



# Early Colorectal Cancer Detection by Machine Learning Model Using Allianz Life Insurance Malaysia Claim Data 2012-2021

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Mentor:

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Internship Duration:

(10/3/2022 – 19/8/2022)

# Purpose of the Study & Objectives

## AIM

The aim of this project is to predict and identify clients who are at high risk of getting colorectal cancer, by using machine learning algorithm.

## Objectives



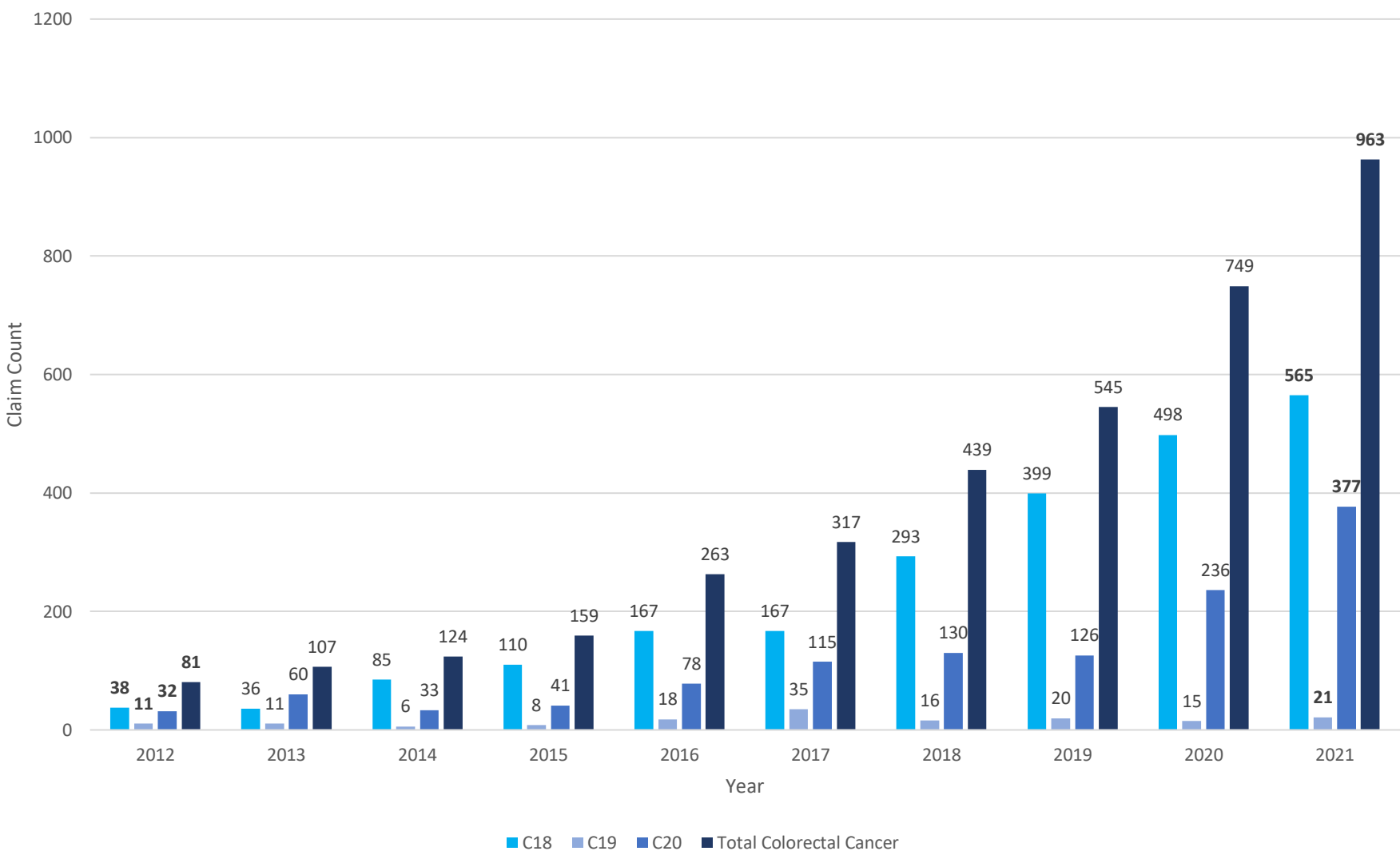
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graph LR; A((Objectives)) --> B[To analyze claims made for colorectal cancer between the year 2012 to 2021.]; A --> C[To analyze the common pattern exist among the clients who are diagnosed with colorectal cancer.]; A --> D[To find the suitable decision threshold value based on the selected machine learning model for optimal accuracy.];
```

To analyze claims made for colorectal cancer between the year 2012 to 2021.

To analyze the common pattern exist among the clients who are diagnosed with colorectal cancer.

To find the suitable decision threshold value based on the selected machine learning model for optimal accuracy.

# Total Claim Count for Colorectal Cancer



From 2020 to  
2021:

29%

Increase

Average:

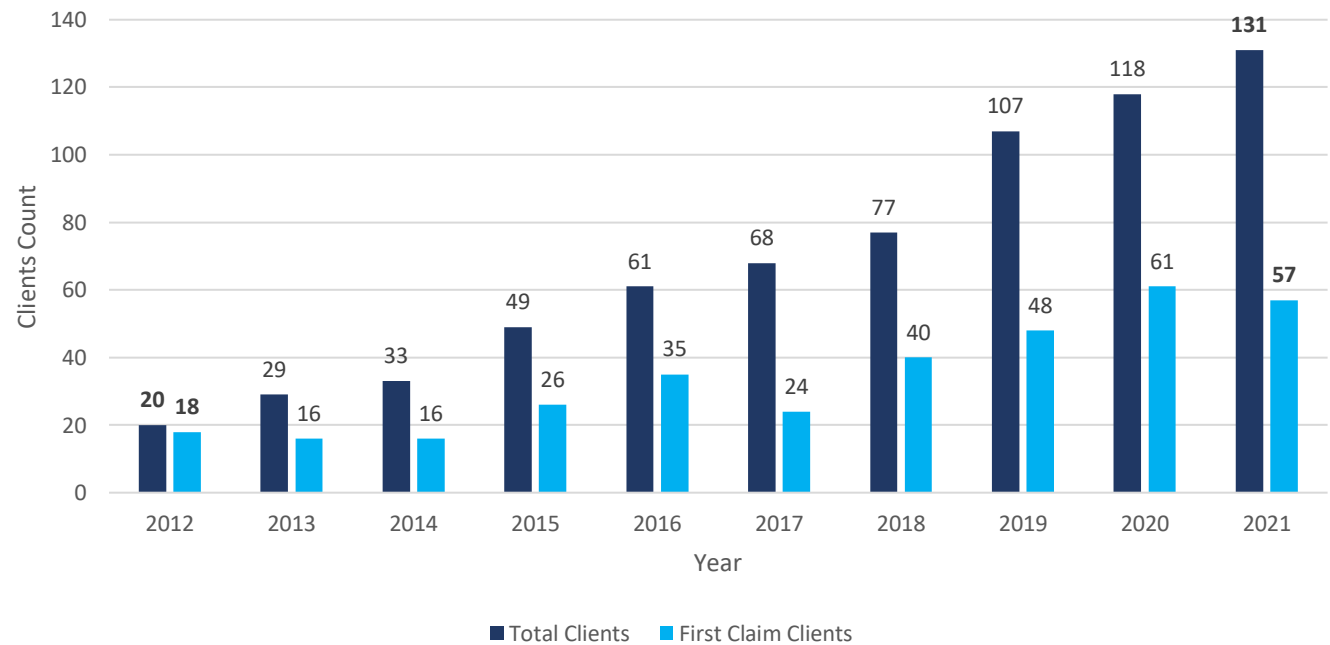
31%

Increase

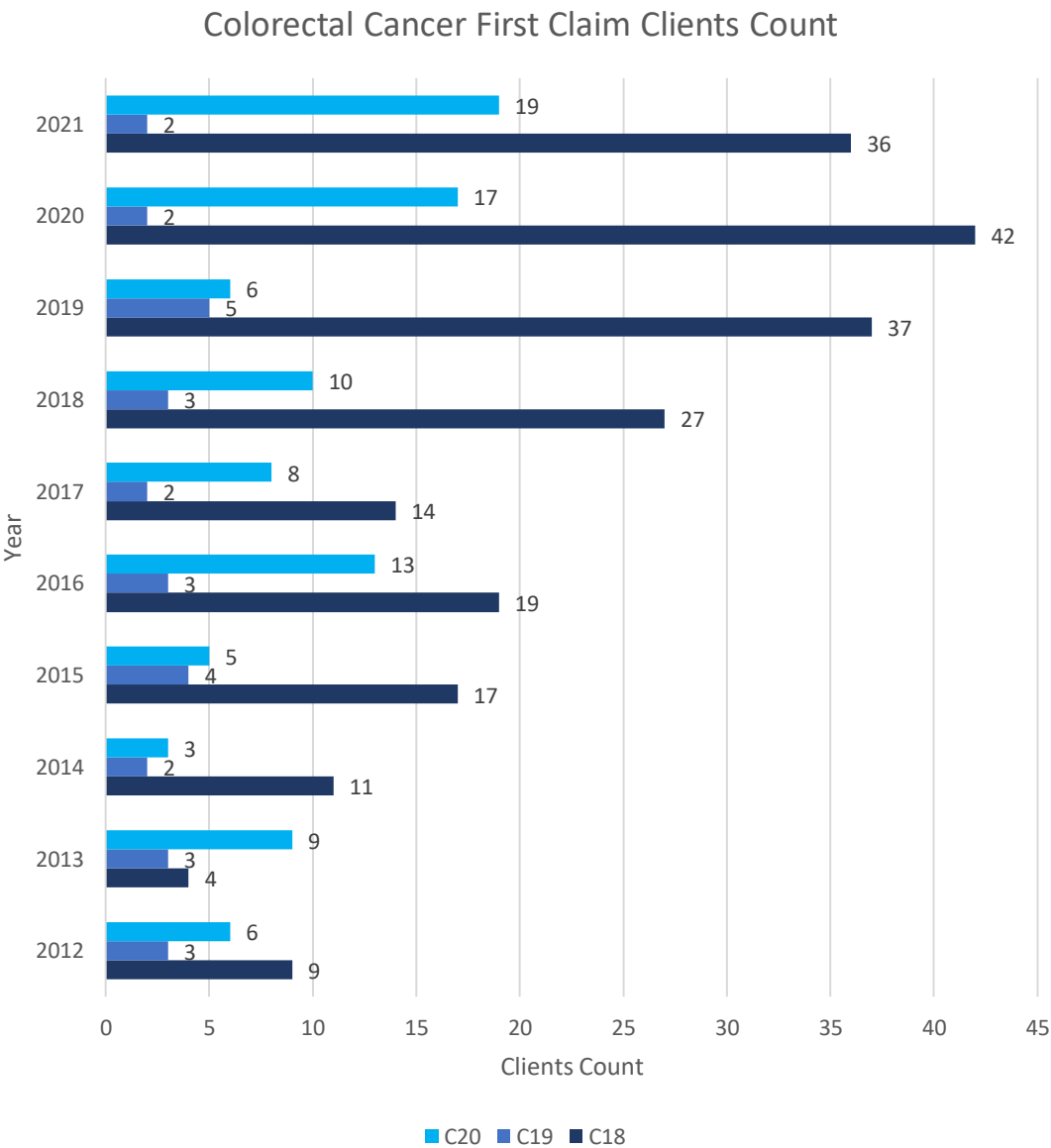
## ICD-10 Reference

C18: Malignant Neoplasm of Colon  
C19: Malignant Neoplasm of Rectosigmoid Junction  
C20: Malignant Neoplasm of Rectum

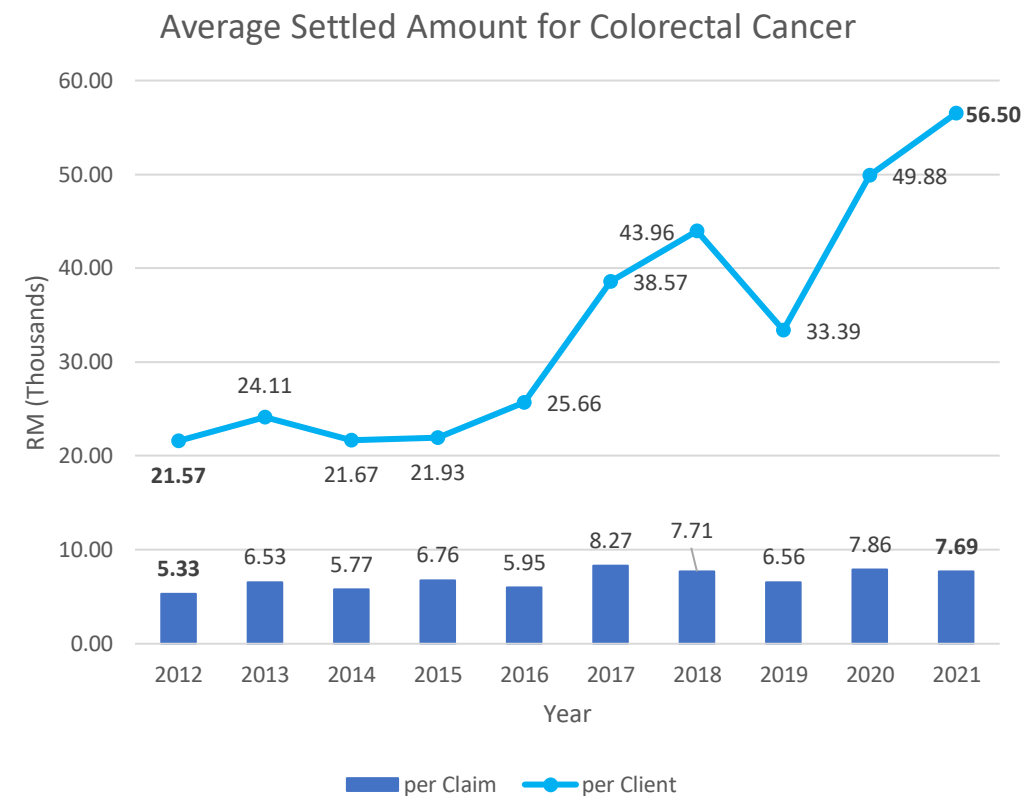
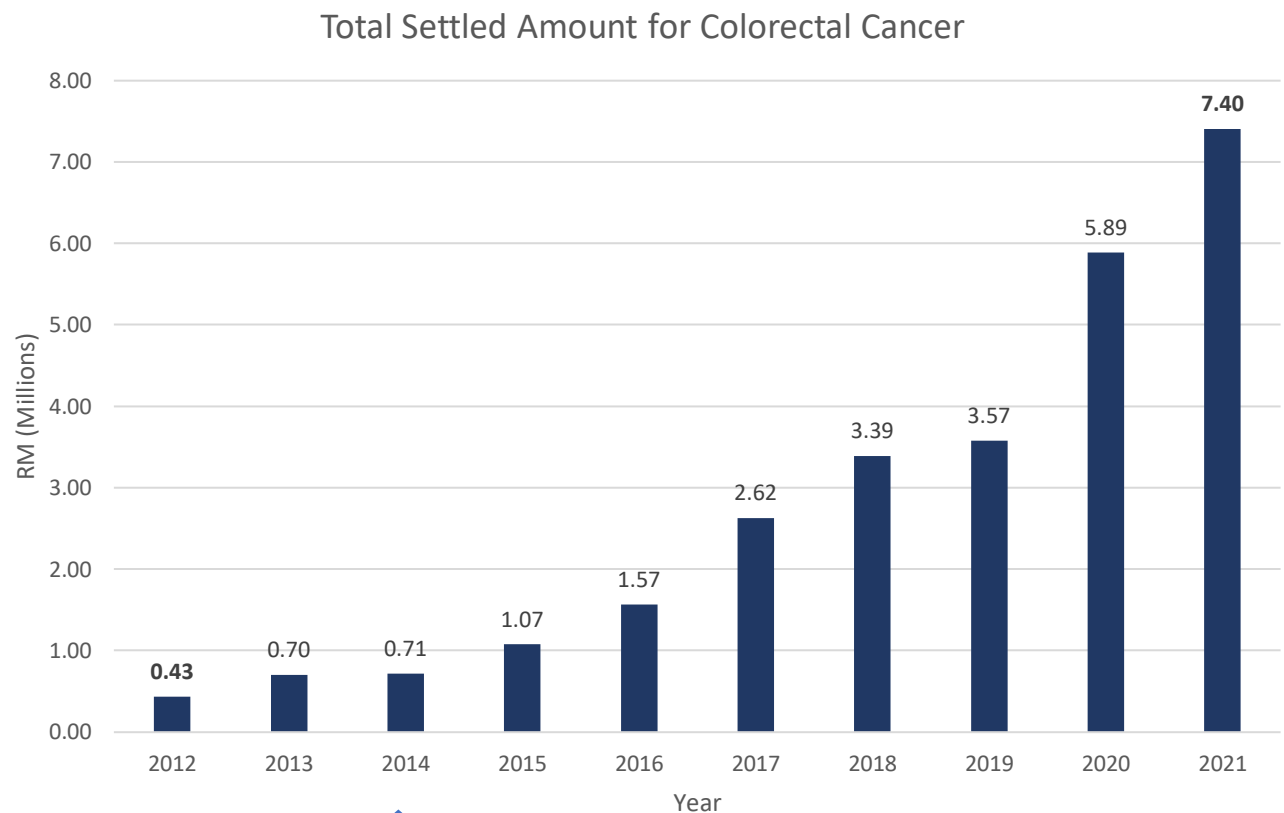
