. C	2019	4	0.15%	2610	99.85%	2614
	2020	3	0.09%	3216	99.91%	3219
	2021	1	0.02%	4526	99.98%	4527
	total	8	0.08%	10352	99.92%	10360
Dr. D	2019	3	0.12%	2427	99.88%	2430
	2020	3	0.13%	2287	99.87%	2290
	2021	0	0.00%	3698	100.00%	3698
	total	6	0.07%	8412	99.93%	8418
Dr. E	2019	2	0.22%	889	99.78%	891
	2020	0	0.00%	567	100.00%	567
	total	2	0.14%	1456	99.86%	1458
Dr. H	2021	2	0.10%	2084	99.90%	2086
Total		39	0.10%	40911	99.90%	40950

Dr E (0.14%) had the highest rate of post-polypectomy bleeding among all endoscopists. For year 2021, all endoscopists had achieved post-polypectomy bleeding rate at or lower than 0.1% (less than 1 in 1000 polypectomy sites).

Table 3.4.3.6 Post-polypectomy bleeding site (N=39)

	No. of polypectomy site	Percentage
Ileum	1	2.6%
Caecum	5	12.8%
Ascending Colon	6	15.4%
Transverse Colon	5	12.8%
Descending Colon	5	12.8%
Sigmoid Colon	5	12.8%
Rectum	11	28.2%
Anastomosis	1	2.6%
Total	39	100.0%

Rectum (28.2%) was the most common location where post-polypectomy bleeding occurred.

3.5. Polyp

It is the abnormal growth of epithelial tissue of colon with any protrusion from mucosal surface. There are mainly four types of polyps depends on the cell type constituent of it, namely neoplastic, hyperplastic/metaplastic, peutz-Jehger polyps and juvenile polyps. The neoplastic polyp, which is an adenoma, has the potential to develop into cancer and is considered to be pre-cancerous entity that needed to be removed. Sessile serrated adenoma/lesion (SSA/SSL), a variant between adenoma and hyperplastic polyp, also has cancerous potential that needed to be removed. All suspected adenomatous polyp or suspected SSA will be removed. Polyp which looks obviously to be hyperplastic with or without aid of narrow band imaging (NBI) will not be removed. However, at most of the times, the type of polyp is known only after removal and pathological examination, so that any polyp suspicious to be adenoma was removed.

3.5.1. The Polyp Detection Rate

The polyp detection rate was 74.3% (slightly lower than 78.1% in the previous report), around three fourths of the patients have at least one polyp detected during colonoscopy procedure. There were total of 13,276 colonoscopy procedures done with at least one polyp detected.

Table 3.5.1 The polyp detection rate (N=17871)

	No. of procedure	Percentage
No polyp detected	4595	25.7%
At least one polyp detected / removed	13276	74.3%
Total	17871	100.0%

79.0% male patients had at least one polyp detected during colonoscopy examination, which was significantly higher than that of female (70.8%).

Table 3.5.2 The polyp detection rate by gender group (N=17871)

	Male		Female	
	No. of procedure	Percentage	No. of procedure	Percentage
No polyp detected	1597	21.0%	2998	29.2%
At least one polyp detected / removed	5995	79.0%	7281	70.8%
Total	7592	100.0%	10279	100.0%

Note: Chi-square test showed that two variables are dependent (p=<0.001)

Dr. C and Dr. D had the highest polyp detection rate (79.0%) among all endoscopists from 2019 to 2021. Followed by Dr. A (74.8%) and Dr. B (71.1%).

However, as different endoscopists had patients in quite a different gender ratio. Hence, we separate the dataset by gender and perform analysis again in table 3.5.4 and 3.5.5.

Table 3.5.3 The polyp detection rate by endoscopists (N=17871)

	No polyp detected		At least one polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	874	25.2%	2589	74.8%	3463	100.0%
Dr. B	1637	28.9%	4026	71.1%	5663	100.0%
Dr. C	840	21.0%	3163	79.0%	4003	100.0%
Dr. D	583	21.0%	2191	79.0%	2774	100.0%
Dr. E	326	36.7%	563	63.3%	889	100.0%
Dr. H	335	31.0%	744	69.0%	1079	100.0%
Total	4595	25.7%	13276	74.3%	17871	100.0%

For male patients, polyp detection rate was significantly different between endoscopists.

Table 3.5.4 The polyp detection rate by endoscopists (Male patients only) (N=7592)

	No polyp detected		At least one polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	506	23.4%	1653	76.6%	2159	100.0%
Dr. B	297	21.4%	1092	78.6%	1389	100.0%
Dr. C	187	15.1%	1054	84.9%	1241	100.0%
Dr. D	313	17.7%	1453	82.3%	1766	100.0%
Dr. E	106	27.1%	285	72.9%	391	100.0%
Dr. H	188	29.1%	458	70.9%	646	100.0%
Total	1597	21.0%	5995	79.0%	7592	100.0%

Note: Two-way ANOVA show significant difference between endoscopists ($p<0.001$), Tukey's post hoc test showed Dr. C had significantly higher polyp detection rate than other endoscopists except Dr. D ($p=0.000$~0.001). Additionally, significant difference was shown for Dr. D vs Dr. A, Dr. D, Dr. E and Dr. H respectively ($p=0.000$~0.001) in Tukey's post hoc test

For female patients, polyp detection rate was also significantly different between endoscopists.

Table 3.5.5 The polyp detection rate by endoscopists (Female patients only) (N=10279)

Endoscopist	No polyp detected		At least one polyp detected		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	368	28.2%	936	71.8%	1304	100.0%
Dr. B	1340	31.4%	2934	68.6%	4274	100.0%
Dr. C	653	23.6%	2109	76.4%	2762	100.0%
Dr. D	270	26.8%	738	73.2%	1008	100.0%
Dr. E	220	44.2%	278	55.8%	498	100.0%
Dr. H	147	34.0%	286	66.1%	433	100.0%
Total	2998	29.2%	7281	70.8%	10279	100.0%

Note: Two-way ANOVA show significant difference between endoscopists ($p<0.001$), Tukey's post hoc test showed Dr. E had significantly lower polyp detection rate than other endoscopists ($p=0.000 \sim 0.008$). Additionally, Dr. C was shown to have significantly higher polyp detection rate than other endoscopists except Dr. D ($p=0.000 \sim 0.031$) in Tukey's post hoc test

21.9% patients did not have any polyps during colonoscopy. A majority of 53.1% patients detected 1-3 polyps. 18.6% of patients detected 4-9 polyps, while only 2.6% patients had 10 or more polyps detected.

