

## MULTILEVEL ANALYSIS OF SOCIAL DETERMINANTS OF ADVANCED STAGE COLORECTAL CANCER DIAGNOSIS

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| Missing Stage<br>Of Colorectal Cancer                             |        |      |      |           |          |
|-------------------------------------------------------------------|--------|------|------|-----------|----------|
|                                                                   | n      | %    | PR   | CI (95%)  | p*       |
| Individual Variables                                              |        |      |      |           |          |
| Sex                                                               |        |      |      |           |          |
| Female                                                            | 17.787 | 34.1 | 1.04 | 1.03-1.06 | <0.001*  |
| Male                                                              | 16.803 | 32.6 | 1.00 | -         |          |
| Age Group                                                         |        |      |      |           |          |
| 18 - 49 years old                                                 | 13.220 | 66.2 | 2.94 | 2.88-3.01 | <0.001*  |
| 50 - 59 years old                                                 | 7.647  | 31.1 | 1.38 | 1.35-1.42 |          |
| 60 - 69 years old                                                 | 6.615  | 22.4 | 1.00 | -         |          |
| 70 years or older                                                 | 7.108  | 24.0 | 1.07 | 1.04-1.10 |          |
| Race                                                              |        |      |      |           |          |
| White                                                             | 14.582 | 36.4 | 1.00 | -         | < 0.001* |
| Non white                                                         | 15.837 | 30.2 | 1.03 | 1.02-1.05 |          |
| No Information                                                    | 4.171  | 36.8 | 1.21 | 1.18-1.25 |          |
| Education                                                         |        |      |      |           |          |
| None/Incomplete fundamental education                             | 11.692 | 27.9 | 1.12 | 1.10-1.14 | <0.001*  |
| Fundamental education                                             | 4.977  | 30.9 | 1.07 | 1.05-1.10 |          |
| Secondary education/ Incomplete                                   | 6.202  | 37.4 | 0.97 | 0.89-0.93 |          |
| Undergraduate education                                           | 2.118  | 35.8 | 1.00 | -         |          |
| No Information                                                    | 9.601  | 41.5 | 0.91 | 1.11-1.20 |          |
| Socioeconomic contextual variables                                |        |      |      |           |          |
| Gini Index                                                        |        |      |      |           |          |
| 0.49-0.56                                                         | 19.991 | 30.1 | 1.00 | -         | <0.001*  |
| 0.59-0.55                                                         | 14.674 | 39.0 | 1.29 | 1.27-1.32 |          |
| HDI                                                               |        |      |      |           |          |
| 0.631-0.731                                                       | 17.525 | 33.3 | 1.34 | 1.26-1.42 | <0.001*  |
| 0.735-0.774                                                       | 16.483 | 33.0 | 1.35 | 1.27-1.43 |          |
| 0.783-0.824                                                       | 582    | 50.5 | 1.00 | -         |          |
| Health service offer contextual variables                         |        |      |      |           |          |
| Density of Family Health Strategy Teams (per 100,000 inhabitants) |        |      |      |           |          |
| 0.37-5.75                                                         | 7.772  | 27.6 | 1.11 | 1.10-1.12 | <0.001*  |
| 5.86-8.53                                                         | 10.088 | 35.9 | 0.98 | 0.97-1.00 |          |
| 8.62-13.26                                                        | 16.730 | 35.2 | 1.00 | -         |          |
| Density of Oncologist (per 100,000 inhabitants)                   |        |      |      |           |          |
| 5.72-28.24                                                        | 16.250 | 32.3 | 1.02 | 1.00-1.03 | <0.01*   |
| 29.56-40.92                                                       | 13.881 | 34.5 | 0.98 | 0.99-1.05 |          |
| 41.23-60.10                                                       | 4.459  | 33.6 | 1.00 | -         |          |
| Density of Coloproctologist (per 1000,000 inhabitants)            |        |      |      |           |          |
| 0.00-1.06                                                         | 9.029  | 30.1 | 1.12 | 1.11-1.13 | <0.001*  |
| 1.40-1.87                                                         | 10.441 | 30.9 | 1.11 | 1.10-1.12 |          |
| 1.99-10.41                                                        | 15.150 | 37.8 | 1.00 | -         |          |
| Density of Gastroenterologist (per 100,000 inhabitants)           |        |      |      |           |          |
| 3.15-15.84                                                        | 16.901 | 33.3 | 1.19 | 1.17-1.21 | <0.001*  |
| 16.12-26.83                                                       | 12.423 | 30.3 | 1.24 | 1.22-1.26 |          |
| 30.08-36.60                                                       | 5.266  | 44.0 | 1.00 | -         |          |
| Density of Oncology Services (per 100,000 inhabitants)            |        |      |      |           |          |
| 1.31-5.34                                                         | 16.805 | 33.2 | 1.05 | 1.04-1.06 | <0.001*  |
| 5.26-7.72                                                         | 4.952  | 27.5 | 1.14 | 1.12-1.15 |          |
| 7.81-14.34                                                        | 12.833 | 36.5 | 1.00 | -         |          |
| Colonoscopy Exams (per 100,000 inhabitants)                       |        |      |      |           |          |
| 0.21-112.73                                                       | 20.669 | 36.1 | 0.98 | 0.96-1.00 | <0.001*  |
| 117.35-239.14                                                     | 9.619  | 28.1 | 1.10 | 1.09-1.12 |          |
| 273.88-388.35                                                     | 4.302  | 35.2 | 1.00 | -         |          |