# Total Clients & First Claim Clients Count for Colorectal Cancer



**ICD-10 Reference**  
C18: Malignant Neoplasm of Colon  
C19: Malignant Neoplasm of Rectosigmoid Junction  
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# Total & Average Settled Amount for Colorectal Cancer

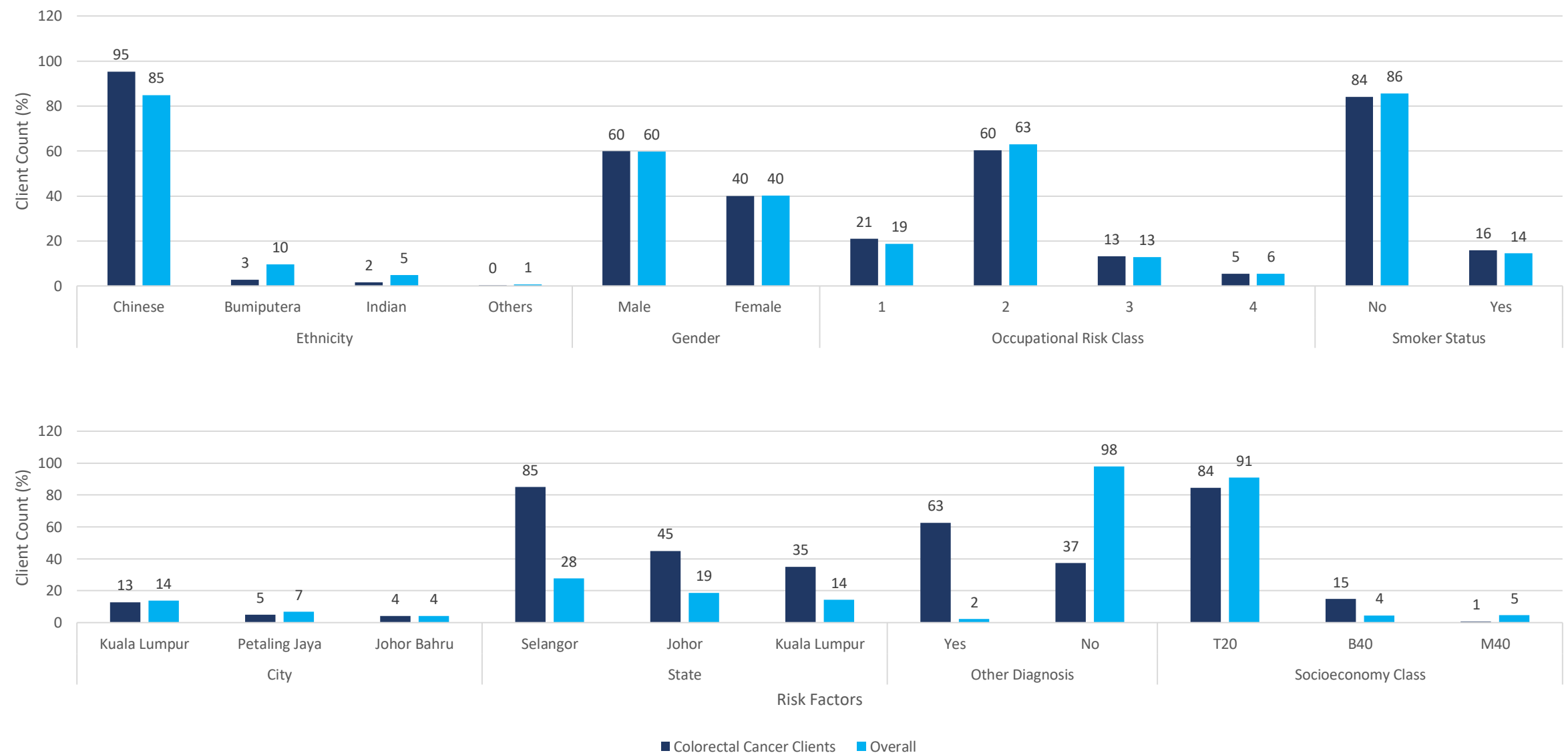


**36%** Increase from **2020** to **2021**, and  
**26%** Increase on average from 2012-2021

Yearly Average Settled Amount for Colorectal Cancer:

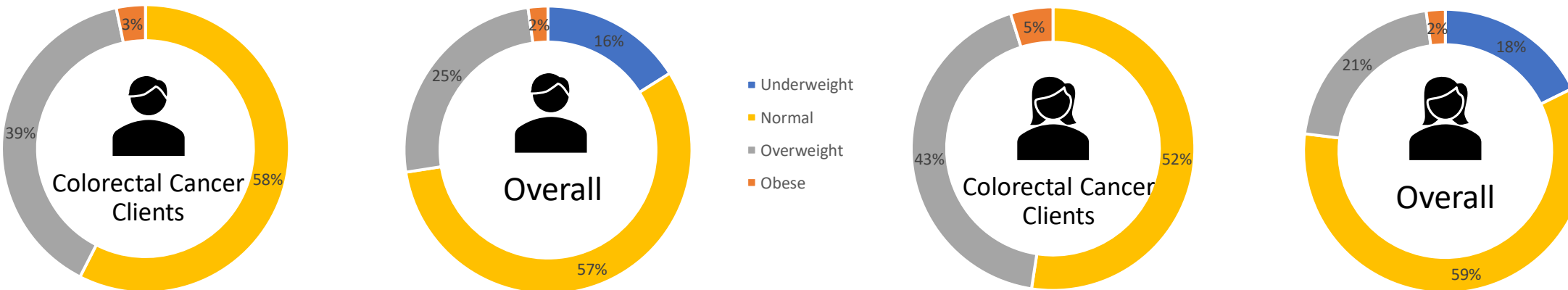
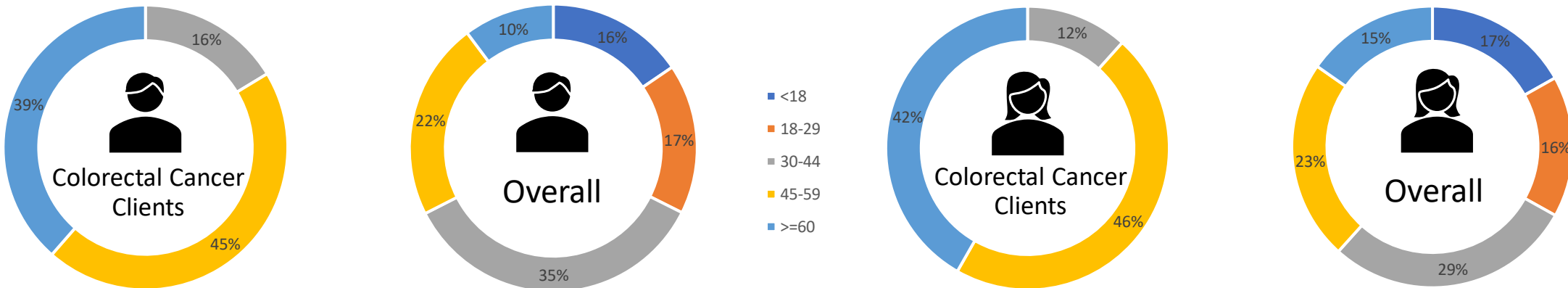
**RM 2,735,321.90**

# Colorectal Cancer Clients Risk Factors Distribution



# BMI, Age and Gender Distribution

Age Distribution of Colorectal Cancer Clients



BMI Distribution of Colorectal Cancer Clients

# Top Model Driver