Graph 3.5.1.1 Cumulative percentage for the number of polyps detected

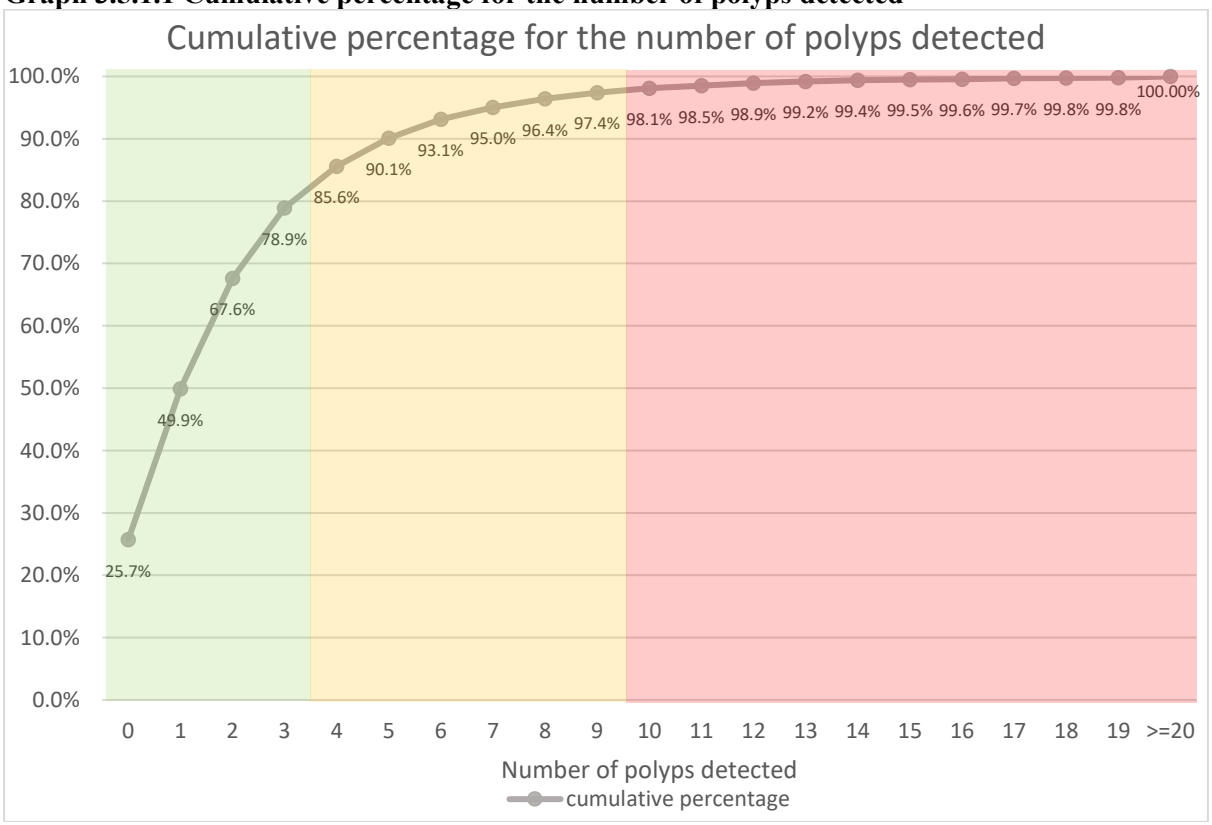


Table 3.5.6 Number of polyps detected (N=17871)

	No. of procedure	Percentage	Cumulative Percentage
No polyp	4595	25.71%	25.71%
At least one polyp detected	13276	74.29%	
Number of polyps:			
1	4325	24.20%	49.92%
2	3152	17.64%	67.55%
3	2021	11.30%	78.86%
4	1202	6.73%	85.58%
5	806	4.51%	90.10%
6	536	3.00%	93.09%
7	334	1.87%	94.96%
8	252	1.41%	96.37%
9	186	1.04%	97.41%
10	120	0.67%	98.09%
11	80	0.45%	98.53%
12	69	0.39%	98.92%
13	51	0.29%	99.21%
14	36	0.20%	99.41%
15	19	0.11%	99.51%
16	19	0.11%	99.62%
17	21	0.12%	99.74%
18	9	0.05%	99.79%
19	4	0.02%	99.81%
20	5	0.03%	99.84%
21	4	0.02%	99.86%
22	6	0.03%	99.89%
23	2	0.01%	99.90%
24	2	0.01%	99.92%
25	2	0.01%	99.93%
26	1	0.01%	99.93%
28	3	0.02%	99.95%
29	1	0.01%	99.96%
30	1	0.01%	99.96%
34	2	0.01%	99.97%
36	2	0.01%	99.98%
46	1	0.01%	99.99%
48	1	0.01%	99.99%
56	1	0.01%	100.00%
Total	17871	100.00%	100.00%

3.6. Adenoma

It is a benign tumour, representing the benign period of a cancer development process, i.e. adenoma-carcinoma sequence. It may develop into cancer in 5-10 years. As long as it was a benign tumour, complete excision with polypectomy can prevent cancer development. Removal of cancer precursor to halt cancer development and to detect early cancer allowing early resection to get better survival were the prime role of colonoscopy in the matter of colorectal cancer treatment and prevention. Adenoma detection rate (ADR) was defined as the rate of at least one adenoma is detected during colonoscopy, which reflects the quality of colonoscopy and performance of endoscopist, it also reflects the incidence of adenoma in our locality.

3.6.1. The Adenoma Detection Rate (ADR)

The American Society for Gastrointestinal Endoscopy (ASGE) recommended that the adenoma detection rate should be at least 25% in order to meet the standard. The higher the adenoma detection rate, implying more patient was prevented from colorectal cancer or arousing more at-risk patient to undertaking future preventive measure; and the end-point is to reduce colorectal cancer and its resulting mortality.

The adenoma detection rate was 56.2% *(2015-2018:* 58.1%*)*, over a half of the patients (10,043 of 17,871 cases) could be detected at least one spot related to adenoma.

Table 3.6.1.1 The adenoma detection rate(N=17871)

	No. of procedure	Percentage
No polyp	4595	25.7%
At least one adenoma polyp detected	10043	56.2%
Non-adenoma polyp / unknown polyp detected	3233	18.1%
Total	17871	100.0%

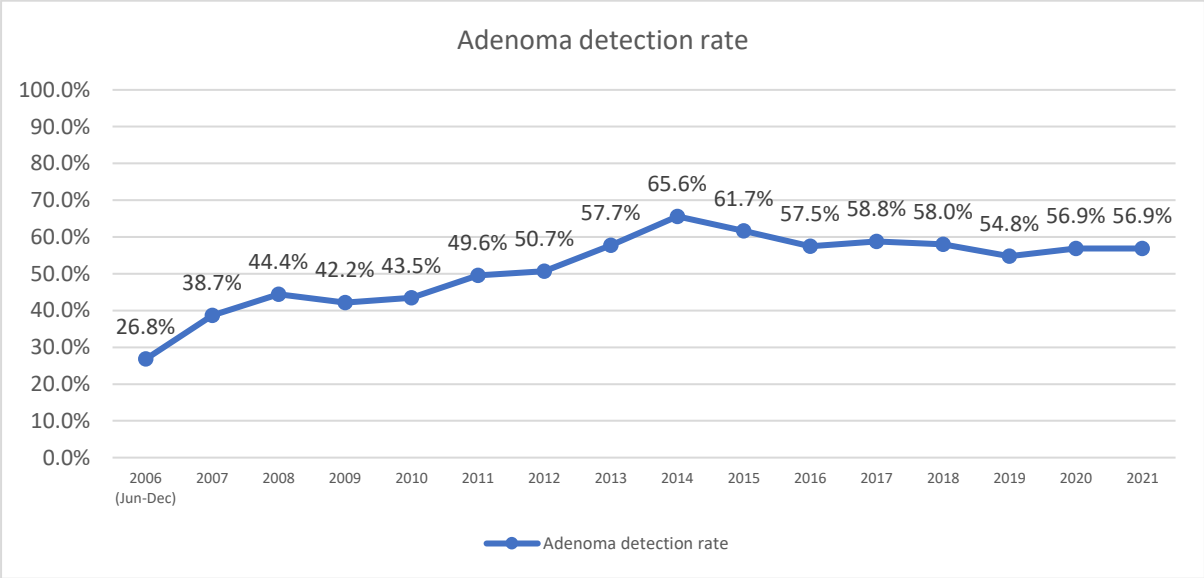
3.6.2. The Adenoma Detection Rate by Procedure Year

The percentage of patient without any polyp detected decreased from 27.0% in 2019 to 25.0% in 2021.

Table 3.6.2.1 The adenoma detection rate by procedure year (N=17871)

Year	No polyp		At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
2019	1621	27.0%	3291	54.8%	1095	18.2%	6007	100.0%
2020	1241	25.1%	2812	56.9%	885	17.9%	4938	100.0%
2021	1733	25.0%	3940	56.9%	1253	18.1%	6926	100.0%
Total	4595	25.7%	10043	56.2%	3233	18.1%	17871	100.0%

Graph 3.6.2.1 The adenoma detection rate by procedure year



Dr. D had the highest adenoma detection rate (64.6%) among all endoscopists from 2019 to 2021. Followed by Dr. A (60.0%) and Dr. C (53.8%).

Table 3.6.2.2 The adenoma detection rate by endoscopists (N=17871)

	No polyp		At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	874	25.2%	2078	60.0%	511	14.8%	3463	100.0%
Dr. B	1637	28.9%	3014	53.2%	1012	17.9%	5663	100.0%
Dr. C	840	21.0%	2154	53.8%	1009	25.2%	4003	100.0%
Dr. D	583	21.0%	1791	64.6%	400	14.4%	2774	100.0%
Dr. E	326	36.7%	438	49.3%	125	14.1%	889	100.0%
Dr. H	335	31.1%	568	52.6%	176	16.3%	1079	100.0%
Total	4595	25.7%	10043	56.2%	3233	18.1%	17871	100.0%

Note: Two-way ANOVA show significant difference between different endoscopists (p=0.001),
Tukey's post hoc test showed significant difference for Dr. D vs other endoscopists (p=0.000~0.004)

For the 13,276 polyp detected cases, the rate of at least one adenoma polyp detected increased from 75.0% in 2019 to 75.9% in 2021, which showed that the chance of having adenoma in each case with polypectomy done kept increased.