PR: Estimated Prevalence Ratio by Robust Poisson Model; CI: Confidence interval; p: Wald's test; \*Statistically significant; SP: São Paulo.

**Table S1** - Prevalence and unadjusted prevalence ratios for missing stage colorectal cancer, according to individual characteristics and contextual variables. Brazil, by place residence, excluding SP (n = 103, 367).

| Variables                             | Empty model    | Model 1           |        | Model 2          |        |
|---------------------------------------|----------------|-------------------|--------|------------------|--------|
|                                       |                | PR (IC 95%)       | p      | PR (CI 95%)      | p      |
| Level 1 (Individual)                  |                |                   |        |                  |        |
| Age Group                             |                |                   |        |                  |        |
| 18 - 49 years old                     | _____          | 2.92 (2.84-3.01)  | 0.001* | 2.96 (2.88-3.05) | 0.001* |
| 50 - 59 years old                     | _____          | 1.38 (1.33-1.43)  |        | 1.39 (1.34-1.43) |        |
| 60 - 69 years old                     | _____          | 1                 |        | 1                |        |
| 70 years or older                     | _____          | 1.07 (1.06-1.011) |        | 1.07 (1.04-1.11) |        |
| Education                             |                |                   |        |                  |        |
| None/Incomplete fundamental education | _____          | 1.00 (0.96-1.03)  | 0.12   | 1.00 (0.97-1.04) | 0.16   |
| Fundamental education                 | _____          | 1.00 (0.97-1.04)  |        | 1.01 (0.97-1.04) |        |
| Secondary education/ Incomplete       | _____          | 1.00 (0.96-1.04)  |        | 1.01 (0.97-1.05) |        |
| Undergraduate education               | _____          | 1                 |        | 1                |        |
| No Information                        | _____          | 0.96 (0.95-1.00)  |        | 0.97 (0.96-1.01) |        |
| Level 2 (Aggregated by FU)            |                |                   |        |                  |        |
| Density of Oncologist                 |                |                   |        |                  |        |
| 5.72-28.24                            | _____          | _____             | _____  | 1.54 (1.41-1.68) | 0.001* |
| 29.56-40.92                           | _____          | _____             | _____  | 1.14 (1.10-1.18) |        |
| 41.23-60.10                           | _____          | _____             | _____  | 1                |        |
| Density of Coloproctologist           |                |                   |        |                  |        |
| 0.00-1.06                             | _____          | _____             | _____  | 1.27 (1.19-1.35) | 0.001* |
| 1.40-1.87                             | _____          | _____             | _____  | 1.16 (1.11-1.21) |        |
| 1.99-10.41                            | _____          | _____             | _____  | 1                |        |
| Density of Oncology Services          |                |                   |        |                  |        |
| 1.31-5.34                             | _____          | _____             | _____  | 1.08 (1.00-1.16) | 0.001* |
| 5.26-7.72                             | _____          | _____             | _____  | 1.10 (1.07-1.12) |        |
| 7.81-14.34                            | _____          | _____             | _____  | 1                |        |
| Fixed effects                         |                |                   |        |                  |        |
| Intercept                             | -0.475         | 0.455             |        | 0.413            |        |
| (CI 95%)                              | (-0.55- -0.39) | (0.31-0.42)       |        | (0.38-0.49)      |        |
| Random effects                        |                |                   |        |                  |        |
| Variance                              | 0.0368         | 0.0292            |        | 0.0249           |        |
| (CI 95%)                              | (0.020-0.065)  | (0.016-0.052)     |        | (0.036-0.046)    |        |
| LR Test                               | 1031.28        | 839.24            |        | 767.71           |        |
| (x², p-value)                         | (<0.001)       | (<0.001)          |        | (<0.001)         |        |

PR: Prevalence ratio adjusted by the multilevel model with random intercept; CI: Confidence interval; p: Wald's test;

\* *p trend* ≤ 0.05; SP: São Paulo.