Rank	Features	Effect
1.	Ethnicity	Chinese clients are <b>more likely</b> to get colorectal cancer.
2.	Gender	Male clients are <b>more likely</b> to get colorectal cancer.
3.	City	Clients from urban cities are <b>more likely</b> to get colorectal cancer.
4.	State	Clients from industrial-based states are <b>more likely</b> to get colorectal cancer.
5.	Other Gastrointestinal Complication	Clients who do not have any previous history of gastrointestinal complications are <b>less likely</b> to get colorectal cancer.
6.	Socio-economy Class	Clients from M40 group are <b>less likely</b> to get colorectal cancer.
7.	Age	Clients who are more than 40 years old are <b>more likely</b> to get colorectal cancer.
8.	BMI	Clients who are overweight and obese are <b>more likely</b> to get colorectal cancer.



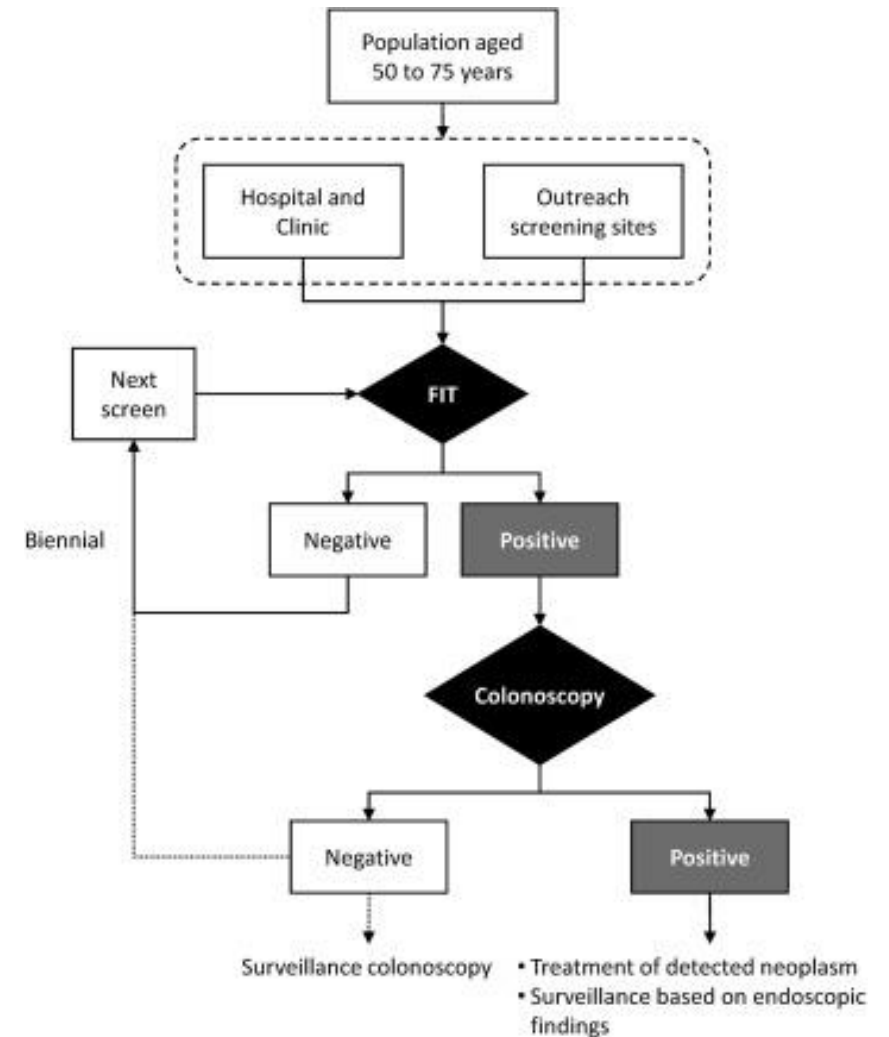
# Pre-Existing Detection Methods

## An updated Asia Pacific Consensus Recommendations on colorectal cancer screening

J J Y Sung,<sup>1</sup> S C Ng,<sup>1,2</sup> F K L Chan,<sup>1,2</sup> H M Chiu,<sup>3</sup> H S Kim,<sup>4</sup> T Matsuda,<sup>5</sup> S S M Ng,<sup>6</sup> J Y W Lau,<sup>6</sup> S Zheng,<sup>7</sup> S Adler,<sup>8</sup> N Reddy,<sup>9</sup> K G Yeoh,<sup>10</sup> K K F Tsoi,<sup>11</sup> J Y L Ching,<sup>2</sup> E J Kuipers,<sup>12</sup> L Rabeneck,<sup>13</sup> G P Young,<sup>14</sup> R J Steele,<sup>15</sup> D Lieberman,<sup>16</sup> K L Goh<sup>17</sup>

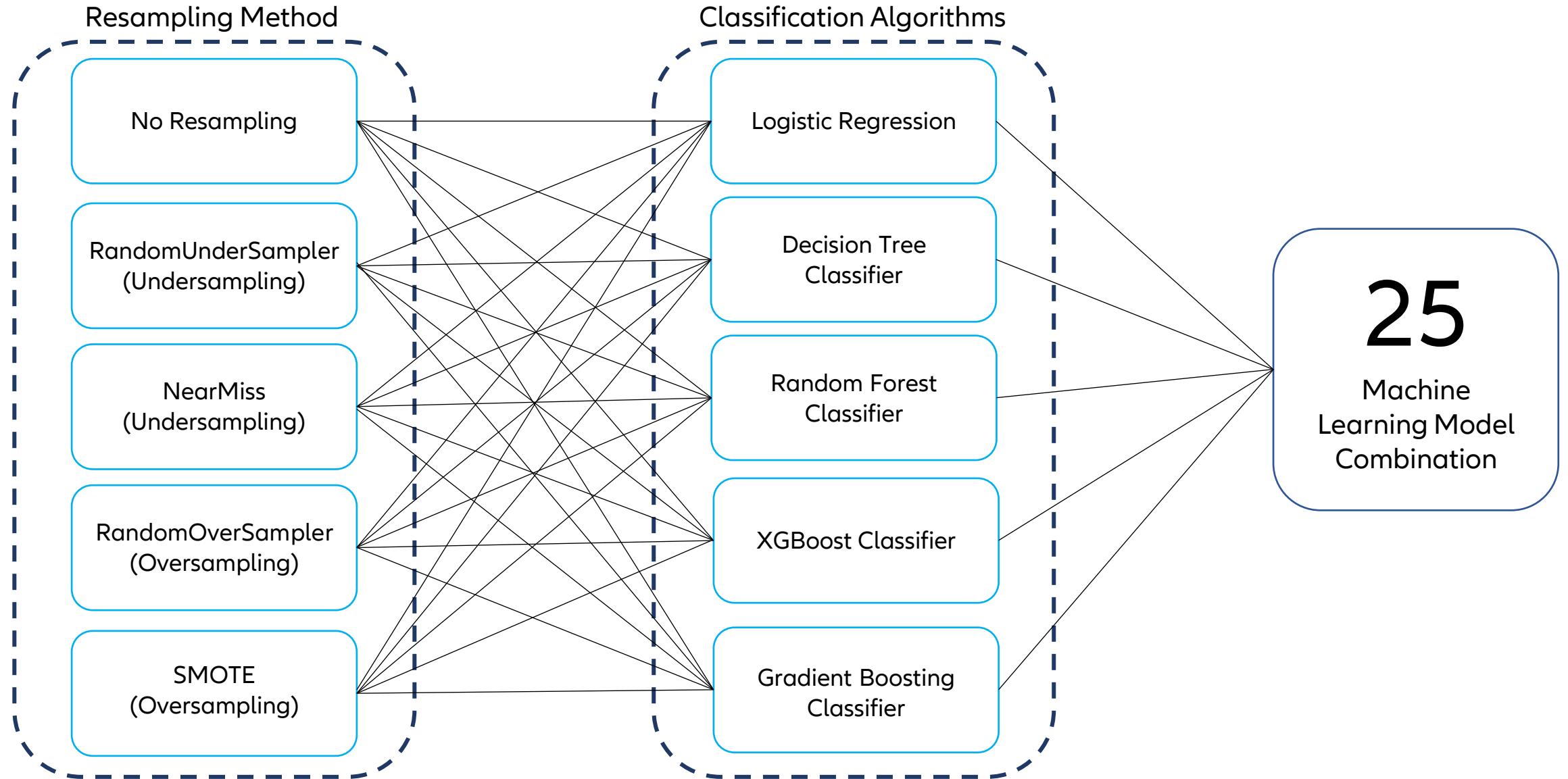
Risk factor	Criteria	Points
Age (years)	< 50	0
	50–69	2
	≥ 70	3
Sex	Female	0