ADR among polyp detected cases represent the accuracy that endoscopist can differentiate adenoma from hyperplastic polyp, or represent different level of safety used for fulfilling goal of removal of all suspected adenoma.

Table 3.6.2.3 The ADR by procedure year (excluding no polyp cases) (N=13276)

	At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
Year	No. of procedure with polyp	Percentage	No. of procedure with polyp	Percentage	No. of procedure with polyp	Percentage
2019	3291	75.0%	1095	25.0%	4386	100.0%
2020	2812	76.1%	885	23.9%	3697	100.0%
2021	3940	75.9%	1253	24.1%	5193	100.0%
Total	10043	75.6%	3233	24.4%	13276	100.0%

Note: Two-way ANOVA show no significant differences between years (p=0.506)

3.6.3. The Adenoma Detection Rate by Gender Group

In male population, 62.0% *(2016-2018: 65.1%)* of them were found at least one adenoma polyp, while 51.9% *(2016-2018: 51.9%)* of female patient were found at least one adenoma polyp. Both percentages are lower than that in the previous report.

Table 3.6.3.1 The adenoma rate by gender group (N=17871)

	Male		Female	
Polyp Status	No. of procedure	Percentage	No. of procedure	Percentage
No polyp	1597	21.0%	2998	29.2%
At least one adenoma polyp	4705	62.0%	5338	51.9%
Non-adenoma polyp / unknown polyp detected	1290	17.0%	1943	18.9%
Total	7592	100.0%	10279	100.0%

Note: Two-way ANOVA show significant difference between different gender ($p<0.001$)

Table 3.6.3.2 The adenoma detection rate by endoscopists (Male patient only) (N=7592)

	No polyp		At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A (1)	506	23.4%	1336	61.9%	317	14.7%	2159	100.0%
Dr. B (2)	297	21.4%	858	61.8%	234	16.8%	1389	100.0%
Dr. C (2)	187	15.1%	726	58.5%	328	26.4%	1241	100.0%
Dr. D (1)	313	17.7%	1204	68.2%	249	14.1%	1766	100.0%
Dr. E (2)	106	27.1%	229	58.6%	56	14.3%	391	100.0%
Dr. H (1)	188	29.1%	352	54.5%	106	16.4%	646	100.0%
Total	1597	21.0%	4705	62.0%	1290	17.0%	7592	100.0%

Note: Two-way ANOVA show significant difference between different endoscopists ($p<0.001$),
Tukey's post hoc test showed significant difference for Dr. D vs other endoscopists ($p=0.000$~0.005)
(1) Male endoscopists
(2) Female endoscopists

Table 3.6.3.3 The adenoma detection rate by endoscopists (Female patient only) (N=10279)

Endoscopist	No polyp		At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A (1)	368	28.2%	742	56.9%	194	14.9%	1304	100.0%
Dr. B (2)	1340	31.4%	2156	50.4%	778	18.2%	4274	100.0%
Dr. C (2)	653	23.6%	1428	51.7%	681	24.7%	2762	100.0%
Dr. D (1)	270	26.8%	587	58.2%	151	15.0%	1008	100.0%
Dr. E (2)	220	44.2%	209	42.0%	69	13.9%	498	100.0%
Dr. H (1)	147	34.0%	216	49.8%	70	16.2%	433	100.0%
Total	2998	29.2%	5338	51.9%	1943	18.9%	10279	100.0%

Note: Two-way ANOVA show significant difference between different endoscopists ($p<0.001$), Tukey's post hoc test showed significant difference for Dr. D vs other endoscopists except Dr. A ($p=0.000$~0.039), as well as that for Dr. E vs other endoscopists except Dr. H ($p=0.000$~0.005)

(1) Male endoscopists

(2) Female endoscopists

From data in table 3.6.3.2 and 3.6.3.3, it is observed that male endoscopists had more male patient cases and female endoscopists had more female patient cases in our centre. Gender is one of the factors for polyp detection rate and adenoma detection rate.

3.6.4. The Adenoma Detection Rate by Age Group

For the adenoma detection rate, the adenoma detection rate was increasing with ascending age group. The average number of adenoma polyps detected also increased with increasing age group. For patients older than 50, their adenoma detection rate raised to over 50%. More important fact to point out here is that for patient younger than 50, there was a quite significant percentage of colonoscopy found to have adenoma, even at their 20's and 30's.

Graph 3.6.4.1 The adenoma detection rate by age group

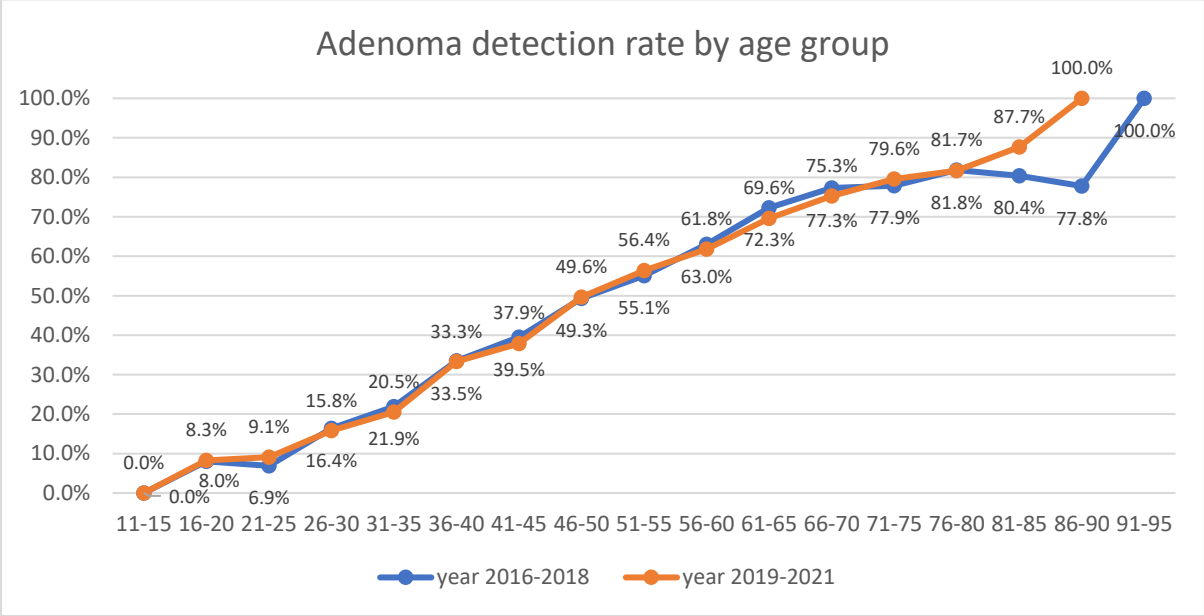


Table 3.6.4.1 The adenoma detection rate by age group (N=17871)

Age group	No polyp		At least one adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Number of Adenoma Polyp		Total
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	Mean	Range	
age 11 - 15	0	0.0%	0	0.0%	1	100.0%	/	/	1
age 16 - 20	48	80.0%	5	8.3%	7	11.7%	1.00	1-1	60
age 21 - 25	149	71.3%	19	9.1%	41	19.6%	1.00	1-1	209
age 26 - 30	280	63.1%	70	15.8%	94	21.2%	1.23	1-3	444
age 31 - 35	430	55.6%	159	20.5%	185	23.9%	1.42	1-7	774
age 36 - 40	469	42.3%	369	33.3%	271	24.4%	1.49	1-7	1109
age 41 - 45	575	39.5%	552	37.9%	328	22.6%	1.64	1-9	1455
age 46 - 50	585	28.6%	1014	49.6%	444	21.7%	1.97	1-34	2043
age 51 - 55	622	23.6%	1486	56.4%	525	19.9%	2.18	1-56	2633
age 56 - 60	649	20.0%	2003	61.8%	589	18.2%	2.34	1-20	3241
age 61 - 65	416	15.9%	1820	69.6%	378	14.5%	2.80	1-21	2614
age 66 - 70	244	12.5%	1465	75.3%	236	12.1%	3.48	1-46	1945
age 71 - 75	101	10.0%	809	79.6%	106	10.4%	3.57	1-22	1015
age 76 - 80	23	8.9%	210	81.7%	24	9.3%	3.70	1-19	257
age 81 - 85	4	6.2%	57	87.7%	4	6.2%	3.56	1-24	65
age 86 - 90	0	0.0%	5	100.0%	0	0.0%	2.40	1-4	5
Total	4595	25.7%	10043	56.2%	3233	18.1%	2.57	1-56	17871

3.6.5. The Size of Adenoma Discovered

With total of there were 25,817 adenoma polyps discovered, 62.0% were within 3mm, 20.9% were 4-5 mm, 10.2% were within 6-9mm. Only 6.9% of them were 10mm or above.

