# Colorectal Cancer Stage at Diagnosis in Male Firefighters

**David J. Lee, PhD**

Department of Public Health Sciences

FCDS 2026 Virtual Annual Conference

September 9, 2026

FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION > PREVENTION

SYLVESTER COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM

Bonnie E. Gould Rothberg, MD, PhD, MPH, MMM, MS-HQS, Tulay Koru-Sengul, PhD, MHS, Wei Zhao MD, MS, Stephanie Negron, MPH, Victoria Pinilla, MPH, MA, Natasha Schaefer Solle, RN, MSN, PhD, Erin N. Kobetz, PhD, Paulo S. Pinheiro, MD, PhD, and David J. Lee, PhD

# Introduction
## Colorectal Cancer (CRC): USA

- **Colon & rectum cancer** was the third leading cause of new cancer cases among males in the USA in 2026[1].
- In Florida, **CRC** is the third most common cancer and the fourth cause of cancer deaths[2].

Male

Estimated New Cases

| | | |
|---|---|---|
| Prostate | 333,830 | 31% |
| Lung & bronchus | 110,910 | 10% |
| Colon & rectum | 84,160 | 8% |
| Melanoma of the skin | 65,400 | 6% |
| Urinary bladder | 64,730 | 6% |
| Kidney & renal pelvis | 50,770 | 5% |
| Non-Hodgkin lymphoma | 43,770 | 4% |
| Oral cavity & pharynx | 43,070 | 4% |
| Leukemia | 39,070 | 4% |
| Pancreas | 35,190 | 3% |
| **All sites** | **1,094,070** | |