	Male	1
Family history of CRC in a first-degree relative	Absent	0
	Present	2
Smoking	Never	0
	Current or past	1

### Asia Pacific Colorectal Screening (APCS) Score



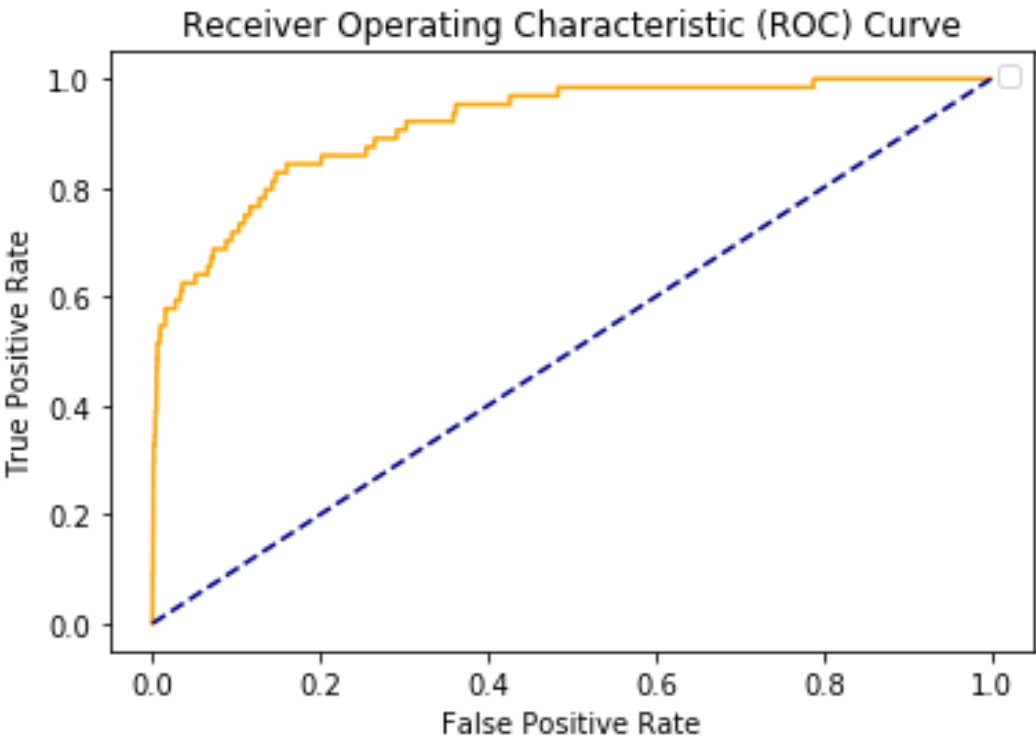
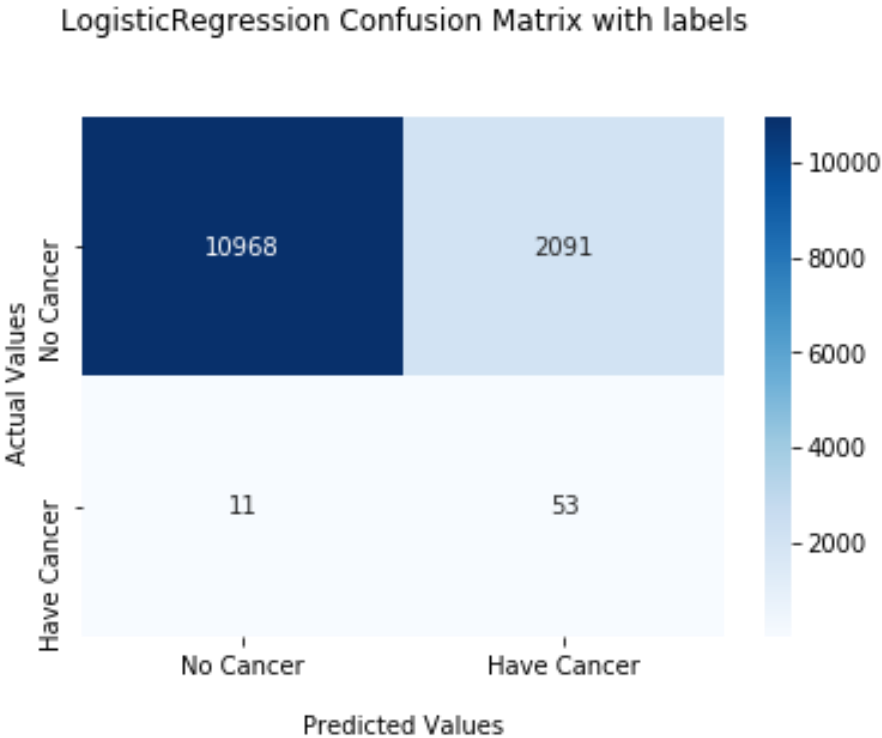
### National Colorectal Cancer Screening Program

# Machine Learning Roadmap



# Selected Machine Learning Model

Machine Learning Model	Resampling Method	Decision Threshold	True Positive Rate (TPR)	False Positive Rate (FPR)	AUC-ROC Score	Accuracy
Logistic Regression	-	0.0029	0.84	0.16	0.92	0.84



# Allianz Colorectal Cancer Screening Program

## Partnership & Sustainable Development Goals



## Implementation

- Utilize In-build mobile applications (Allianz Vivy, Allianz MyHealth) to notify our clients.
- Several questions need to be answered to claim the voucher.
- By utilizing our own mobile applications for this project, we can:
  - Obtain additional client information (dietary intake, lifestyle).
  - Reduce cost of building new mobile application.
  - Increase the app accessibility among Allianz clients.

- The Malaysian Cohort project is currently conducting early screening test via iFOBT kit to detect colorectal cancer among the local population. Fortunately, the screening is free for participants of The Malaysian Cohort project.
- UKM Medical Center (UKMMC) is the first government hospital equipped with a Full Spectrum Endoscopy (FUSE) technology which can detect polyps (colorectal cancer stage 0). The screening cost around RM300, (RM150 for elderly people > 60 years old).