Table 3.6.5.1 Adenoma size (N=25817)

	No. of adenoma	Percentage
Within 3mm	16002	62.0%
4-5mm	5392	20.9%
6-9mm	2639	10.2%
10-14mm	931	3.6%
15-19mm	323	1.3%
20mm or above	530	2.0%
Total	25817	100.0%

3.6.6 The Location of Adenoma Discovered

With total of there are 25,817 adenoma polyps discovered, the top 3 locations with the highest detection rate are ascending colon (27.44%), sigmoid colon (22.10%) and transverse colon (19.08%).

Table 3.6.6.1 Location of adenoma polyp discovered (N=25817)

	No. of adenoma	Percentage
Ileocecal Valve	14	0.05%
Appendix Aperture	4	0.02%
Caecum	2294	8.89%
Ascending Colon	7084	27.44%
Hepatic Flexure	24	0.09%
Transverse Colon	4925	19.08%
Splenic Flexure	2	0.01%
Descending Colon	4078	15.80%
Sigmoid Colon	5705	22.10%
Rectosigmoid Colon	17	0.07%
Rectum	1663	6.44%
Ileum	7	0.03%
Total	25817	100.00%

3.6.7 Detailed Number of Adenomas Detected

There was a slightly decrease in the adenoma detection rate compared with the previous report. The mean number of adenomas detected (N=17,871) were 1.44 *(2016-2018: 1.59)*. The average number of adenoma polyps detected for cases with at least one adenoma polyp detected (N=10,043) were 2.57 *(2016-2018: 2.73)*.

43.8% of patients did not have any adenoma found in colonoscopy examination. 24.4% of patients had 1 adenoma polyp, 13.0% had 2 adenoma polyps and 11.1% had 3-4 adenoma polyps.

Table 3.6.7.1 Number of adenomas detected (N=17871)

	No. of procedure	Percentage	Cumulative Percentage
No polyp	4595	25.71%	25.71%
Non-adenoma polyp / unknown polyp detected	3233	18.09%	43.81%
At least one adenoma polyp detected	10043	56.20%	
Number of adenomas:			
1	4366	24.43%	68.24%
2	2327	13.02%	81.25%
3	1252	7.01%	88.26%
4	725	4.06%	92.32%
5	463	2.59%	94.91%
6	299	1.67%	96.58%
7	172	0.96%	97.54%
8	111	0.62%	98.16%
9	101	0.57%	98.73%
10	61	0.34%	99.07%
11	45	0.25%	99.32%
12	36	0.20%	99.52%
13	25	0.14%	99.66%
14	16	0.09%	99.75%
15	8	0.04%	99.80%
16	8	0.04%	99.84%
17	3	0.02%	99.86%
18	6	0.03%	99.89%
19	3	0.02%	99.91%
20	2	0.01%	99.92%
21	2	0.01%	99.93%
22	2	0.01%	99.94%
23	1	0.01%	99.95%
24	1	0.01%	99.96%
28	1	0.01%	99.96%
29	1	0.01%	99.97%
34	2	0.01%	99.98%
35	1	0.01%	99.98%
36	1	0.01%	99.99%
46	1	0.01%	99.99%
56	1	0.01%	100.00%
Total	17871	100.00%	100.00%

3.6.8 The Adenoma Detection Rate per Polypectomy

The adenoma detection rate per polypectomy is an important indicator to measure the performance of colonoscopy. If the rate is too low, it means that the endoscopist cannot differentiate adenoma accurately. On the other hand, if the rate approaches 100%, it means that polyp is removed only when endoscopist highly confirms that it is an adenoma. This may represent low safety margin, there is a risk of missing adenoma.

From the data collected, there were total 40,952 polyps removed, 63.0% of them were adenoma polyp. The rates (62.0% - 64.6%) were steady during the study period. The result was satisfactory since the rate was just a bit higher than 50%.

Table 3.6.8.1 The adenoma polyp detection rate (per polypectomy) by procedure year (N=40952)

	Adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
Year	No. of polyp	Percentage	No. of polyp	Percentage	No. of polyp	Percentage
2019	8419	62.9%	4966	37.1%	13385	100.0%
2020	7553	64.6%	4130	35.4%	11683	100.0%
2021	9845	62.0%	6039	38.0%	15884	100.0%
Total	25817	63.0%	15135	37.0%	40952	100.0%

Note: Two-way ANOVA show significant difference between different years ($p<0.001$), Tukey's post hoc tests show significant difference for 2019 vs 2020 ($p=0.012$) and 2020 vs 2021 ($p=0.000$)

Among all polyps removed for male patients, 64.5% of them were adenoma polyp. The rate was higher than that in female (61.5%). The result for both groups were satisfactory.

Table 3.6.8.2 The adenoma polyp detection rate (per polypectomy) by gender group (N=40952)

	Male		Female	
Polyp Status	No. of polyp	Percentage	No. of polyp	Percentage
Adenoma polyp	13602	64.5%	12215	61.5%
Non-adenoma polyp / unknown polyp detected	7475	35.5%	7660	38.5%
Total	21077	100.0%	19875	100.0%

Note: Chi-square test showed that two variables are dependent ($p<0.001$)

The adenoma detection rate per polypectomy for all endoscopists ranged from 51.2% to 70.1%. Dr. C (51.2%) had the lowest adenoma detection rate per polypectomy while Dr. E (70.1%) had the highest rate. Majority of our endoscopists had result between 65.2% to 68.7%, which around two-thirds of the polyps removed were diagnosed as adenoma.

Table 3.6.8.3 The adenoma polyp detection rate (per polypectomy) by endoscopists (N=40952)

	Adenoma polyp detected		Non-adenoma polyp / unknown polyp detected		Total	
Endoscopist	No. of polyp	Percentage	No. of polyp	Percentage	No. of polyp	Percentage
Dr. A (1)	5181	68.7%	2362	31.3%	7543	100.0%
Dr. B (2)	7291	65.8%	3794	34.2%	11085	100.0%
Dr. C (2)	5309	51.2%	5051	48.8%	10360	100.0%
Dr. D (1)	5653	67.1%	2767	32.9%	8420	100.0%
Dr. E (2)	1022	70.1%	436	29.9%	1458	100.0%
Dr. H (1)	1361	65.2%	725	34.8%	2086	100.0%
Total	25817	63.0%	15135	37.0%	40952	100.0%

(1) Male endoscopists
(2) Female endoscopists

3.7 Sessile Serrated Adenoma/ Lesion

It is a flat or slightly raised growth in the colon or rectum characterized by a saw-toothed, serrated appearance under a microscope. Typically found in the proximal colon, particularly in the cecum and ascending colon, a sessile serrated adenoma/lesion differs from traditional adenomatous polyps in both morphology and detection challenges, it is often larger and flat, making it difficult to identify during colonoscopy. Considered a precancerous lesion, a sessile serrated adenoma/lesion can progress to colorectal cancer through distinct pathways compared to conventional adenomas and lacks the typical dysplasia associated with them. Due to its potential cancer risk, patients with a sessile serrated adenoma/lesion may require more frequent surveillance and follow-up colonoscopies to monitor for any progression.

3.7.1 The Sessile Serrated Adenoma/ Lesion Detection Rate

The sessile serrated adenoma/lesion detection rate represents the accuracy with which endoscopists can identify these precancerous lesions during screening procedures. A high detection rate indicates the endoscopist's proficiency in recognizing sessile serrated adenomas/lesions, which are often flat and challenging to distinguish from surrounding mucosa. This accuracy is critical for ensuring the appropriate removal of all suspected sessile serrated adenomas/lesions, as incomplete removal can lead to potential cancer development. Additionally, the detection rate of sessile serrated adenomas/lesions reflects the level of safety and thoroughness in colonoscopy practices, fulfilling the goal of comprehensive surveillance for colorectal lesions. By effectively identifying sessile serrated adenomas/lesions, endoscopists can significantly reduce the risk of colorectal cancer and improve patient outcomes, underscoring the importance of this detection rate in clinical practice.

