RESEARCH ARTICLE

Incidence of Colorectal Cancer in Loei Province, Thailand: Report from a Population-Based Cancer Registry

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Abstract

Background: Data regarding trends in Colorectal Cancer (CRC) incidence within Loei province are currently unavailable. Additionally, there is a scarcity of information from previous studies examining CRC time trends across Thailand. **Objective:** The purpose of this study was to study the estimate the trend and incidence of CRC in Loei Province. **Methods:** An analytical retrospective cohort study was conducted using data from the Loei population-based cancer registry, collected through the Thai cancer-based program of National Cancer Institute of Thailand. A total of 754 patients were diagnosed with CRC (IDC-O-3, C18.0, C18.1, C18.2, C18.3, C18.4, C18.5, C18.6, C18.7, C18.8, C18.9, C1.9, C2.0) in Loei during 2017 – 2022. Age-standardized rates (ASR) were estimated, and their 95% confidence interval were reported. Annual percent change (APC) was calculated to quantify the incidence rate trends using Join-point regression. Both APC and 95% confidence interval were reported. **Result:** We found that the overall ASR from 2017 to 2022 for all ages was 13.7 per 100 000 person-years for both sexes. (95% CI; 12.88, 14.56). Male ASR =15.54 per 100,000 person-years (95% CI; 14.70, 16.38). Female ASR = 12.07 per 100,000 person-years (95% CI; 11.23, 12.91). Additionally, the preliminary trends of overall CRC incidence increased between 2017 to 2022 by an APC of 3.72% (APC= 3.72; 95% CI; -6.62, 15.85). The percentage change for males increased by 5.49 % (APC= 5.49; 95% CI; -2.13, 14.26) per year. For females, the annual percentage change increased by 1.91 percent (APC= 1.91; 95% CI; -14.20, 22.53). **Conclusion:** Our preliminary findings show an increasing trend in CRC incidence among both men and women in Loei Province. To gain a more comprehensive understanding and identify clearer patterns, future studies should analyze these trends over extended periods, such as 10 years or more. Evaluating the coverage and completeness of the cancer registry data will also be crucial. This knowledge will provide a foundation for planning effective CRC prevention and control strategies in the region.

Keywords: Colorectal cancer- Trends in incidence- Population-based cancer registry- Annual percent change

Introduction

Colorectal Cancer (CRC) is the 3rd leading cancer globally and the 2nd most leading cause of cancer-related death among both males and females, predominantly affecting adults above 50 years [1]. In 2020, there were an estimated 1.9 million new cases and 930,000 deaths [2], with an age-standardized rates (ASR) of CRC were 21.9 per 100,000 in Males and 15.2 per 100,000 in females [2]. In WHO Southeast Asia Region, CRC was the 5th most common cancer in 2022, with an age-standardised rates (ASR) of 6.9 per 100,000 (Male: 8.3/100000 and Female: 5.5/100000) [1]. In Thailand, there are 20,173 (Male: 10

216) new cases of CRC in 2022 (ASR: 15.9/100000) constituting 4th leading cancer type and 3rd leading cause of cancer-related mortality.

Data from the latest monograph on cancer burden in Thailand (Volume X, 2016-2018) indicate that colorectal cancer (CRC) was the third most prevalent cancer in males and the second most prevalent in females. The corresponding Age-Standardized Rates (ASR) were 18.7 and 13.3 per 100,000, respectively. Earlier publications (Cancer in Thailand, Volumes I-IX, 1988-2015) reported historical ASR trends, with rates for males documented as 16.2, 14.4, 14.7, 12.9, 11.3, 10.9, and 8.8 per 100,000, and for females as 11.2, 11.2, 11.0, 9.2, 7.9, 7.3, and 7.6 per

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100,000 over the covered period. respectively. Analysis of colorectal cancer (CRC) mortality in Thailand for 2020 revealed distinct geographical differences. Bangkok exhibited the highest rate (14.9 per 100,000 population), succeeded by the Central (10.8), Northern (9.1), Northeastern (5.4), and Southern (5.2) regions [3-13].