**Congrats**

You Are Eligible For A Free Teleconsultation Voucher

To claim this voucher, complete the FREE health Checkup.

- ✓ Avail one time free Teleconsultation benefit from our board certified doctors
- ✓ Get e-Prescriptions, recommendations and referrals.

**Your Details**

NRIC	990422055227
First name	Karthikraja
Last Name	Selvan
Date Of birth	22-04-1999
Gender	MALE
Email	karthikraja2204@gmail.com

By clicking on the button below, I consent to the Babylon Terms & Conditions and Babylon's collection, use and disclosure of my personal data in accordance with the Babylon Privacy Policy

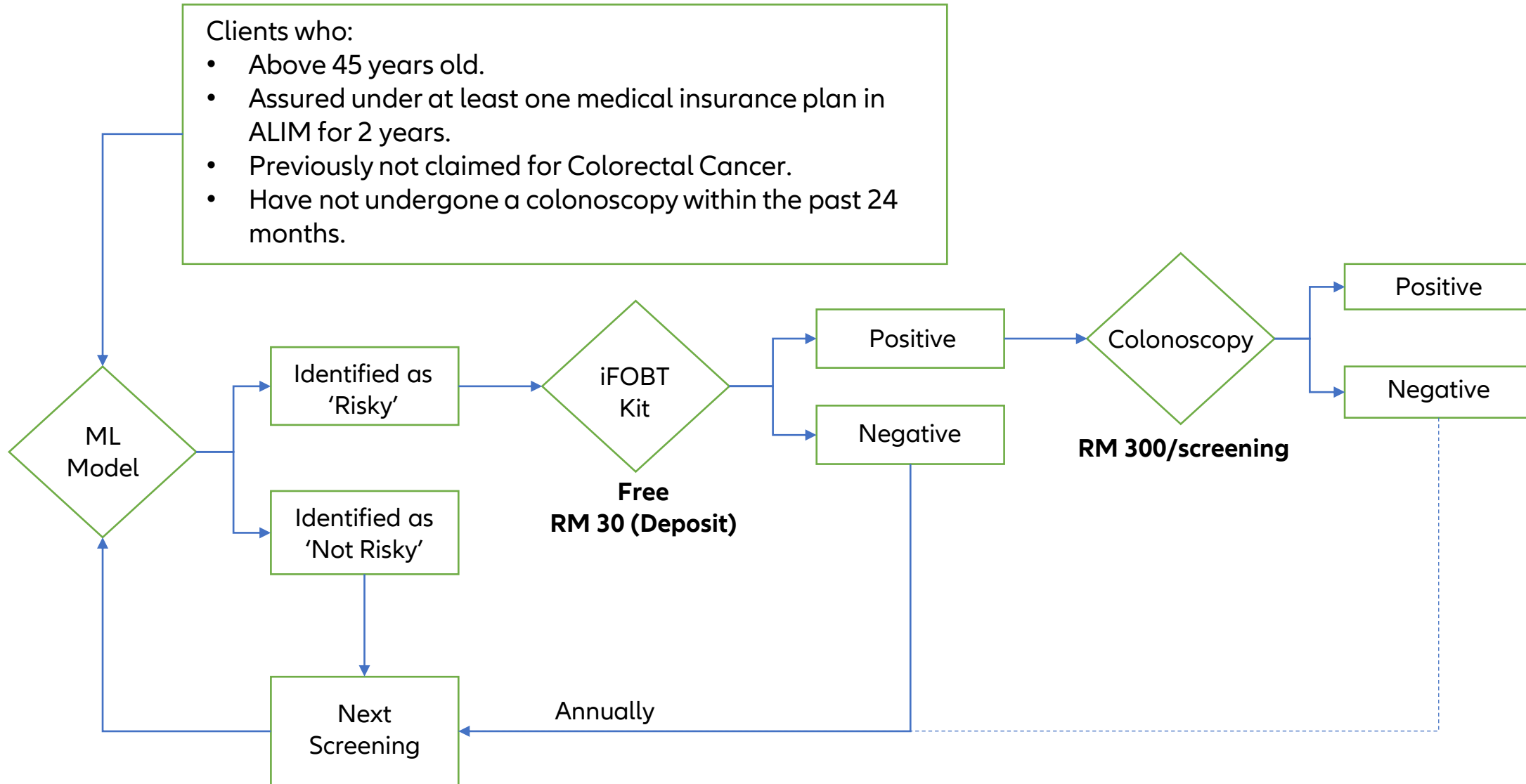
**Activate Free Health Checkup**

No, Maybe Later

With this project, we can achieve the following Sustainability Development Goals:



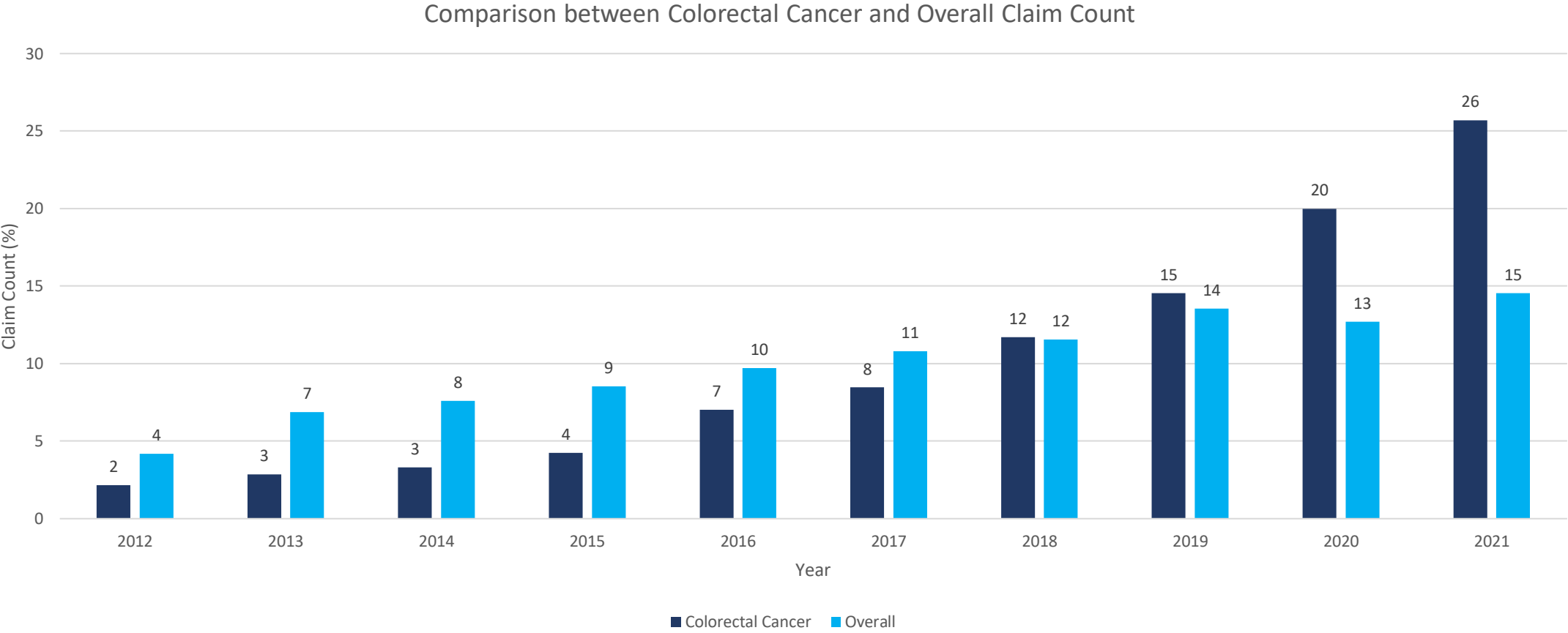
# Allianz Colorectal Cancer Screening Program Flowchart





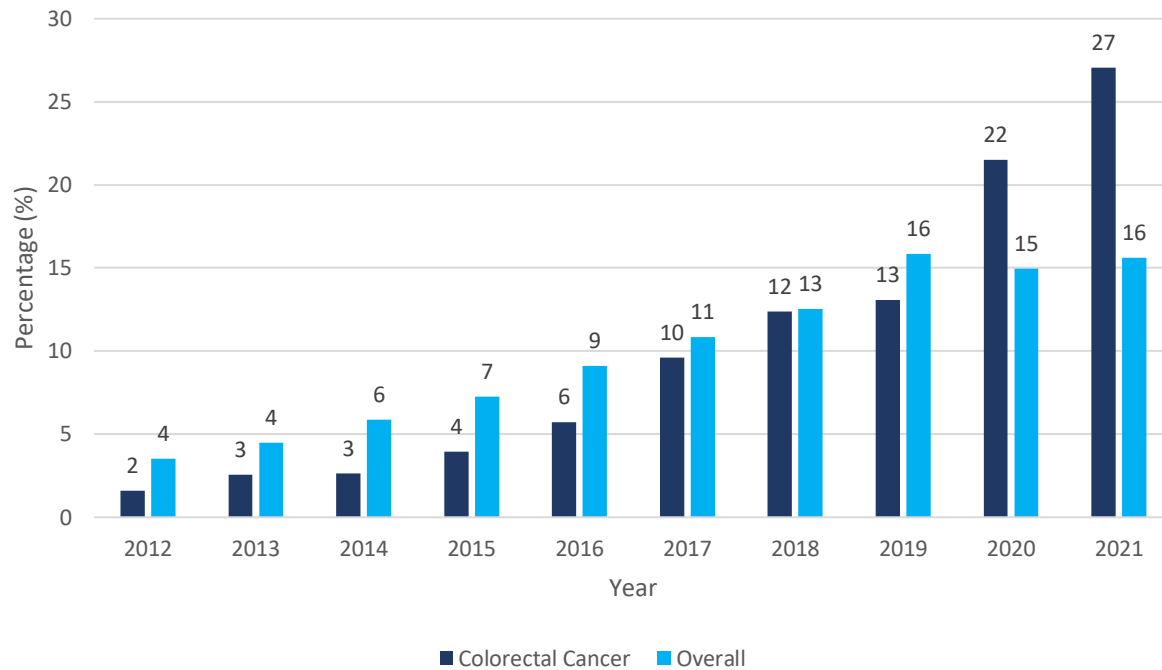
Thank You

# Appendix



# Appendix

Comparison Between Colorectal Cancer and Overall Settled Amount



