COLON CANCER: AN INTEGRATION OF REAL WORLD DATA INTO CANCER REGISTRIES

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ABSTRACT

Colon cancer is one of the most prevalent malignancies in Western countries, with survival rates varying significantly across regions. In order to combine cancer registry records with real-world data, deterministic methods are applied to link data from three Italian regions. Our colon cancer patients are prevalent and their incidence dates range from 1995 to 2019. They were anonymized with a time-ending common identification key not more renewable. Care indicators are formulated to capture key stages of the patient pathway (diagnosis, treatment and end-of-life care), drawing inspiration from the Innovative Partnership for Action Against Cancer (IPAAC) study. An exploratory analysis is conducted and non-parametric Kaplan-Meier estimations are applied to obtain an initial overview of patients' disease trajectories. Colon cancer patients in Friuli-Venezia Giulia, Naples and Palermo exhibit notable regional differences in screening participation and initial-phase endoscopy utilization.

Keywords: colon cancer, public health, care indicators

INTRODUCTION

Some preliminary information:

- 53000 new colon cancer cases every year in Italy;
- Cancer registries (CRs) often lack detailed information on diagnostics, treatment and follow-up;
- Data integration of administrative and health data with CRs information improve performance for accurate diagnosis, survival analysis and treatment planning.

General aims:

- Data integration of CRs with other types of sources;
- Care indicators development.

MATERIALS & METHODS

Table 1: Building Colon Indicators in Italian regions

Diagnosis phase
1) Screen detected colon cancer cases
2) Colon cancer patients diagnosed by endoscopy who received a complete colonoscopy
Treatment phase
3) Stage III resected colon cancer patients who received chemotherapy
4) Type of treatment received by metastatic colon cancer patients
End of life phase
5) Resected colon cancer who died after 30 days
6) Patients receiving chemotherapy in the last 2 weeks
7) New hospital admissions in the last 30 days of life
8) Intensive care unit (ICU) admissions in the last 30 days of life
9) Enrollment in specialist palliative care program

INITIAL PHASE RESULTS

Table 2: Distribution of Colon Cancer Screening and Endoscopy by Stage in Three Italian Regions

Region	Parameter	Stage 1	Stage 2	Stage 3	Stage 4	Unknown	Total
Friuli-Venezia Giulia	**Screening**						
	Not screened	858 (99.7%)	848 (100.0%)	647 (99.5%)	200 (99.0%)	3614 (99.9%)	6167 (99.8%)
	Screened	3 (0.3%)	0 (0.0%)	3 (0.5%)	2 (1.0%)	4 (0.1%)	12 (0.2%)
	Endoscopy						
	No	36 (8.3%)	61 (14.0%)	40 (9.2%)	26 (6.0%)	272 (62.5%)	435 (7.0%)
	Yes	825 (14.4%)	787 (13.7%)	610 (10.6%)	176 (3.1%)	3346 (58.3%)	5744 (93.0%)
	Total	861 (13.9%)	848 (13.7%)	650 (10.5%)	202 (3.3%)	3618 (58.6%)	6179 (100.0%)
Naples	**Screening**						
	Not screened	83 (100.0%)	234 (100.0%)	93 (100.0%)	89 (98.9%)	2199 (99.9%)	2698 (99.9%)
	Screened	0 (0.0%)	0 (0.0%)	0 (0.0%)	1 (1.1%)	2 (0.1%)	3 (0.1%)
	Endoscopy						
	No	58 (3.5%)	182 (11.0%)	72 (4.3%)	56 (3.4%)	1293 (77.8%)	1661 (61.5%)
	Yes	25 (2.4%)	52 (5.0%)	21 (2.0%)	34 (3.3%)	908 (87.3%)	1040 (38.5%)
	Total	83 (3.1%)	234 (8.7%)	93 (3.4%)	90 (3.3%)	2201 (81.5%)	2701 (100.0%)
Palermo	**Screening**						
	Not screened	17 (94.4%)	144 (100.0%)	89 (98.9%)	39 (100.0%)	1991 (99.9%)	2280 (99.9%)
	Screened	1 (5.6%)	0 (0.0%)	1 (1.1%)	0 (0.0%)	1 (0.1%)	3 (0.1%)
	Endoscopy						
	No	3 (0.3%)	45 (4.3%)	26 (2.5%)	12 (1.1%)	970 (91.9%)	1056 (46.3%)
	Yes	15 (1.2%)	99 (8.1%)	64 (5.2%)	27 (2.2%)	1022 (83.3%)	1227 (53.7%)
	Total	18 (0.8%)	144 (6.3%)	90 (3.9%)	39 (1.7%)	1992 (87.3%)	2283 (100.0%)