Data from the Loei Hospital Cancer Registry for 2017 indicates that Colorectal Cancer (CRC) was the third most common malignancy among the top 10 cancers treated (following liver and lung cancer), with 95 cases. The 60-64 age group accounted for the largest number of these cases (n=27, 28.4%). In 2018, CRC maintained its third-place ranking with 127 cases, and the peak incidence shifted to the 70-74 age group (n=22, 17.3%). Primary tumor examination was the predominant diagnostic method in both years [14]. An annual increase in the age-standardized incidence rate (ASR) was observed in Loei Province [15]. Access to screening programs is considered a factor in the potential reduction of Colorectal Cancer (CRC) incidence. Nevertheless, despite the availability of the Fecal Immunochemical Test (FIT) as a fundamental public screening tool, incomplete coverage of the at-risk population persists. Consequently, failure to screen and treat these individuals results in continued morbidity and mortality associated with CRC [16].

Data regarding trends in Colorectal Cancer (CRC) incidence within Loei province are currently unavailable. Additionally, there is a scarcity of information from previous studies examining CRC time trends across Thailand. Consequently, this current study aimed to determine the estimating trend and incidence of CRC in Loei Province.

Materials and Methods

Study design

An analytical retrospective cohort study was conducted using data from the Loei Population-Based Cancer Registry (LPBCR), managed via the Thai Cancer Based Program (TCB) under the National Cancer Institute of Thailand. Data were extracted for 754 patients diagnosed with Colorectal Cancer (CRC) between January 1, 2017, and December 31, 2022. CRC diagnoses were classified according to the International Classification of Diseases for Oncology, 3rd edition (ICD-O-3) using codes C18.0-C18.9, C19.9, and C20.9 [17].

Population denominators

Population denominators for calculation were provided by the Office of the National Economic and Social Development Council in 2010-2040 [18]. Age-adjusted CRC incidence was standardized to the world population proposed by Segi (1960) and later modified by Doll (1976) [19, 20].

Statistical methods

Descriptive epidemiology of study patients

The characteristics of the patients were summarized using descriptive statistics. Means and standard deviations, medians, and their ranges (minima and maxima) were used for continuous variables, while frequency counts and percentages were used for categorical variables.

Trends analysis

We analyzed trends in incidence using the Joinpoint Regression Program version 4.9.1.0 (2023). Joinpoint regression identifies the annual percent change (APC) of incidence rates in each statistically significant trend interval developed by the statistical research and applications branch of the US National Cancer Institute (NCI), was used to investigate the trends in the incidence rate of CRC, identify points where a significant change in the linear slope of the trends occurred, and 95% confidence interval (CI) of the APC [21].

Incidence analyses

Age Standardized Rates (ASRs) were calculated for sixteen different age groups (0-4, 5-9, …, 70-74, and 75+). Incidence rates are presented in cases per 100,000 by Doll [20].

Data processing

Data were recorded by Thai Cancer Based (TCB) software provided by the National Cancer Institute of Thailand (NCIT) [22]. All cases of CRC recorded from cancer registry were checked to determine whether there were duplicate entries with other Thai hospitals and registries [23].

The verification was performed with necessary correction, including logic, range, and internal consistency, which were checked using statistical software [24].

Results

Descriptive epidemiology and baseline characteristics

The total number of CRC in Loei province was 754 cases (Male: 385(51.1 %); Female:369(48.9%) as per the LPBCR database between 2017 and 2022. Average age of diagnosis 64.6±11.4 years, and the Median age was 65.0 years (Min=18, Max=98). The age group with the largest number of cases was 75 years and over (n= 147, 19.5%), the highest in 2021 (n= 32, 21.8%), while in 2017 was the lowest (n= 15, 10.2%). In contrast, the 15–19 and 20–24 years age groups had the lowest representation, each contributing only 0.1% of the cases.

According to histology of primary evidence was mostly used as the basis of diagnosis. The most common stage of disease was 'Stage III' in 2021 (n= 55, 20.7%), 2020 (n= 49, 18.4%), 2019 (n= 47, 17.7%), 2022 (n= 45, 16.9%), 2018(n= 42, 15.8%) and 2017 (n= 28, 10.5%). The most site was 'Rectum' in 2020 (n= 60, 20.8%), 2021 (n= 52, 18.0%), 2018 (n= 51, 17.7%), 2019 (n= 48, 16.6%), 2022 (n= 43, 14.9%) and 2017 (n= 35, 12.1%). The most histological type was Adenocarcinoma. For the histological grading the most common was Moderately differentiated (Table 1).

Incidence

The Age standardized rates (ASR)

The respective ASR per 100,000 for CRC in Loei Province from 2017 to 2022 ranged from 10.7, 12.9, 15.0, 16.0, 16.5 and 11.9. Thus, the overall ASR per 100,000

Table 1. Characteristics of CRC in Loei Province from 2017-2022.