The sessile serrated adenoma/lesion detection rate was 1.5%. There were total of 273 colonoscopy procedures done with at least one sessile serrated adenoma/lesion detected.

Table 3.7.1.1 The sessile serrated adenoma/lesion detection rate(N=17871)

	No. of procedure	Percentage
No polyp	4595	25.7%
At least one sessile serrated adenoma/lesion detected	273	1.5%
Non-sessile serrated adenoma/lesion / unknown polyp detected	13003	72.8%
Total	17871	100.0%

3.7.2 The Sessile Serrated Adenoma/ Lesion Detection Rate by Procedure Year

The percentage of patient with at least one sessile serrated adenoma/lesion detected decreased from 1.7% in 2019 to 1.3% in 2021.

Table 3.7.2.1 The sessile serrated adenoma/lesion detection rate by procedure year (N=17871)

	No polyp		At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Year	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
2019	1621	27.0%	100	1.7%	4286	71.4%	6007	100.0%
2020	1241	25.1%	85	1.7%	3612	73.1%	4938	100.0%
2021	1733	25.0%	88	1.3%	5105	73.7%	6926	100.0%
Total	4595	25.7%	273	1.5%	13003	72.8%	17871	100.0%

Dr. D had the highest sessile serrated adenoma/lesion detection rate (2.5%) among all endoscopists from 2019 to 2021. Followed by Dr. E (1.7%) and Dr. A (1.5%).

Table 3.7.2.2 The sessile serrated adenoma/lesion detection rate by endoscopists (N=17871)

	No polyp		At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A	874	25.2%	52	1.5%	2537	73.3%	3463	100.0%
Dr. B	1637	28.9%	63	1.1%	3963	70.0%	5663	100.0%
Dr. C	840	21.0%	59	1.5%	3104	77.5%	4003	100.0%
Dr. D	583	21.0%	68	2.5%	2123	76.5%	2774	100.0%
Dr. E	326	36.7%	15	1.7%	548	61.6%	889	100.0%
Dr. H	335	31.1%	16	1.5%	728	67.4%	1079	100.0%
Total	4595	25.7%	273	1.5%	13003	72.8%	17871	100.0%

Note: Two-way ANOVA show significant difference between endoscopists ($p<0.001$), Tukey's post hoc test showed significant difference for Dr. D vs Dr. A, Dr. B and Dr. C respectively ($p=0.000 \sim 0.028$)

For the 13,276 polyp detected cases, the rate of at least one sessile serrated adenoma/lesion detected decreased from 2.3% in 2019 to 1.7% in 2021, which showed that the chance of having sessile serrated adenoma/lesion in each case with polypectomy done kept decreased.

Table 3.7.2.3 The sessile serrated adenoma/lesion detection rate by procedure year (Excluding no polyp cases) (N=13276)

	At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Year	No. of procedure with polyp	Percentage	No. of procedure with polyp	Percentage	No. of procedure with polyp	Percentage
2019	100	2.3%	4286	97.7%	4386	100.0%
2020	85	2.3%	3612	97.7%	3697	100.0%
2021	88	1.7%	5105	98.3%	5193	100.0%
Total	273	2.1%	13003	97.9%	13276	100.0%

Note: Two-way ANOVA show no significant difference between years (p=0.063)

3.7.3 The Sessile Serrated Adenoma/ Lesion Detection Rate by Gender Group

In male population, 1.6% of them were found at least one sessile serrated adenoma/lesion, while 1.5% of female patient were found at least one sessile serrated adenoma/lesion.

Table 3.7.3.1 The sessile serrated adenoma/lesion detection rate by gender group (N=17871)

	Male		Female	
Polyp Status	No. of procedure	Percentage	No. of procedure	Percentage
No polyp	1597	21.04%	2998	29.17%
At least one sessile serrated adenoma/lesion	123	1.62%	150	1.46%
Non-sessile serrated adenoma/lesion / unknown polyp detected	5872	77.34%	7131	69.37%
Total	7592	100.00%	10279	100.00%

Note: Two-way ANOVA show no significant difference between different gender (p=0.386)

From data in table 3.7.3.2 and 3.7.3.3, it is observed that the sessile serrated adenoma/lesion detection rates were similar between male (1.6%) and female (1.5%) patients, suggesting comparable prevalence across genders. However, there was notable variability among endoscopists, with detection rates ranging from 0.8% to 2.4% in male patients and 1.1% to 2.6% in female patients. Dr. D consistently demonstrated the highest detection rates for both genders (2.4% for male patients and 2.6% for female patients), potentially indicating superior skills or more thorough examination techniques. Interestingly, some endoscopists showed marked differences in their detection rates between male and female patients, which could be attributed to gender-specific factors.

Table 3.7.3.2 The sessile serrated adenoma/lesion detection rate by endoscopists (Male patient only) (N=7592)

	No polyp		At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A (1)	506	23.4%	29	1.3%	1624	75.2%	2159	100.0%
Dr. B (2)	297	21.4%	14	1.0%	1078	77.6%	1389	100.0%
Dr. C (2)	187	15.1%	28	2.3%	1026	82.7%	1241	100.0%
Dr. D (1)	313	17.7%	42	2.4%	1411	79.9%	1766	100.0%
Dr. E (2)	106	27.1%	5	1.3%	280	71.6%	391	100.0%
Dr. H (1)	188	29.1%	5	0.8%	453	70.1%	646	100.0%
Total	1597	21.0%	123	1.6%	5872	77.3%	7592	100.0%

Note: Two-way ANOVA show significant difference between different endoscopists (p=0.004), Tukey's post hoc test showed significant difference for Dr. B vs Dr. D (p=0.030)

(1) Male endoscopists

(2) Female endoscopists

Table 3.7.3.3 The sessile serrated adenoma/lesion detection rate by endoscopists (Female patient only) (N=10279)

	No polyp		At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Endoscopist	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage
Dr. A (1)	368	28.2%	23	1.8%	913	70.0%	1304	100.0%
Dr. B (2)	1340	31.4%	49	1.1%	2885	67.5%	4274	100.0%
Dr. C (2)	653	23.6%	31	1.1%	2078	75.2%	2762	100.0%
Dr. D (1)	270	26.8%	26	2.6%	712	70.6%	1008	100.0%
Dr. E (2)	220	44.2%	10	2.0%	268	53.8%	498	100.0%
Dr. H (1)	147	34.0%	11	2.5%	275	63.4%	433	100.0%
Total	2998	29.2%	150	1.5%	7131	69.4%	10279	100.0%

Note: Two-way ANOVA show significant difference between different endoscopists (p=0.002), Tukey's post hoc test showed significant difference for Dr. D vs Dr. B and Dr. C respectively (p=0.008,0.012)

(1) Male endoscopists

(2) Female endoscopists

3.7.4 The Sessile Serrated Adenoma/ Lesion Detection Rate by Age Group

There is an age-related increase in sessile serrated adenoma/lesion detection rates, particularly among older age groups. Notably, the detection rate is 0% for individuals aged 11-25, indicating that sessile serrated adenomas/lesions are extremely rare or not detected in younger populations. From age 26 onwards, there is a gradual increase in detection rates in most middle-age groups, with a sharp rise observed in the oldest age categories. These findings suggest that continued screening or surveillance for older adults, particularly those over 80, may be warranted, challenging some current guidelines that recommend ceasing screening at a certain age. This highlights the importance of age as a critical risk factor for these potentially precancerous lesions.