INTERMEDIATE PHASE RESULTS

Table 3: Distribution of cancer treatments by tumour stage across three Italian regions

Treatment	Stage 1	Stage 2	Stage 3	Stage 4	Unknown	Total
Friuli-Venezia Giulia						
Chemotherapy	1 (0.1%)	0 (0.0%)	3 (0.5%)	0 (0.0%)	9 (0.2%)	13 (0.2%)
Chemotherapy+Radiotherapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.1%)	3 (0.0%)
Chemotherapy+Radiotherapy+Surgery	34 (3.9%)	47 (5.5%)	78 (12.0%)	29 (14.4%)	291 (8.0%)	479 (7.8%)
Chemotherapy+Surgery	77 (8.9%)	293 (34.6%)	464 (71.4%)	144 (71.3%)	1282 (35.4%)	2260 (36.6%)
Other treatments, not directly referred to colon cancer*	1 (0.1%)	4 (0.5%)	3 (0.5%)	0 (0.0%)	46 (1.3%)	54 (0.9%)
Radiotherapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	3 (0.1%)	3 (0.0%)
Radiotherapy+Surgery	43 (5.0%)	45 (5.3%)	8 (1.2%)	1 (0.5%)	124 (3.4%)	221 (3.6%)
Surgery	705 (81.9%)	459 (54.1%)	94 (14.5%)	28 (13.9%)	1860 (51.4%)	3146 (50.9%)
Sum	861 (100%)	848 (100%)	650 (100%)	202 (100%)	3618 (100%)	6179 (100%)
Naples						
Chemotherapy	2 (2.4%)	4 (1.7%)	2 (1.6%)	7 (7.8%)	94 (4.3%)	109 (4.0%)
Chemotherapy+Radiotherapy	0 (0.0%)	1 (0.4%)	0 (0.0%)	0 (0.0%)	5 (0.2%)	6 (0.2%)
Chemotherapy+Radiotherapy+Surgery	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	13 (0.6%)	13 (0.5%)
Chemotherapy+Surgery	1 (1.2%)	4 (1.7%)	5 (4.0%)	43 (47.8%)	370 (17.1%)	423 (15.7%)
Other treatments, not directly referred to colon cancer*	52 (62.7%)	161 (68.8%)	79 (63.2%)	26 (28.9%)	802 (37.0%)	1120 (41.5%)
Radiotherapy	0 (0.0%)	0 (0.0%)	2 (1.6%)	0 (0.0%)	4 (0.2%)	6 (0.2%)
Radiotherapy+Surgery	0 (0.0%)	0 (0.0%)	1 (0.8%)	0 (0.0%)	6 (0.3%)	7 (0.3%)
Surgery	28 (33.7%)	64 (27.4%)	36 (28.8%)	14 (15.6%)	875 (40.3%)	1017 (37.7%)
Total	83 (100.0%)	234 (100.0%)	125 (100.0%)	90 (100.0%)	2169 (100.0%)	2701 (100.0%)
Palermo						
Chemotherapy	0 (0.0%)	0 (0.0%)	5 (5.6%)	2 (5.1%)	79 (4.0%)	86 (3.8%)
Chemotherapy+Radiotherapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	11 (0.6%)	11 (0.5%)
Chemotherapy+Radiotherapy+Surgery	0 (0.0%)	2 (1.4%)	1 (1.1%)	4 (10.3%)	17 (0.9%)	24 (1.1%)
Chemotherapy+Surgery	0 (0.0%)	19 (13.2%)	36 (40.0%)	23 (59.0%)	270 (13.6%)	348 (15.2%)
Other treatments, not directly referred to colon cancer*	1 (5.6%)	1 (0.7%)	2 (2.2%)	0 (0.0%)	689 (34.6%)	693 (30.4%)
Radiotherapy	0 (0.0%)	0 (0.0%)	0 (0.0%)	0 (0.0%)	8 (0.4%)	8 (0.4%)
Radiotherapy+Surgery	0 (0.0%)	2 (1.4%)	2 (2.2%)	1 (2.6%)	18 (0.9%)	23 (1.0%)
Surgery	17 (94.4%)	120 (83.3%)	44 (48.9%)	9 (23.1%)	900 (45.2%)	1090 (47.7%)
Total	18 (100.0%)	144 (100.0%)	90 (100.0%)	39 (100.0%)	1992 (100.0%)	2283 (100.0%)