Characteristics	2017		2018		2019		2020		2021		2022		2017-2022	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Sex														
Male	44	11.4	67	17.4	65	16.9	71	18.4	70	18.2	68	17.7	385	51.1
Female	49	13.3	51	13.8	68	18.4	69	18.7	81	22	51	13.8	369	48.9
Age at diagnosis														
15 - 19	1	100	-	-	-	-	-	-	-	-	-	-	1	0.1
20 - 24	-	-	1	20	-	-	3	60	1	20	-	-	5	0.7
25 - 29	-	-	-	-	1	100	-	-	-	-	-	-	1	0.1
30 - 34	1	50	-	-	-	-	-	-	-	-	1	50	2	0.3
35 - 39	-	-	-	-	3	75	-	-	1	25	-	-	4	0.5
40 - 44	1	6.7	2	13.3	5	33.3	4	26.7	-	-	3	20	15	2
45 - 49	4	13.3	3	10	8	26.7	5	16.7	7	23.3	3	10	30	4
50- 54	9	11.1	17	21	16	19.8	13	16.1	9	11.1	17	21	81	10.7
55 - 59	8	9.1	16	18.2	20	22.7	13	14.8	17	19.3	14	15.9	88	11.7
60 - 64	26	18.1	20	13.9	20	13.9	32	22.2	31	21.5	15	10.4	144	19.1
65 - 69	15	11.5	19	14.5	28	21.4	25	19.1	29	22.1	15	11.45	131	17.4
70 - 74	13	12.4	20	19.1	13	12.4	14	13.3	24	22.9	21	20	105	13.9
75+	15	10.2	20	13.6	19	12.9	31	21.1	32	21.8	30	20.4	147	19.5
Mean (Standard deviation) = 64.4 years (11.4 years)														
Median (Min: Max) = 65 years (18 years : 98 years)														
Basis of diagnosis														
History & Physical exam	-	-	3	15.8	5	26.3	6	31.6	2	10.53	3	15.8	19	2.5
Endoscopy & Radiology	7	15.9	8	18.2	11	25	8	18.2	6	13.6	4	9.1	44	5.8
Surgery & Autopsy	-	-	-	-	1	50	-	-	1	50	-	-	2	0.3
Histology of Metastasis	-	-	1	5.3	-	-	10	52.6	7	36.8	1	5.3	19	2.5
Histology of Primary	86	12.8	106	15.8	116	17.3	116	17.3	135	20.2	111	16.6	670	88.9
Stage at diagnosis														
Stage I	2	7.7	-	-	9	34.6	8	30.8	4	15.4	3	11.5	26	3.5
Stage II	18	13.2	22	16.2	24	17.7	17	12.5	30	22.1	25	18.4	136	18
Stage III	29	12.3	48	20.4	47	20	37	15.7	49	20.9	25	10.6	235	31.2
Stage IV	28	10.5	42	15.8	47	17.7	49	18.4	55	20.7	45	16.9	266	35.3
Unknown	16	17.6	6	6.6	6	6.6	29	31.9	13	14.3	21	23.1	91	12.1
Topography														
Cecum (C18.0)	4	9.8	5	12.2	5	12.2	4	9.8	13	31.7	10	24.4	41	5.4
Appendix (C18.1)	1	20	1	20	0	0	1	20	1	20	1	20	5	0.7
Ascending colon (C18.2)	7	18.4	3	7.9	7	18.4	7	18.4	10	26.3	4	10.5	38	5
Hepatic flexure of colon (C18.3)	1	3.6	3	10.7	3	10.7	7	25	7	25	7	25	28	3.7
Transverse colon (C18.4)	3	10	5	16.7	4	13.3	5	16.7	5	16.7	8	26.7	30	4
Splenic flexure of colon (C18.5)	3	17.7	0	0	1	5.9	4	23.5	5	23.5	4	23.5	17	2.3
Descending colon (C18.6)	3	11.5	2	7.7	6	23.1	4	15.4	7	26.9	4	15.4	26	3.5
Sigmoid colon (C18.7)	19	13.5	17	12.1	23	16.3	26	18.4	34	24.1	22	15.6	141	18.7
Colon,NOS (C18.9)	9	11.3	19	23.8	25	31.3	16	20	5	6.3	6	7.5	80	10.6
Rectosigmoid junction (C19.0)	8	13.6	12	20.3	11	18.6	6	10.2	12	20.3	10	17	59	7.8
Rectum (C20.0)	35	12.1	51	17.7	48	16.6	60	20.8	52	18	43	14.9	289	38.3
Histological type														
Squamous cell carcinoma (8070)	1	100	-	-	-	-	-	-	-	-	-	-	1	0.1
Adenocarcinoma (8050)	84	12.1	108	15.6	119	17.2	130	18.7	143	20.6	110	15.9	694	92.1
Unspecified and Other (8000)	8	13.6	10	17	14	23.7	10	17	8	13.6	9	15.3	59	7.8
Histological grading														
Well-differentiated	26	11.7	44	19.7	28	12.6	36	16.1	47	21.1	42	18.8	223	29.6
Moderately-differentiated	44	12.8	41	11.9	66	19.1	64	18.6	78	22.6	52	15.1	345	45.8