Graph 3.7.4.1 The sessile serrated adenoma/lesion detection rate by age group

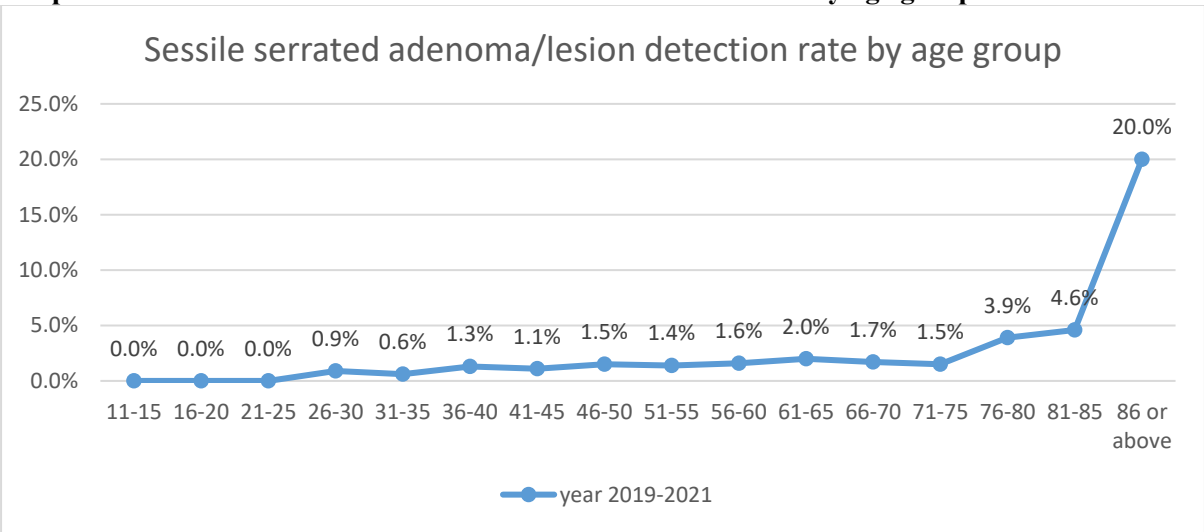


Table 3.7.4.1 The sessile serrated adenoma/lesion detection rate by age group (N=17871)

Age group	No polyp		At least one sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Number of Sessile serrated adenoma/lesion		Total
	No. of procedure	Percentage	No. of procedure	Percentage	No. of procedure	Percentage	Mean	Range	
age 11 - 15	0	0.0%	0	0.0%	1	100.0%	/	/	1
age 16 - 20	48	80.0%	0	0.0%	12	20.0%	/	/	60
age 21 - 25	149	71.3%	0	0.0%	60	28.7%	/	/	209
age 26 - 30	280	63.1%	4	0.9%	160	36.0%	1.00	1-1	444
age 31 - 35	430	55.6%	5	0.6%	339	43.8%	1.00	1-1	774
age 36 - 40	469	42.3%	14	1.3%	626	56.4%	1.07	1-2	1109
age 41 - 45	575	39.5%	16	1.1%	864	59.4%	1.13	1-2	1455
age 46 - 50	585	28.6%	30	1.5%	1428	69.9%	1.17	1-3	2043
age 51 - 55	622	23.6%	37	1.4%	1974	75.0%	1.27	1-3	2633
age 56 - 60	649	20.0%	53	1.6%	2539	78.3%	1.70	1-3	3241
age 61 - 65	416	15.9%	52	2.0%	2146	82.1%	1.19	1-6	2614
age 66 - 70	244	12.5%	33	1.7%	1668	85.8%	1.33	1-5	1945
age 71 - 75	101	10.0%	15	1.5%	900	88.6%	1.27	1-3	1016
age 76 - 80	23	8.9%	10	3.9%	224	87.2%	1.40	1-3	257
age 81 - 85	4	6.2%	3	4.6%	58	89.2%	1.00	1-1	65
age 86 - 90	0	0.0%	1	20.0%	4	80.0%	1.00	1-1	5
Total	4595	25.7%	273	1.5%	13003	72.8%	1.21	1-6	17871

3.7.5 The Size of Sessile Serrated Adenoma/ Lesion Discovered

Over a half (57.6%) of the detected sessile serrated adenomas/lesions are within 5mm. Medium-sized sessile serrated adenomas/lesions, ranging from 6-9mm and 10-14mm, collectively comprising about one-third (32.8%) of all sessile serrated adenomas/lesions. Larger sessile serrated adenomas/lesions are less common, with a mere 9.7% reaching 15mm or above. This size distribution has important clinical implications, as smaller sessile serrated adenomas/lesions can be more challenging to detect during colonoscopy, potentially leading to missed lesions. The predominance of smaller sessile serrated adenomas/lesions underscores the need for high-quality endoscopic techniques and equipment to ensure adequate detection. Conversely, while larger sessile serrated adenomas/lesions are less frequent, they may pose a higher risk of malignant transformation and require more aggressive management. This data emphasizes the importance of thorough examination techniques to identify smaller, more prevalent sessile serrated adenomas/lesions, while also highlighting the need for vigilance in detecting the less common but potentially more dangerous larger lesions.

Table 3.7.5.1 Sessile serrated adenoma/lesion size (N=330)

	No. of sessile serrated adenoma/lesion	Percentage
Within 3mm	105	31.8%
4-5mm	85	25.8%
6-9mm	53	16.1%
10-14mm	55	16.7%
15-19mm	19	5.8%
20mm or above	13	3.9%
Total	330	100.0%

3.7.6 The Location of Sessile Serrated Adenoma/ Lesion Discovered

The data reveals a clear predilection for certain locations. The ascending colon emerges as the most common site for sessile serrated adenomas/lesions, accounting for over one-third (34.24%) of all cases, followed by the sigmoid colon (19.39%) and the caecum (16.97%). This distribution pattern underscores the importance of thorough examination of the proximal colon during colonoscopy, as over half of all sessile serrated adenomas/lesions are found in the ascending colon and caecum combined. These findings have important implications for colonoscopy techniques and training, suggesting that extra attention should be paid to the right side of the colon to ensure optimal detection of sessile serrated adenomas/lesions, while not neglecting other areas where these lesions can occur.

Table 3.7.6.1 Location of Sessile serrated adenoma/lesion discovered (N=330)

	No. of sessile serrated adenoma/lesion	Percentage
Appendix Aperture	1	0.30%
Caecum	56	16.97%
Ascending Colon	113	34.24%
Hepatic Flexure	1	0.30%
Transverse Colon	31	9.39%
Splenic Flexure	1	0.30%
Descending Colon	19	5.76%
Sigmoid Colon	64	19.39%
Rectum	44	13.33%
Total	330	100.00%

3.7.7 Detailed Number of Sessile Serrated Adenomas/ Lesions Detected

The majority of procedures that detected sessile serrated adenomas/lesions identified only a single lesion, with 230 out of 273 cases with detected sessile serrated adenomas/lesions falling into this category. This data indicates that the occurrence of multiple sessile serrated adenomas/lesions within the same individual is relatively rare, underscoring the typically solitary nature of these lesions in affected patients.

Table 3.7.7.1 Number of sessile serrated adenomas/lesions detected (N=17871)

	No. of procedure	Percentage	Cumulative Percentage
No polyp	4595	25.71%	25.71%
Non-sessile serrated adenoma/lesion / unknown polyp detected	13003	72.76%	98.47%
At least one sessile serrated adenoma/lesion detected	273	1.53%	
Number of sessile serrated adenomas/lesions:			
1	230	1.29%	99.76%
2	34	0.19%	99.95%
3	7	0.04%	99.99%
5	1	0.01%	99.99%
6	1	0.01%	99.99%
Total	17871	100.00%	100.00%

3.7.8 The Sessile Serrated Adenoma/ Lesion Detection Rate per Polypectomy

The sessile serrated adenoma/lesion detection rate per polypectomy is a critical quality indicator for colonoscopy, as it provides valuable insights into the effectiveness of endoscopists in accurately identifying and removing these lesions. A low detection rate may suggest endoscopists are struggling to recognize sessile serrated adenomas/lesions, potentially leading to missed lesions and increased interval cancer risk, while a high rate of non-adenoma polyp/sessile serrated lesion removed could indicate over-diagnosis or excessive polyp removal, raising concerns about resource utilization.

The data reveals a declining trend in sessile serrated adenoma/lesion detection rates from 2019 to 2021 (1.0% - 0.6%), with 330 sessile serrated adenomas/lesions identified out of 40,952 polyps removed.

Table 3.7.8.1 The sessile serrated adenoma/lesion detection rate (per polypectomy) by procedure year (N=40952)

	Sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Year	No. of polyp	Percentage	No. of polyp	Percentage	No. of polyp	Percentage
2019	128	1.0%	13257	99.0%	13385	100.0%
2020	99	0.8%	11584	99.2%	11683	100.0%
2021	103	0.6%	15781	99.4%	15884	100.0%
Total	330	0.8%	40622	99.2%	40952	100.0%

Note: Two-way ANOVA show significant difference between years (p=0.012), Tukey's post hoc tests show significant difference for 2019 vs 2021 (p=0.010).

The marginally higher sessile serrated adenoma/lesion detection rate in females (0.2% difference compared to males) suggests a slightly increased prevalence of sessile serrated adenomas/lesions in women, or potentially a small difference in detection sensitivity between genders.