*Prevalent patients entered in the study already treated for colon cancer

Figure 1: Survival curves based on KM-estimator in Friuli-Venezia Giulia

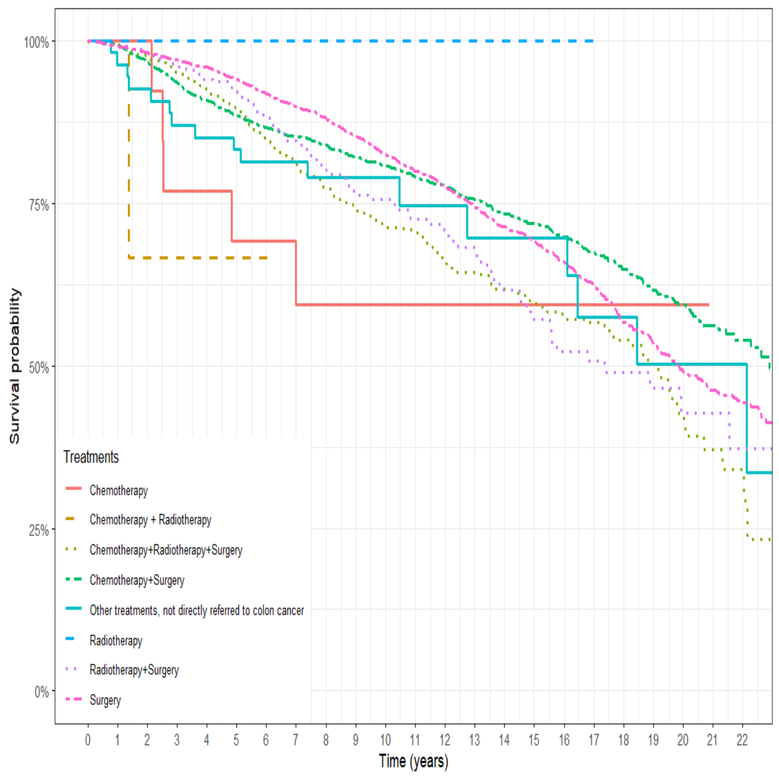


Figure 2: Survival curves based on KM-estimator in Naples

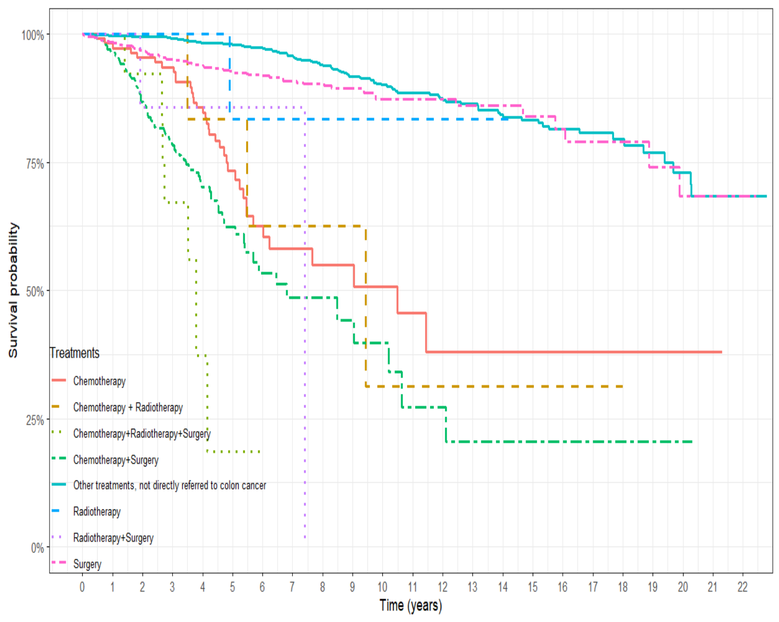
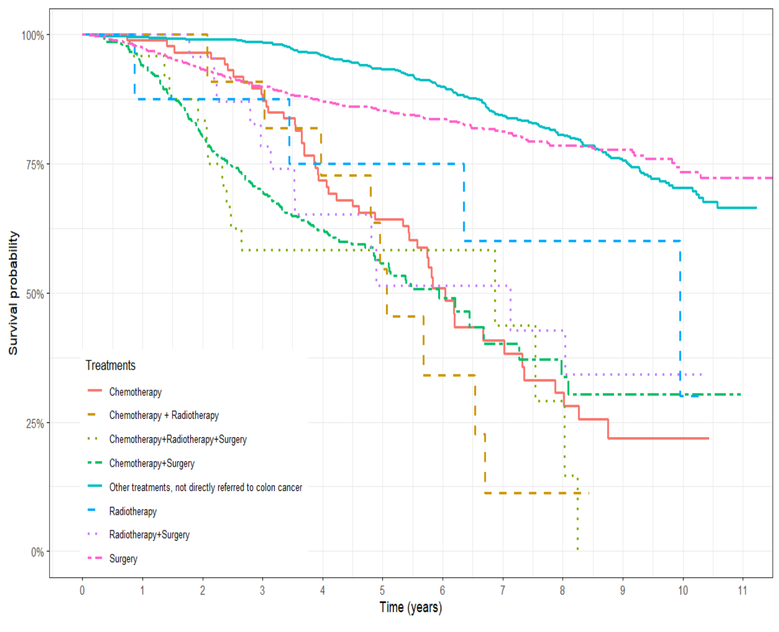


