



# A delay in the diagnosis of colorectal cancer screened by fecal immunochemical tests during the COVID-19 pandemic: a longitudinal cohort study

Fumiaki Ishibashi<sup>1,2</sup> · Dai Shida<sup>3</sup> · Sho Suzuki<sup>1</sup> · Mizuki Nagai<sup>1</sup> · Kentaro Mochida<sup>1</sup> · Tetsuo Morishita<sup>1</sup>

Accepted: 16 October 2022 / Published online: 16 November 2022

© The Author(s), under exclusive licence to Springer-Verlag GmbH Germany, part of Springer Nature 2022

## Abstract

**Purpose** There is concern that the COVID-19 pandemic may cause people to refrain from undergoing examination resulting in delayed detection of colorectal cancer (CRC). The purpose of this study was to investigate whether there was a delay in CRC detection due to withholding of screening.

**Methods** The colonoscopy screening rate and the CRC detection rate were calculated for patients who underwent fecal immunochemical tests (FITs) from 2018 to 2021 in the longitudinal cohort. The stages of CRC cases detected as a result of positive FIT in each year were compared.

**Results** A total of 39,521 patients were initially screened by FIT over a 4-year period. The FIT-positive rate was 4.7% (441/9,349) in 2018, 4.6% (420/9,156) in 2019, 4.9% (453/9,255) in 2020, and 4.3% (504/11,760) in 2021. The colonoscopy screening rate for positive FIT results was lower in 2020 than in 2019 (25.8% vs. 38.1%,  $P < 0.001$ ), and higher in 2021 than in 2020 (56.7% vs. 25.8%,  $P < 0.001$ ). The CRC detection rate among colonoscopy recipients was higher in 2021 than in 2020 (13% vs. 4%,  $P = 0.014$ ). Stage 1 or higher CRC accounted for 25.0% (1/4) in 2020, and 78% (18/23) in 2021. Among the CRC cases detected each year, 1 (14%), 1 (25%), and 10 (43%) did not undergo colonoscopy despite positive FIT results in the previous year.

**Conclusions** The COVID-19 pandemic has reduced the detection of CRC by screening colonoscopy following FIT and might have led to a delay in the detection of CRC.

**Keywords** Colorectal cancer · Fecal immunochemical test · Colonoscopy · COVID-19

## Introduction

Colorectal cancer (CRC) is the second leading cause of cancer death in the United States and other countries [1, 2]. Combining fecal immunochemical tests (FITs) and colonoscopy or sigmoidoscopy is one of the recommendation by US Preventive Services Task Force for the early detection of CRC [3]. The most significant concern about this screening strategy is that the detection of CRC is absolutely

affected by FIT-positive patients' willingness to undergo colonoscopy. In fact, the low colonoscopy visit rate among FIT-positive patients is a serious problem [4, 5]. During the coronavirus disease 2019 (COVID-19) pandemic, which began in December 2019, the colonoscopy visit rate of FIT-positive patients has been further reduced, which may delay the detection of CRC. In fact, it has been reported that the COVID-19 pandemic has led to a significant decrease in the number of colonoscopies and reportedly fewer cases of CRC detected [6, 7]. This study was a longitudinal cohort study designed to investigate colonoscopy visit rates and CRCs detected during the COVID-19 pandemic.

## Materials and methods

This retrospective longitudinal cohort study investigated the proportion of FIT-positive patients who underwent colonoscopy and the CRC detection rate. Patients who

✉ Fumiaki Ishibashi  
ishibashi-gast@iuhw.ac.jp

<sup>1</sup> Department of Gastroenterology, International University of Health and Welfare Ichikawa Hospital, 6-1-14, Konodai, Ichikawa-shi, Chiba 272-0827, Japan

<sup>2</sup> Endoscopy Center, Koganei Tsurukame Clinic, 6-14-28, Honcho, Koganei-shi, Tokyo 184-0004, Japan

<sup>3</sup> Division of Frontier Surgery, The Institute of Medical Science, The University of Tokyo, Tokyo, Japan

underwent a CRC screening program by FITs in the Tama area of Tokyo (a suburb located in the western part of central Tokyo) during the respective periods of January to December 2018, 2019, 2020, and 2021 were included. The primary screening program for CRC by FITs was a public program supported by the Tama District administration, and the testing was available during a six-month period from July to December each year. Citizens over the age of 40 were considered eligible for this screening program. FITs were performed using the twofold method, and negative or positive results were reported by mailing a report to the examinee's home. Patients with at least one positive FIT were instructed to undergo a colonoscopy within three months for reimbursement. A list of FIT-positive individuals was compiled using a centrally managed database. The FIT-positive patients were followed up by medical record review or telephone call to determine whether they had undergone a colonoscopy within 3 months of receiving a FIT. If the patients underwent colonoscopy, they were also surveyed to determine whether advanced adenoma (> 10 mm in size, histologically high-grade adenoma, or villous type adenoma) and CRC were detected. If CRC was detected, CRC staging was confirmed based on the final