Table 1. Continued

Characteristics	2017		2018		2019		2020		2021		2022		2017-2022	
	n	%	n	%	n	%	n	%	n	%	n	%	n	%
Histological grading														
Poorly-differentiated	4	10	3	7.5	5	12.5	7	17.5	10	25	11	27.5	40	5.3
Undifferentiated	-	-	-	-	-	-	1	100	-	-	-	-	1	0.1
NK cell (natural killer)	-	-	-	-	-	-	-	-	-	-	1	100	1	0.1
Not stated or not applicable	19	13.2	30	20.8	34	23.6	32	22.2	16	11.1	13	9	144	19.1

was 13.7 (95% CI: 12.88, 14.56) (Figure 1).

Joinpoint Repression

Based on a Joinpoint regression analysis, the overall CRC incidence increased between 2017 to 2022 annual percent change of 3.72% (APC= 3.72; 95% CI: -6.62, 15.85) per year. among males 5.49% per year (APC 5.49; 95% CI, −2.13, 14.26) and 1.91% per year among females (APC 1.91; 95% CI, −14.20, 22.53).

Discussion

The Age-Standardized Rate (ASR)

The current study, the overall Age-Standardized Rate (ASR) for colorectal cancer (CRC) in Loei Province between 2017 and 2022 was determined to be 13.7 per 100,000 population (95% CI: 12.88, 14.56).

This finding provides a crucial benchmark for comparison with national and regional figures. For instance, the national CRC ASR for Thailand during a comparable period was reported as approximately ASR=18.7 for male, ASR=13.3 for female per 100,000 [13]. Thus, the rate observed in Loei appears slightly higher than the national average. When compared to specific regions within Thailand known for higher CRC incidence, such as Khon Kaen which reported an ASR of 16.0 (Male), and 12.5 (Female) [25], the burden in Loei seems moderately lower.

Broadening the comparison to the Asian context reveals significant variation. High-incidence countries like

Japan have reported substantially higher CRC ASRs, often exceeding 45.5 (Male), 28.5 (Female) per 100,000 [26].

Conversely, some other Southeast Asian nations may report rates closer to or even lower than that found in Loei (Indonesia, ASR=15.7 (Male), ASR=8.9 (Female) [26]. Therefore, the CRC ASR in Loei province appears to be moderate within the broader Asian landscape but similar to the overall Thai national rate.

Although the overall trend of colorectal cancer (CRC) incidence in Loei Province showed an increasing pattern, a notable decrease in the age-standardized incidence rate (ASR) was observed in 2022. This fluctuation could be attributed to several contextual factors. First, the COVID-19 pandemic likely disrupted cancer screening services and routine healthcare utilization during 2020–2022, which may have led to underdiagnosis or delays in reporting new CRC cases [26, 27]. Second, annual variations in incidence rates are common in provinces with smaller populations due to the limited number of cases, which can lead to year-to-year fluctuations in ASR [28]. Lastly, changes in health-seeking behaviors, including reduced hospital visits during the pandemic, may have contributed to a temporary decrease in cancer detection. These factors should be considered when interpreting short-term trends in provincial-level cancer registries.

Annual Percent Change (APC)