Table 3.7.8.2 The sessile serrated adenoma/lesion detection rate (per polypectomy) by gender group (N=40952)

	Male		Female	
Polyp Status	No. of polyp	Percentage	No. of polyp	Percentage
Sessile serrated adenoma/lesion	153	0.7%	177	0.9%
Non-sessile serrated adenoma/lesion / unknown polyp detected	20924	99.3%	19698	99.1%
Total	21077	100.0%	19875	100.0%

Note: Chi-square test showed that two variables are independent (p=0.070)

The sessile serrated adenoma/lesion detection rate per polypectomy for all endoscopists ranged from 0.7% to 1.1%. Dr. C (0.7%) had the lowest sessile serrated adenoma/lesion detection rate while Dr. E (1.1%) had the highest sessile serrated adenoma/lesion detection rate.

Table 3.7.8.3 The sessile serrated adenoma/lesion detection rate (per polypectomy) by endoscopists (N=40952)

	Sessile serrated adenoma/lesion detected		Non-sessile serrated adenoma/lesion / unknown polyp detected		Total	
Endoscopist	No. of polyp	Percentage	No. of polyp	Percentage	No. of polyp	Percentage
Dr. A (1)	68	0.9%	7475	99.1%	7543	100.0%
Dr. B (2)	75	0.7%	11010	99.3%	11085	100.0%
Dr. C (2)	70	0.7%	10290	99.3%	10360	100.0%
Dr. D (1)	82	1.0%	8338	99.0%	8420	100.0%
Dr. E (2)	16	1.1%	1442	98.9%	1458	100.0%
Dr. H (1)	19	0.9%	2067	99.1%	2086	100.0%
Total	330	0.8%	40622	99.2%	40952	100.0%

(1) Male endoscopists
(2) Female endoscopists

Table 3.7.8.4 Number of adenomas detected in overall cases by endoscopists (N=17871)

Endoscopist	No. of sessile serrated adenoma/lesion detected	No. of sessile serrated adenoma/lesion detected per procedure	No. of adenoma detected	No. of adenoma detected per procedure	Total no. of procedure
Dr. A	68	0.02	5181	1.50	3463
Dr. B	75	0.01	7291	1.29	5663
Dr. C	70	0.02	5309	1.33	4003
Dr. D	82	0.03	5653	2.04	2774
Dr. E	16	0.02	1022	1.15	889
Dr. H	19	0.02	1361	1.26	1079
Total	330	0.02	25817	1.44	17871

3.8 Cancer

Adenocarcinoma, which is the most common type of cancerous growth in colon and rectum, is the type that we refer as colonic or rectal cancer. Most of them are developed from an adenoma while some are from sessile serrated polyp (through alternative pathway). It can rarely be developed de-novo (without polyp stage). It can invade and spread to the organ, and cause death eventually. It needs a radical resection which is the resection of cancer segment and related lymph node area. Some may require additional chemotherapy and/or radiotherapy. Even with complete resection, there are still about 30% chance of recurrence and subsequent death.

3.8.1 Cancer Detection Rate

For the cancer detection rate, no cancer detected for 98.3% cases, while 1.7% cases detected at least one cancer in the colonoscopy procedure.

Table 3.8.1.1 The cancer detection rate (N=17871)

	No. of procedure	Percentage
No Cancer detected	17560	98.3%
Cancer Detected	311	1.7%
Total	17871	100.0%

2.1% *(2016-2018: 3.2%)* of male patients detected cancer during the colonoscopy examination while the rate for female patients is 1.5% *(2016-2018: 1.9%)*. Both rates are lower than that in the previous report.

Table 3.8.1.2 The cancer detection rate by gender group (N=17871)

	Male		Female	
	No. of procedure	Percentage	No. of procedure	Percentage
No Cancer detected	7432	97.9%	10128	98.5%
Cancer Detected	160	2.1%	151	1.5%
Total	7592	100.0%	10279	100.0%

Note: Chi-square test showed that two variables are dependent ($p<0.001$)

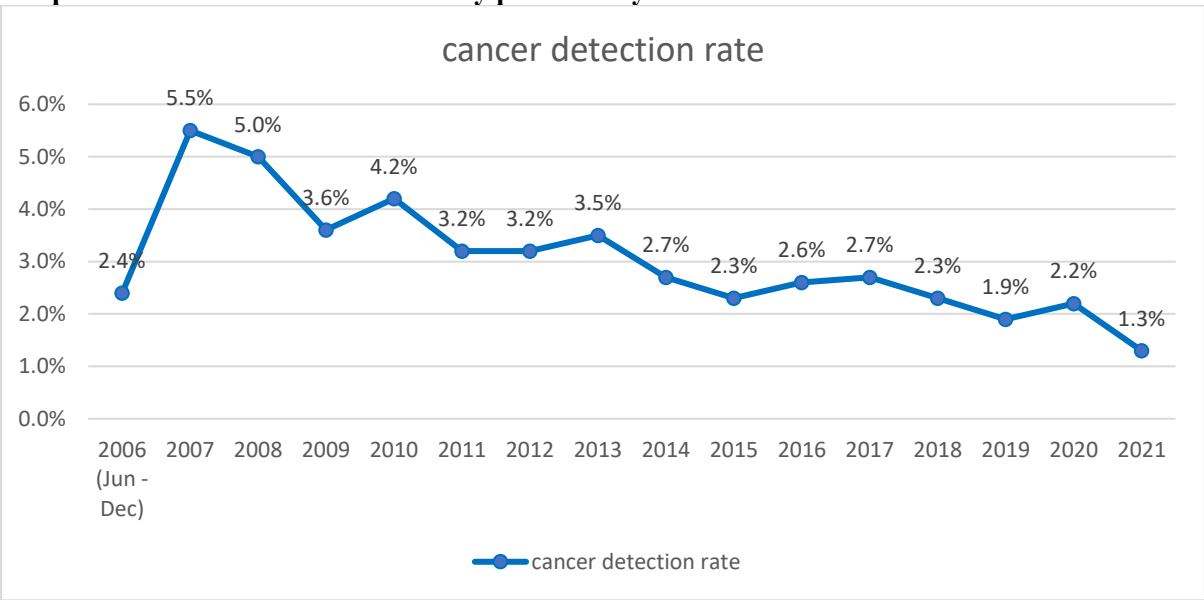
During the study period, the cancer detection rate is the lowest in 2021, with only 1.3% patients detected cancer during colonoscopy examination.

Table 3.8.1.3 Cancer detection rate by procedure year (N=17871)

Year	No Cancer detected		Cancer Detected	
	No. of procedure	Percentage	No. of procedure	Percentage
2019	5892	98.1%	115	1.9%
2020	4830	97.8%	108	2.2%
2021	6838	98.7%	88	1.3%
Total	17560	98.3%	311	1.7%

Note: Chi-square test showed that two variables are dependent ($p<0.001$)

Graph 3.8.1.1 Cancer detection rate by procedure year

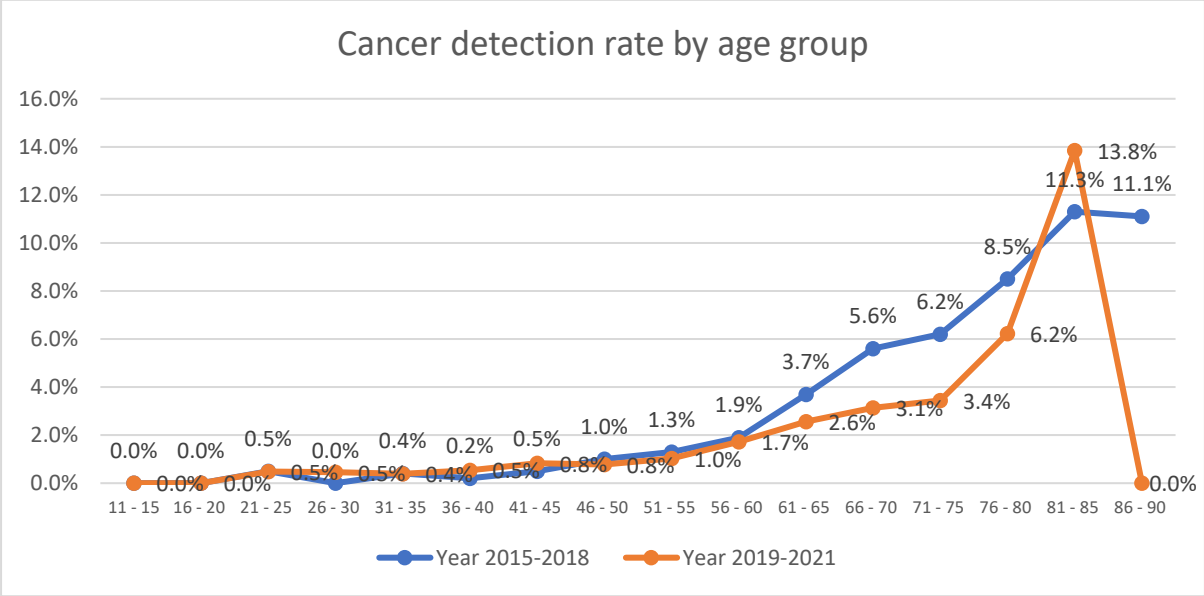


The age group with highest cancer detection rate is “age 81-85”, with 13.8% patients detected cancer. Followed by “age 76-80” and “age 71-75”, with 6.2% and 3.4% respectively.