pathology diagnosis of the endoscopically or surgically resected specimen. Intramucosal carcinoma was classified as Stage 0 according to the American Joint Committee on Cancer TNM system [8]. A Student t-test was used to compare continuous variables. A Chi-square test or Fisher's exact test was used to compare categorical variables appropriately.  $P < 0.05$  was considered statistically significant. All statistical analyses were performed using R 4.0.4 [9]. This study was approved by the Institutional Review Board of Shinjuku Tsurukame Clinic on February 8, 2022 (Approval number: 2202).

## Results

In 2018, 2019, 2020, and 2021, respectively, 9,349, 9,156, 9,255, and 11,760 patients in this cohort received FITs, with no decrease in FITs received by year (Table 1). There were no significant differences in patient background or number of FITs received. The number (rate) of FIT-positive patients in each year did not differ, 441 (4.7%), 420 (4.6%), 453 (4.9%), and 504 (4.3%). However, the screening rates by colonoscopy among the FIT-positive

**Table 1** Characteristics of the patients who received FITs

Year	2018	2019	2020	2021	P value	
					2019 vs 2020	2020 vs 2021
<b>Baseline characteristics of patients who received FITs</b>	(n=9349)	(n=9156)	(n=9255)	(n=11,760)		
Age (median year, IQR)	48 (42–56)	48 (42–56)	49 (42–56)	49 (42–56)	$P=0.903$	$P=0.921$
Sex						
Male	4147	4064	4095	5193	$P=0.860$	$P=0.909$
Female	5202	5092	5160	6567		
Patients with positive FITs (%)	441 (4.7%)	420 (4.6%)	453 (4.9%)	504 (4.3%)	$P=0.344$	$P=0.039$
Patients receiving a FIT for the first time in the past 5 years (%)	2089 (22.3%)	1959 (21.4%)	3132 (33.8%)	3677 (31.3%)	$P < 0.001$	$P < 0.001$
Patients who received a FIT for two consecutive years (%)	7260 (77.7%)	7197 (78.6%)	6123 (66.2%)	8083 (68.7%)	$P < 0.001$	$P < 0.001$
Patients who received a FIT for three consecutive years (%)	4736 (40.0%)	3685 (40.2%)	3914 (42.3%)	5084 (43.2%)	$P=0.005$	$P=0.176$
<b>Characteristics among the patients with a positive FIT</b>	(n=441)	(n=420)	(n=453)	(n=504)		
Patients who underwent colonoscopy (%)	182 (41.2%)	160 (38.1%)	117 (25.8%)	286 (56.7%)	$P < 0.001$	$P < 0.001$
Patients who underwent their first colonoscopy within 4 years (%)	135 (30.6%)	128 (30.4%)	108 (23.8%)	172 (34.1%)	$P=0.033$	$P < 0.001$
<b>Characteristics among the patients who underwent colonoscopy</b>	(n=135)	(n=128)	(n=108)	(n=172)		
Advanced adenomas detected (%)	15 (11%)	19 (15%)	11 (10%)	43 (25%)	$P=0.382$	$P=0.004$
Colorectal cancers detected (%)	5 (4%)	7 (6%)	4 (4%)	23 (13%)	$P=0.741$	$P=0.014$
Stage of colorectal cancers detected					$P=0.277$	$P=0.031$
Stage 0	3 (60%)	4 (57%)	3 (75%)	5 (22%)		
Stage 1,2	1 (20%)	2 (29%)	0 (0%)	12 (52%)		
Stage 3,4	1 (20%)	1 (14%)	1 (25%)	6 (26%)		

FIT fecal immunochemical test

patients decreased in 2020 from 2019 (25.8% vs 38.1%,  $P < 0.001$ ) and increased in 2021 from 2020 (56.7% vs 25.8%,  $P < 0.001$ ). The advanced adenoma detection rate was significantly higher in 2021 than in 2020 (25% vs. 10%,  $P = 0.004$ ). Also, the CRC detection rate was significantly higher in 2021 than in 2020 (13% vs 4%,  $P = 0.014$ ). Stage 1 or higher CRC accounted for 25.0% (1/4) in 2020, and 78% (18/23) in 2021. The proportion of CRCs at stage 1 or higher was higher in 2021 than in 2019 ( $P = 0.031$ ) whereas there was no difference between 2019 and 2020 ( $P = 0.277$ ). Among the CRC cases detected each year, 1 (14%), 1 (25%), and 10 (43%) did not undergo colonoscopy despite positive FIT results in the previous year.