The analysis of colorectal cancer (CRC) incidence trends in Loei Province from 2017 to 2022 using Joinpoint regression indicated an overall increase, with an Annual
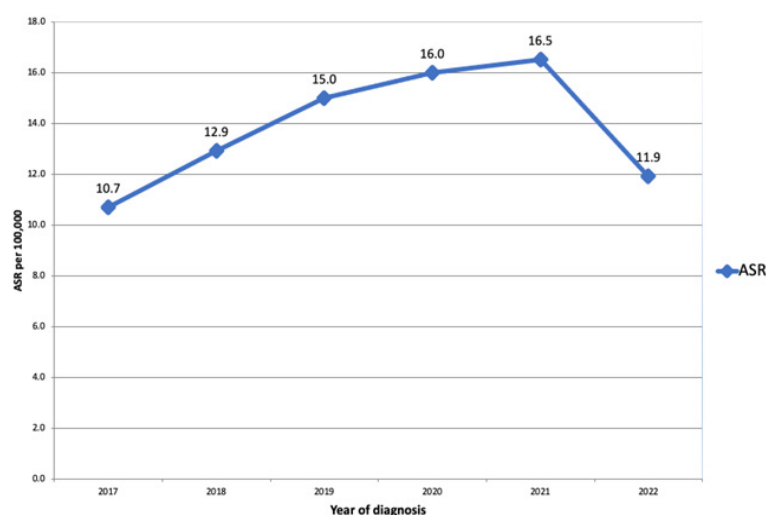

Figure 1. Incidence rates for CRC in Loei Province from 2017–2022

Percent Change (APC) of +3.72% (95% CI: -6.62, 15.85). This trend appeared steeper among males (APC +5.49%; 95% CI: -2.13, 14.26) than females (APC +1.91%; 95% CI: -14.20, 22.53). Critically, the wide 95% confidence intervals for all three estimates encompass zero, signifying that these observed increases lack statistical significance over this specific six-year period.

Nationally, CRC incidence in Thailand has generally been reported as increasing over recent decades. For example, studies analyzing data from earlier periods, such as 1989-2012, reported a statistically significant national APC of approximately increasing among both men and women: aged 45 years and older group AAPC=3.40, 2.30 and 3.90, respectively); aged 50 years and older group AAPC=2.90, 2.20 and 3.40; aged under 45 years AAPC=6.30, 6.00 and 6.90; and aged under 50 years (AAPC=5.70, 3.20 and 5.70) [29].

While the direction of the trend observed in Loei (+3.72%) aligns with this historical national increase, its magnitude appears similar to the previously reported national rate, though the non-significance of the Loei APC limits definitive comparison. Furthermore, the more pronounced, albeit non-significant, increase among males in Loei (+5.49%) mirrors observations in some national Thai reports where male CRC incidence trends have outpaced those in females

In the wider Asian context, CRC incidence trends show considerable heterogeneity. Many East Asian countries like South Korea and Japan, which previously experienced sharp increases, have recently shown stabilizing or even declining trends, particularly in younger cohorts, often attributed to the impact of national screening programs [2]. For instance, Beijing, China reported an APC of 7.7 increasing during 1998-2005 [30]. Conversely, many South and Southeast Asian countries are still experiencing rising CRC incidence, reflecting ongoing transitions in lifestyle and risk factor prevalence [26].

The non-significant increase observed in Loei (+3.72%) might place it among regions experiencing ongoing rises, contrasting with the stabilization seen in some high-income East Asian nations.

However, the lack of statistical significance does not negate the fact that CRC is affecting people in Loei province and continued surveillance is essential.to establish a reliable trend for Loei province and ascertain its trajectory relative to diverse national and continental Asian patterns.

The observed point estimates, particularly for males, suggest that underlying drivers for CRC may be actively influencing incidence in Loei, even if a definitive trend is not yet statistically confirmed within this timeframe.

In conclusion, in sum up, this study demonstrated that the incidence rate of CRC in Loei Province is increasing for both men and women. Future study should focus on extended period for trends in incidence of CRC five or 10 years for more comprehensive and clear trends, and also to emphasize the coverage of cancer registries. The knowledge gained in the study may be used for planning the prevention and control of CRC in the Loei province.

Advantages and disadvantages of trends in incidence of CRC

Strengths of the study

A key strength of this study is its novelty as the first follow-up investigation of colorectal cancer (CRC) trends analyzed by age, period, and birth cohort specifically within Loei province, Thailand. Furthermore, the identified trends provide a valuable foundation for future research and supply essential data for informing the planning of CRC prevention and control programs, both locally within this region and potentially at the national level in Thailand.

Limitations of the study

The study had several limitations. Firstly, the coverage of the cancer registries used may represent a limitation. Secondly, the analysis spanned a relatively short time period of 6 years (2017–2022), which may be insufficient to capture long-term trends.

Author Contribution Statement

Acknowledgements

Data Availability

The datasets are not publicly available but are available from the corresponding author upon reasonable request.

Ethical Declaration

The research was approved by the Khon Kaen University Ethics Committee for Human Research (reference no. HE662214).

Conflict of Interest

The authors have no conflicts of interest to declare.

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