Figure 3: Survival curves based on KM-estimator in Palermo



CONCLUSION

Initial Phase Results

- Screening participation was very low across all three regions ($<= 0.2\%$). This low value could be due to specific selected patients: screening program started after 2008 in Friuli-Venezia Giulia and probably after the incidence period of individuals in Naples. In Palermo, there were coordination problems among local health boards.
- Endoscopy rates varied across regions: Friuli-Venezia Giulia had the highest endoscopy uptake (93.0%), Naples had the lowest (38.5%), Palermo had moderate uptake (53.7%).

Treatment Phase Results

- Friuli-Venezia Giulia: Surgery was the most common treatment (50.9% of patients) and arrives to 87.5% with Chemotherapy. 5-year survival is better among patients received surgery, excluding radiotherapy, and the addiction of Chemotherapy contributes to a higher survival in long term than other treatments.
- Naples: A high percentage of patients (41.5%) received treatments no related to colon cancer. 5-year survival is better in patients without colon cancer related medicaments. 10-year survival is characterised by no improved survivals when patients receive both surgery and chemotherapy.
- Palermo: Similar to Naples in 5-year survival. However, there is a switch among no related colon cancer and surgery in 10-year survival.

End of Life Results

Palliative care was limited:

- Friuli-Venezia Giulia: 16.4% hospice enrolment, 39.7% non-hospice palliative care.
- Palermo: 2.2% non-hospice palliative care.
- Naples: No recorded palliative care data.

END OF LIFE RESULTS

Table 4: End of life indicators in Friuli-Venezia Giulia, Naples and Palermo

Indicator	Friuli-Venezia Giulia	Naples	Palermo
Resected Colon Cancer (last 30 days)	261 (4.2%/ all patients, 14.9%/ deaths)	6 (0.2%/ all patients, 1.6%/ deaths)	3 (0.1% all patients 0.5% /deaths)
ICU Admission (last 30 days)	97 (1.6 %/ all patients, 5.5%/ deaths)	–	–
Chemotherapy (last 2 weeks)	215 (3.5%/ all patients, 12.3%/ deaths)	–	2 (0.1 %/ all patients, 0.3%/ deaths)
Hospital Admission (last 30 days)	714 (11.5%/ all patients, 40.8%/ deaths)	74 (2.7%/ all patients, 20.2%/ deaths)	3 (0.1% / all patients, 0.5% deaths)
Palliative Care	Hospice: 1013 (16.4% / all patients, 57.9%/ deaths) No hospice: 694 (11.2% / all patients 39.7% / deaths)	– –	– 13 (0.6%/ all patients, 2.2%/ deaths)

FUTURE RESEARCH

Sweden data could be included in the analysis to compare Italian healthcare procedures with those used in other countries. Different types of statistical methods will be applied to link various data sets, for example, deep learning models will be deployed as an alternative to deterministic linkage. In addition, only observed KM survival is performed, thus relative survival will be the next step.

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