## Discussion

Previous studies have reported a decrease in the number of screenings by colonoscopy and changes in the detection rate of CRC during the COVID-19 pandemic compared to before the pandemic [10, 11]. As far as we know, this is the first report investigating the actual status of CRC screening by FITs before, during, and after the COVID-19 pandemic. The strength of this study is that comparison of CRC data after the COVID-19 pandemic with during the pandemic within the same cohort allowed estimation of whether there was a delay in CRC detection. In Japan, the first wave of the pandemic hit in January–March 2020, and a declaration of a state of emergency was issued in Tokyo in April. The declaration was sustained intermittently thereafter until the end of 2020, and people were encouraged by the government to take the minimum necessary course of action. In this cohort, 2019 can be positioned as the year in which COVID-19 had no impact, 2020 as the year in which behavioral restrictions due to the COVID-19 pandemic were strong, and 2021 as the year in which the behavioral restrictions were lifted. Interestingly, initial screening by FITs had a low threshold for being performed and the number of tests did not decrease in 2020, while colonoscopy was avoided, resulting in a significant decrease in visits. In 2021, the rate of colonoscopy visits increased, and the rate of CRC detection also increased, perhaps as a reaction to refraining from receiving an examination in the previous year. Importantly, most CRCs detected in 2021 were found at stage 1 or above, and 10 patients (43.5%) were thought to have delayed diagnosis due to not undergoing colonoscopy despite being FIT-positive in 2020. It is concerned that, if these 10 patients had undergone screening colonoscopy in 2020, their CRC might have been detected at a lower stage. The

advanced adenoma detection rate also decreased in 2020 and increased in 2021, suggesting a similar trend for pre-cancerous lesions. The problem with CRC screening by FITs is that the accuracy varies greatly depending on how much the colonoscopy visit rate as a secondary analysis can be increased.

## Conclusion

The longitudinal cohort study revealed that the COVID-19 pandemic in 2020 has reduced the detection of CRC by screening colonoscopy following FIT and subsequently increased the detection of CRC in 2021. Changes in the trend of colonoscopy visits might have resulted in an increase in the number of CRCs with Stage 1 or higher in 2021.

**Author contribution** FI and SS designed the study. FI and DS acquired the data. FI and SS processed the data and performed the statistical analyses. FI, DS, MN, KM and SS interpreted the data. TM supervised the whole project. FI wrote the manuscript.

## Declarations

**Conflict of interest** The authors declare no competing interests.

## References

1. Siegel RL, Miller KD, Goding SA et al (2020) Colorectal cancer statistics, 2020. *CA Cancer J Clin* 70:145–164
2. Saito Y, Oka S, Kawamura T et al (2021) Colonoscopy screening and surveillance guidelines. *Dig Endosc* 33:486–519
3. US Preventive Services Task Force, Davidson KW, Barry MJ, Mangione CM et al (2021) screening for colorectal cancer: US Preventive Services Task Force Recommendation Statement. *JAMA* 325:1965–1977
4. Forbes N, Hilsden RJ, Martel M et al (2021) Association between time to colonoscopy after positive fecal testing and colorectal cancer outcomes: a systematic review. *Clin Gastroenterol Hepatol* 19:1344–1354
5. Mutneja HR, Bhurwal A, Arora S et al (2021) A delay in colonoscopy after positive fecal tests leads to higher incidence of colorectal cancer: A systematic review and meta-analysis. *J Gastroenterol Hepatol* 36:1479–1486
6. Leeds JS, Awadelkarim B, Dipper C et al (2021) Effect of the SARS-CoV2 Pandemic on endoscopy provision - the impact of compliance with national guidance. *Expert Rev Gastroenterol Hepatol* 15:459–464
7. Rutter MD, Brookes M, Lee TJ et al (2021) Impact of the COVID-19 pandemic on UK endoscopic activity and cancer detection: a National Endoscopy Database Analysis. *Gut* 70:537–543
8. Amin MB, Edge SB, Greene FL et al (2017) *AJCC Cancer Staging Manual*, 8th edn. Springer, New York
9. R Core Team. A language and environment for statistical computing. R Foundation for Statistical Computing, Vienna, Austria. <https://www.R-project.org/>

10. Randle HJ, Gorin A, Manem N et al (2022) Colonoscopy screening and surveillance disparities during the COVID-19 pandemic. *Cancer Epidemiol* 80:102212
11. Lou J, Kooragayala K, Williams JP et al (2022) The early impact of the COVID-19 pandemic on lung, colorectal, and breast cancer screening and treatment at a tertiary cancer center. *Am J Clin Oncol* 45:381–390

**Publisher's Note** Springer Nature remains neutral with regard to jurisdictional claims in published maps and institutional affiliations.