**Model 1:** Statistical model with inclusion of individual level variables; **Model 2:** Statistical model with inclusion of variables of individual level and contextual level per FU.

**Table S2** - Multilevel analysis among individual and contextual variables for missing colorectal cancer stage in individuals aged 18 to 99 years old in the period from 2010 to 2019. Brazil, according to place residence, except SP

(n = 103,367).

| Advanced Stage<br>Of Colorectal Cancer                  |        |      |      |           |          |
|---------------------------------------------------------|--------|------|------|-----------|----------|
|                                                         | n      | %    | PR   | CI (95%)  | p*       |
| Individual Variables                                    |        |      |      |           |          |
| Marital Status                                          |        |      |      |           |          |
| Unmarried                                               | 14.494 | 62.9 | 1.16 | 1.13-1.19 | <0.001*  |
| Married                                                 | 22.724 | 68.0 | 1.00 | -         |          |
| No Information                                          | 8.110  | 64.0 | 1.12 | 1.09-1.15 |          |
| Tobacco Smoking                                         |        |      |      |           |          |
| Never                                                   | 16.988 | 65.8 | 1.00 | -         | <0.001*  |
| Yes                                                     | 12.983 | 67.9 | 1.03 | 1.02-1.05 |          |
| No Information                                          | 15.357 | 63.6 | 0.97 | 0.95-0.98 |          |
| Alcohol consumption                                     |        |      |      |           |          |
| Never                                                   | 18.005 | 65.0 | 1.00 | -         | < 0.001* |
| Yes                                                     | 10.154 | 70.4 | 1.08 | 1.07-1.10 |          |
| No Information                                          | 17.169 | 63.7 | 0.97 | 0.97-0.99 |          |
| Source of Referral                                      |        |      |      |           |          |
| Public (SUS)                                            | 29.754 | 66.4 | 1.04 | 1.02-1.05 | < 0.001* |
| Private/Health Insurance                                | 6.257  | 64.0 | 1.00 | -         |          |
| No Information                                          | 9.317  | 64.3 | 1.00 | 0.98-1.02 |          |
| Socioeconomic contextual variables                      |        |      |      |           |          |
| Percapita Income                                        |        |      |      |           |          |
| 360.34-749.69                                           | 21.155 | 64.8 | 1.28 | 1.12-1.46 | <0.001*  |
| 762.52-1039.30                                          | 23.759 | 66.3 | 1.23 | 1.07-1.40 |          |
| 1084.46-1715.11                                         | 414    | 72.5 | 1.00 | -         |          |
| Aging Rate                                              |        |      |      |           |          |
| 3.66-4.53                                               | 21.773 | 65.7 | 1.00 | -         | <0.01*   |
| 4.75-8.83                                               | 1.956  | 61.7 | 1.12 | 1.07-1.17 |          |
| 9.07-26.09                                              | 21.599 | 65.9 | 0.99 | 0.97-1.01 |          |
| Health service offer contextual variables               |        |      |      |           |          |
| Density of Family Doctor (per 100,000 inhabitants)      |        |      |      |           |          |
| 6.44-11.51                                              | 11.989 | 64.7 | 1.02 | 0.99-1.05 | <0.001*  |
| 12.75-17.44                                             | 15.364 | 66.7 | 0.96 | 0.94-0.98 |          |
| 17.80-33.96                                             | 17.975 | 65.4 | 1.00 | -         |          |
| Health Insurance Plan Density (per 100,000 inhabitants) |        |      |      |           |          |
| 5.05-22.84                                              | 22.143 | 65.3 | 1.00 | -         | <0.002*  |
| 23.61 -31.87                                            | 17.472 | 66.3 | 0.98 | 0.97-0.98 |          |
| 36.65-41.98                                             | 5.173  | 65.1 | 0.99 | 0.96-1.01 |          |
| Rectosigmoidoscopy Exams (per 100,000 inhabitants)      |        |      |      |           |          |
| 0.00-14.68                                              | 21.469 | 66.7 | 1.02 | 1.01-1.04 | <0.001*  |
| 18.60-39.98                                             | 12.695 | 64.5 | 0.99 | 0.98-1.01 |          |
| 40.77-120.68                                            | 11.164 | 64.8 | 1.00 | -         |          |

PR: Estimated Prevalence Ratio by Robust Poisson Model; CI: Confidence interval; p: Wald's test; \*Statistically significant; SP: São Paulo.

**Table S3** - Prevalence and unadjusted prevalence ratios for advanced stage colorectal cancer, according to individual characteristics and contextual variables. Brazil, by place residence, excluding SP (n = 69,047).