Table 3.8.1.4 Cancer detection rate by age group (N=17871)

	No Cancer detected		Cancer Detected (2019 - 2021)		Cancer Detected (2016-2018)	Difference
Age group	No. of procedure	Percentage	No. of procedure	Percentage	Percentage	Percentage
age 11 - 15	1	100.0%	0	0.0%	0.0%	0.0%
age 16 - 20	60	100.0%	0	0.0%	0.0%	0.0%
age 21 - 25	208	99.5%	1	0.5%	0.5%	0.0%
age 26 - 30	442	99.5%	2	0.5%	0.0%	0.5%
age 31 - 35	771	99.6%	3	0.4%	0.4%	0.0%
age 36 - 40	1103	99.5%	6	0.5%	0.2%	0.3%
age 41 - 45	1443	99.2%	12	0.8%	0.5%	0.3%
age 46 - 50	2027	99.2%	16	0.8%	1.0%	-0.2%
age 51 - 55	2606	99.0%	27	1.0%	1.3%	-0.3%
age 56 - 60	3185	98.3%	56	1.7%	1.9%	-0.2%
age 61 - 65	2547	97.4%	67	2.6%	3.7%	-1.1%
age 66 - 70	1884	96.9%	61	3.1%	5.6%	-2.5%
age 71 - 75	981	96.6%	35	3.4%	6.2%	-2.8%
age 76 - 80	241	93.8%	16	6.2%	8.5%	-2.3%
age 81 - 85	56	86.2%	9	13.8%	11.3%	2.5%
age 86 - 90	5	100.0%	0	0.0%	11.1%	-11.1%
age 91 - 95	0	0.0%	0	0.0%	0.0%	0.0%
Total	17560	98.3%	311	1.7%	2.5%	-0.8%

Graph 3.8.1.2 Cancer detection rate by age group



3.8.2 Cancer Location

From the 311 patients with cancer detected during the endoscopy process, a total of 319 cancer sites were identified. A majority of 39.5% cancer was detected at rectum, followed by 34.8% of cancer was detected at sigmoid colon.

Table 3.8.2.1 Cancer location (N=319)

	No. of cancer site	Percentage
Ileocecal Valve	1	0.3%
Caecum	5	1.6%
Ascending Colon	22	6.9%
Hepatic Flexure	6	1.9%
Transverse Colon	17	5.3%
Splenic Flexure	1	0.3%
Descending Colon	18	5.6%
Sigmoid Colon	111	34.8%
Rectosigmoid Colon	8	2.5%
Rectum	126	39.5%
Anal Canal	4	1.3%
Total	319	100.0%

Remark: One patient may have multiple cancer sites

Table 3.8.2.2 Cancer location by procedure year (N=319)

	2019		2020		2021	
	No. of cancer site	Percentage	No. of cancer site	Percentage	No. of cancer site	Percentage
Ileocecal Valve	0	0.0%	0	0.0%	1	1.1%
Caecum	1	0.9%	3	2.6%	1	1.1%
Ascending Colon	7	6.4%	5	4.3%	10	10.5%
Hepatic Flexure	2	1.8%	2	1.7%	2	2.1%
Transverse Colon	7	6.4%	7	6.1%	3	3.2%
Splenic Flexure	0	0.0%	0	0.0%	1	1.1%
Descending Colon	7	6.4%	7	6.1%	4	4.2%
Sigmoid Colon	40	36.7%	38	33.0%	33	34.7%
Rectosigmoid Colon	3	2.8%	2	1.7%	3	3.2%
Rectum	42	38.5%	51	44.3%	33	34.7%
Anal Canal	0	0.0%	0	0.0%	4	4.2%
Total	109	100.0%	115	100.0%	95	100.0%

4 Discussion and Conclusion

Our present audit showed that our colonoscopy performance in various parameters including bowel preparation, caecal intubation rate, ileal intubation rate, ADR, morbidity and mortality was kept up to level of our last audit result and the guideline of international standards from American Society for Gastrointestinal Endoscopy (ASGE)[3] and European Society for Gastrointestinal Endoscopy (ESGE)[4]

The bowel preparation result showed our nursing staff had been doing satisfactory work on following bowel preparation program and on conveying information to our patient. Performance of all our present endoscopists was similarly satisfactory.

ADR as the main indicator of our colonoscopy service performance was contributed by multiple factors including incidence of adenoma in our population, age, gender, attitude/culture of endoscopists and assisting staff, and technological improvement. Our ADR was slightly lower than last audit (58.1% in 2016-2018), but still kept at high level of 56.2% that may represent incidence of adenoma in our patient remained high. Another factor we considered paramount to maintain level of ADR is attitude and culture of endoscopists and assisting nursing staff on thorough scrutiny and removal all adenoma as possible. Technology improvement of endoscopy and instrument also play a role in improving ADR, especially new model of endoscopy system with high resolution, long focus range, high refresh rate and various filter function.

Morbidly and mortality was acceptably low in this audit. Training and credentialing of medical staff, equipment and its maintenance, resuscitation, infective control were factors that we need to considered in our management to further reduce morbidity and mortality.

To sum up with service performance in our present audit, our clinical performance was up to standard. All our present endoscopists performed similarly satisfactorily. Area need improvement included time slot arrangement in high variability in length of procedure in view of many patients need polypectomy and further reduction of post-polypectomy bleeding rate. Area needs to take attention for colonoscopies includes: high rate of adenoma at ascending colon and new recognized precancerous lesion SSL; both require longer time and more careful screening.

[3] ASGE.(2014). Quality indicators for GI endoscopic procedures - complete set. https://www.asge.org/docs/default-source/education/practice_guidelines/doc-2014_quality_in_endoscopy_set.pdf

[4] ESGE.(2019). Performance measures for small-bowel endoscopy: a European Society of Gastrointestinal Endoscopy (ESGE) Quality Improvement Initiative. https://www.esge.com/performance-measures-for-small-bowel-endoscopy/

Table 4.1.1 Result comparison with international standards

Quality Indicator	ASGE (2014)	ESGE (2019)	TSSEC result (2006 - 2015)	TSSEC result (2016 - 2018)	TSSEC result (2019 - 2021)
Rate of appropriate bowel preparation	> 85%	> 95%	99.7%	99.6%	99.9%
Caecal intubation rate	> 90%	> 90%	99.5%	99.3%	99.4%
Perforation rate	< 0.1%	Not mentioned	0.0095%	0%	0%
Post-polypectomy bleeding rate	< 1%	Not mentioned	0.40%	0.24%	0.27%
Adenoma detection rate	> 25%	> 25%	54.8%	58.1%	56.2%

In our audit data, we pick up some important finding about our patient colorectal health that may need to be noticed

From the previous audit data, there was a rising trend of ADR from 2006 to 2014 with peak of 64.5% in 2014. The trend seems to plateau off in our 2016-2018 audit at about 58%, and slightly reduced in the present audit to 56.2%. This level was still considered as alarmingly high, which may reflect incidence of adenoma in our population was similarly high. However, our data did not separate symptomatic patient from asymptomatic screening patient, which may not be able to imply directly to the population.

The overall cancer rate continued to decrease to 1.7% from year 2019 to 2021 (Table 3.8.1.1) with 1.3 % in 2021 in the present audit (Graph 3.8.1.1). The decreasing trend of cancer detection was most likely related to increased colonoscopy and polypectomy of adenoma in our population. Screening program and arousal of population for colonoscopy play important roles. However, ADR remained at high level of over 56%, effort on promoting colonoscopy for symptomatic patient and screening program need to continue.