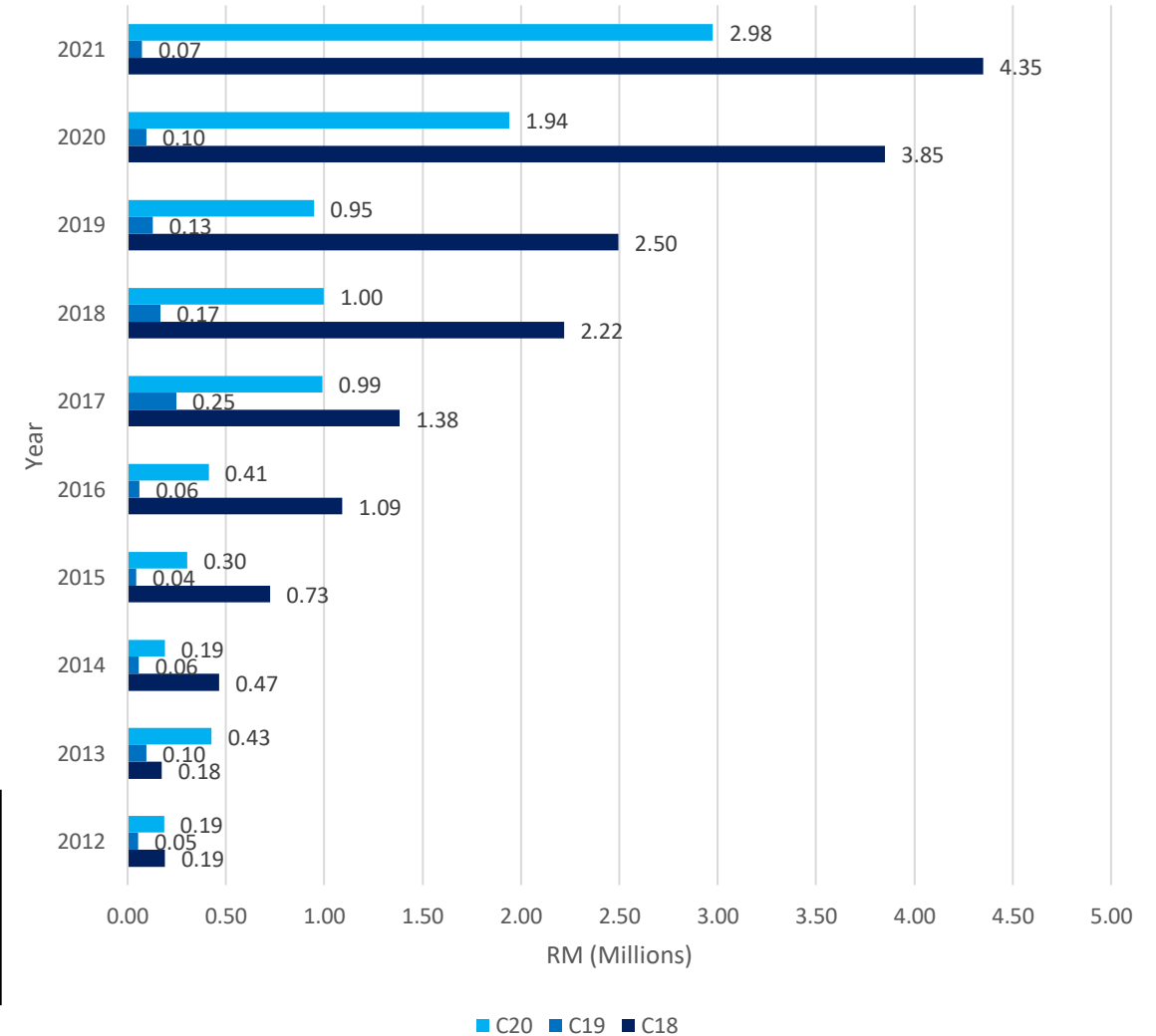
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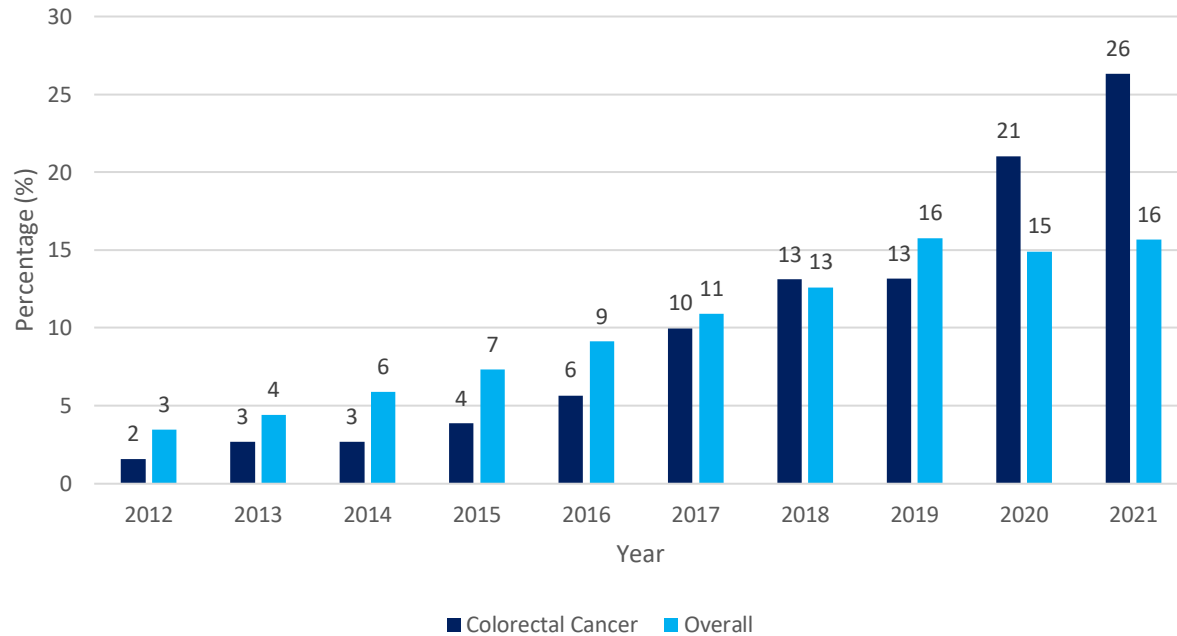
Colorectal Cancer Settled Amount





# Appendix

## Comparison Between Colorectal Cancer and Overall Cost



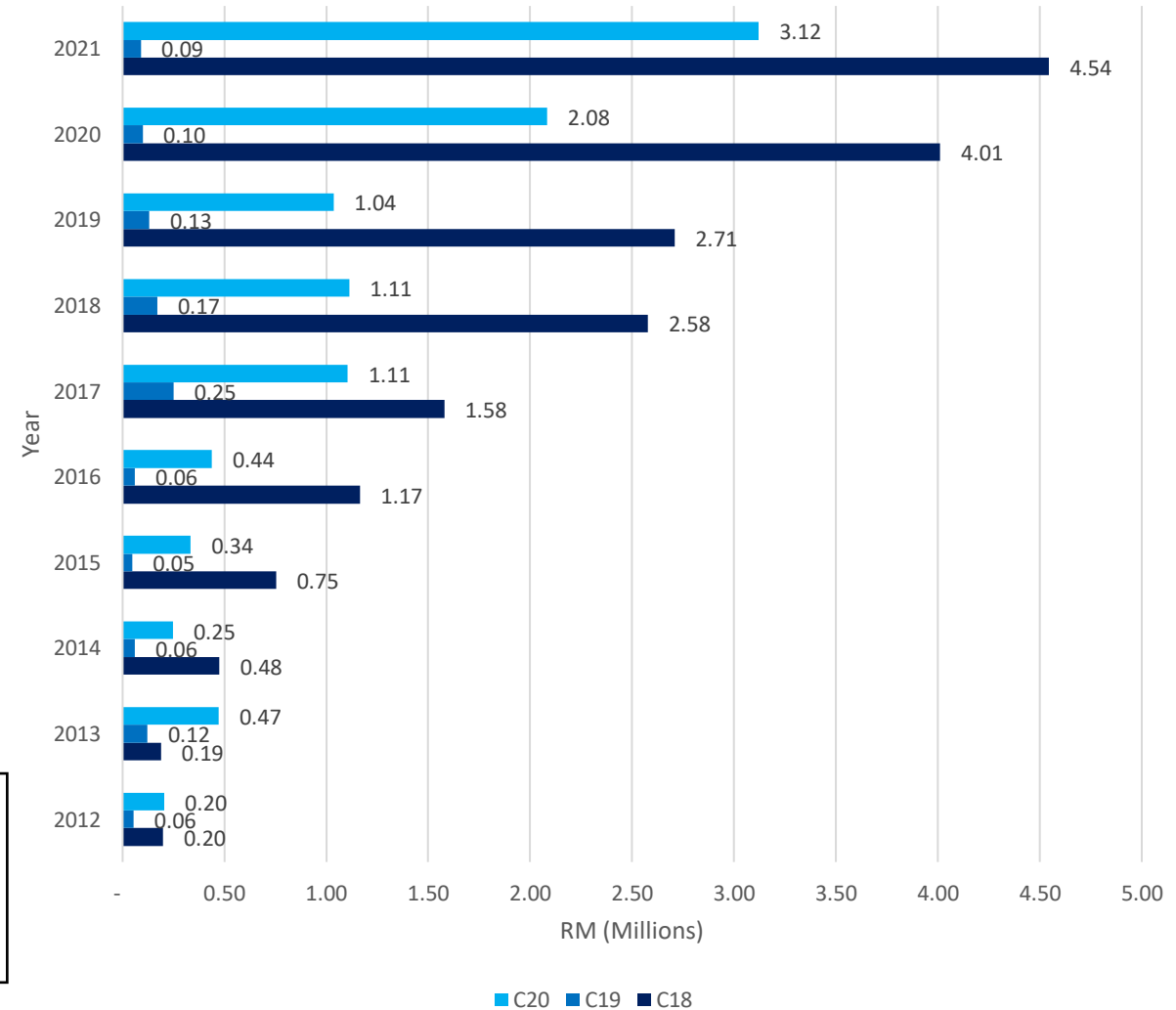
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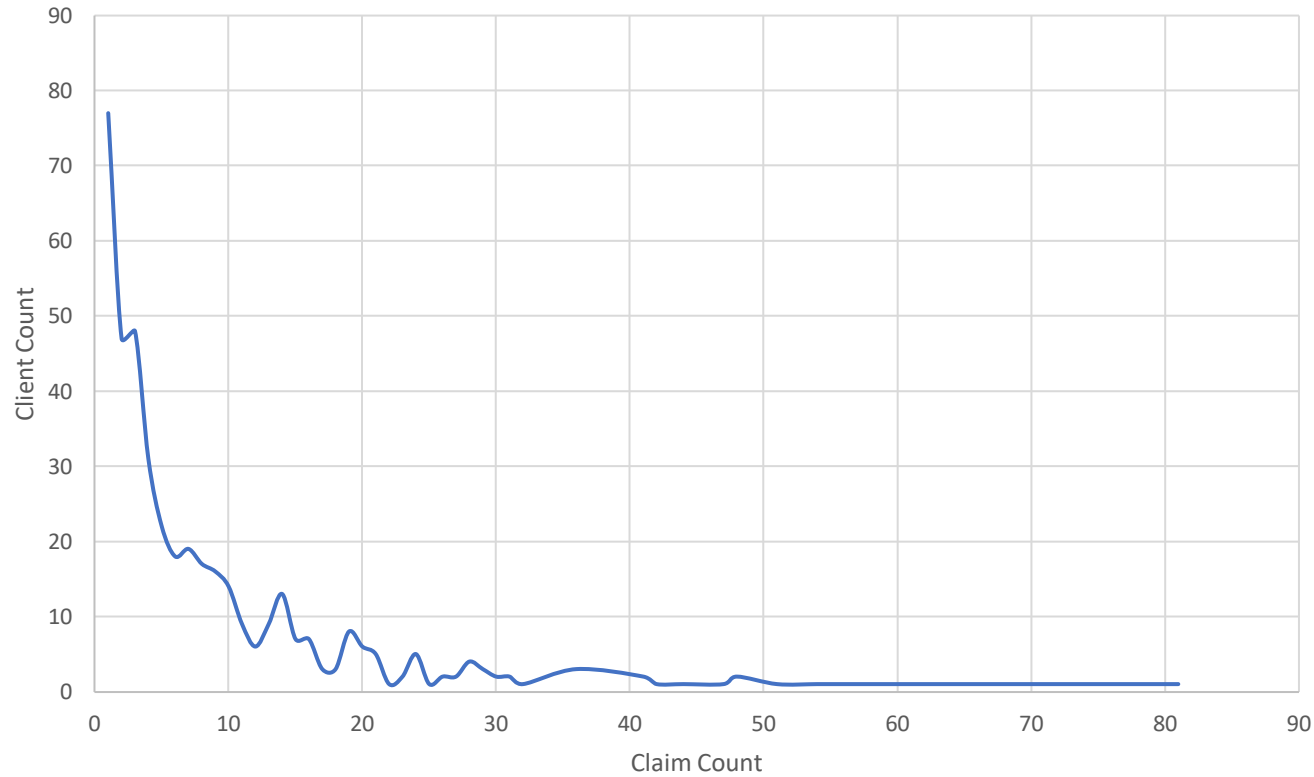
C20: Malignant Neoplasm of Rectum

## Colorectal Cancer Cost



# Appendix

Colorectal Cancer Claim Frequency



First Claim Clients Current Policy Status