FIREFIGHTER CANCER INITIATIVE

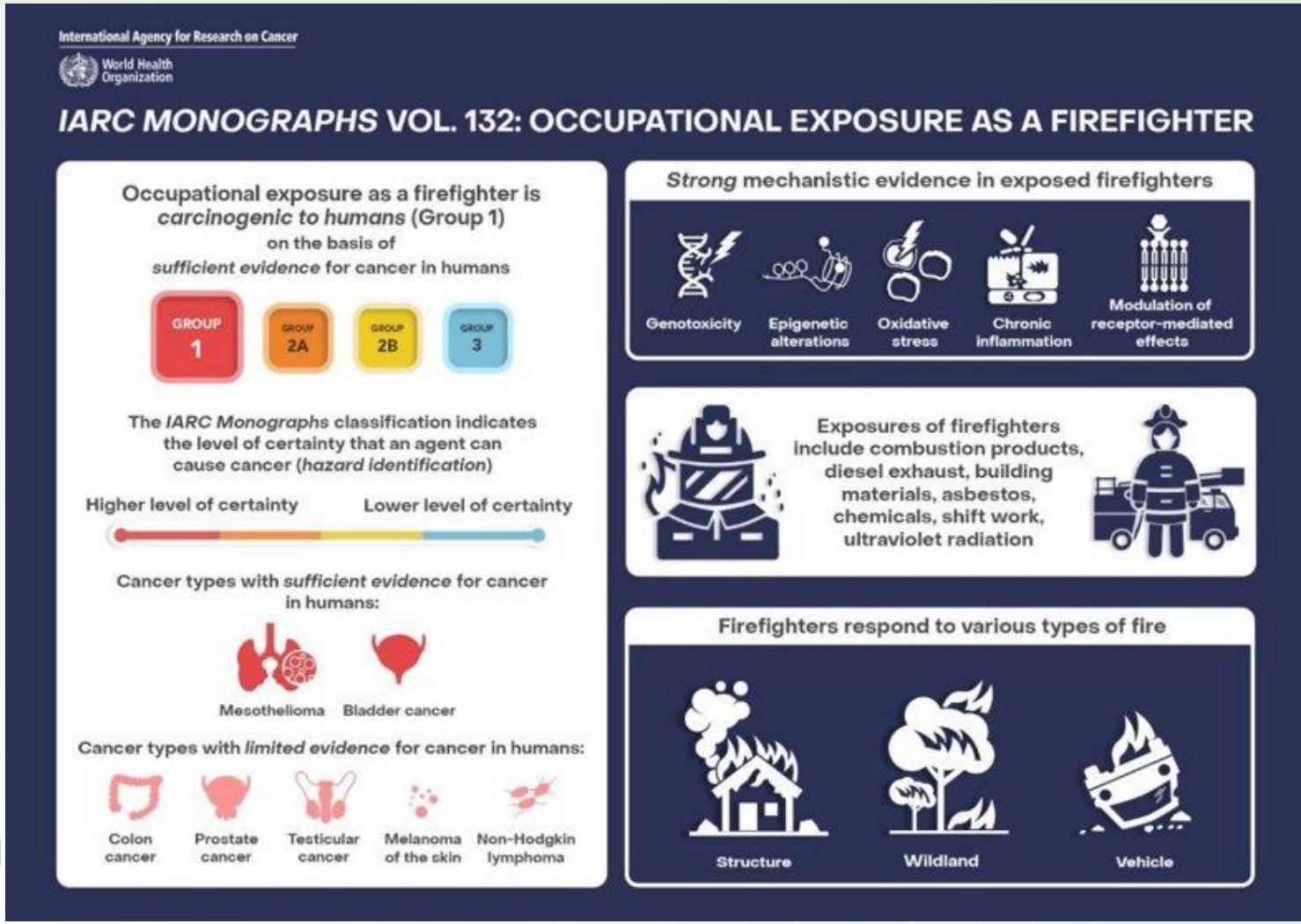
RESEARCH > EDUCATION > PREVENTION

SYLVESTER COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM

1. Siegel RL, Kratzer TB, Wagle NS, Sung H, Jemal A. *Cancer statistics, 2026*. *CA Cancer J Clin*. 2026;e70043. doi:10.3322/caac.70043
2. Division of Cancer Prevention and Control. Colorectal Cancer Statistics. https://www.cdc.gov/cancer/colorectal/statistics/index.htm. Accessed 2023.

# Introduction

- IARC has determined that occupational exposures as a firefighter are carcinogenic[1].
- Meta-analyses have shown that firefighters have a significantly higher risk of mortality from rectal cancer[2-4].




FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION


1 . Demers et al 2022. Carcinogenicity of occupational exposure as a firefighter
2. Jalilian et al 2019, Cancer incidence and mortality among firefighters.
3. Laroche et al 2021, Cancer Incidence and Mortality among Firefighters: An Overview of Epidemiologic Systematic Reviews.
4. Lee et al 2023, Cancer Risk and Mortality among Firefighters: A Meta-Analytic Review

# Introduction

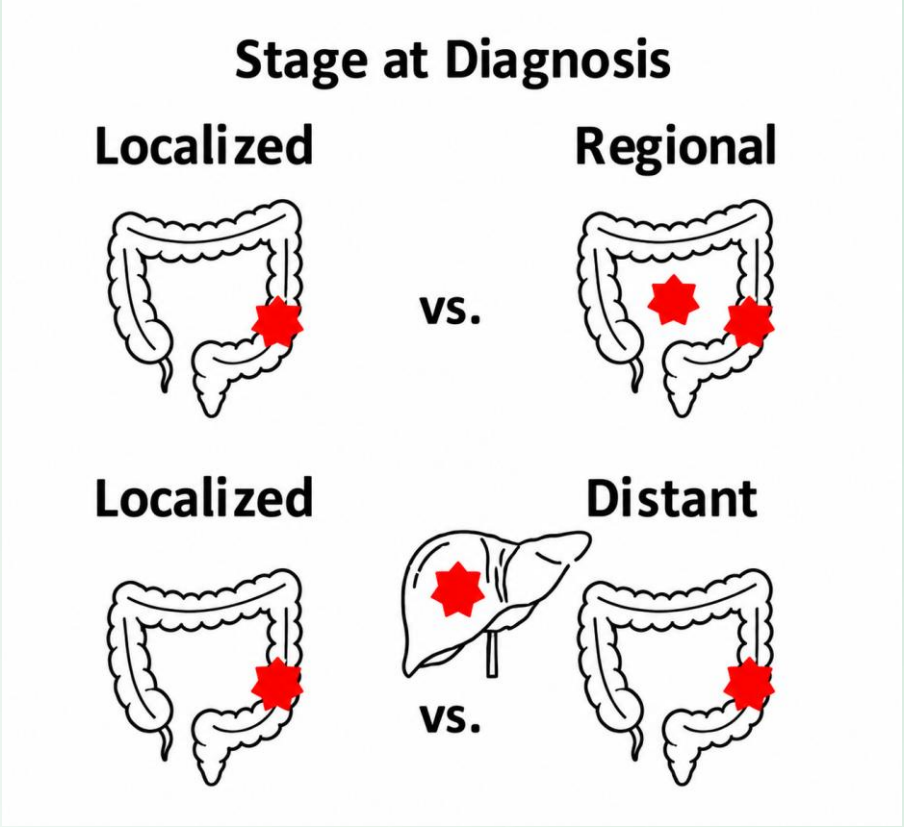
- **Purpose**: To characterize the distribution of stage at diagnosis among CRC cases diagnosed in Florida firefighters and compare this distribution to other occupational groups.
- We compare firefighter CRC stage at diagnosis with white-collar, blue-collar, and service worker occupational groups.
- This study addresses how **CRC stage at diagnosis** differs between firefighters and other occupational groups, using a population-based cancer registry linked with employment and certification records.

FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION > PREVENTION

# Significance of Stage at Diagnosis

- Stage at diagnosis is a critical prognostic factor for CRC outcomes[5-6]:
  - **Localized** (confined to bowel wall): **91%** 5-year survival
  - **Regional** (spread to nearby lymph nodes/tissue): **73%** 5-year survival
  - **Distant** (metastasized to other organs): **13%** 5-year survival
- The distribution of CRC stage at diagnosis among firefighters is unknown. Understanding these differences can help identify whether firefighters would benefit from enhanced or occupation-specific screening efforts.




FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION > PREVENTION

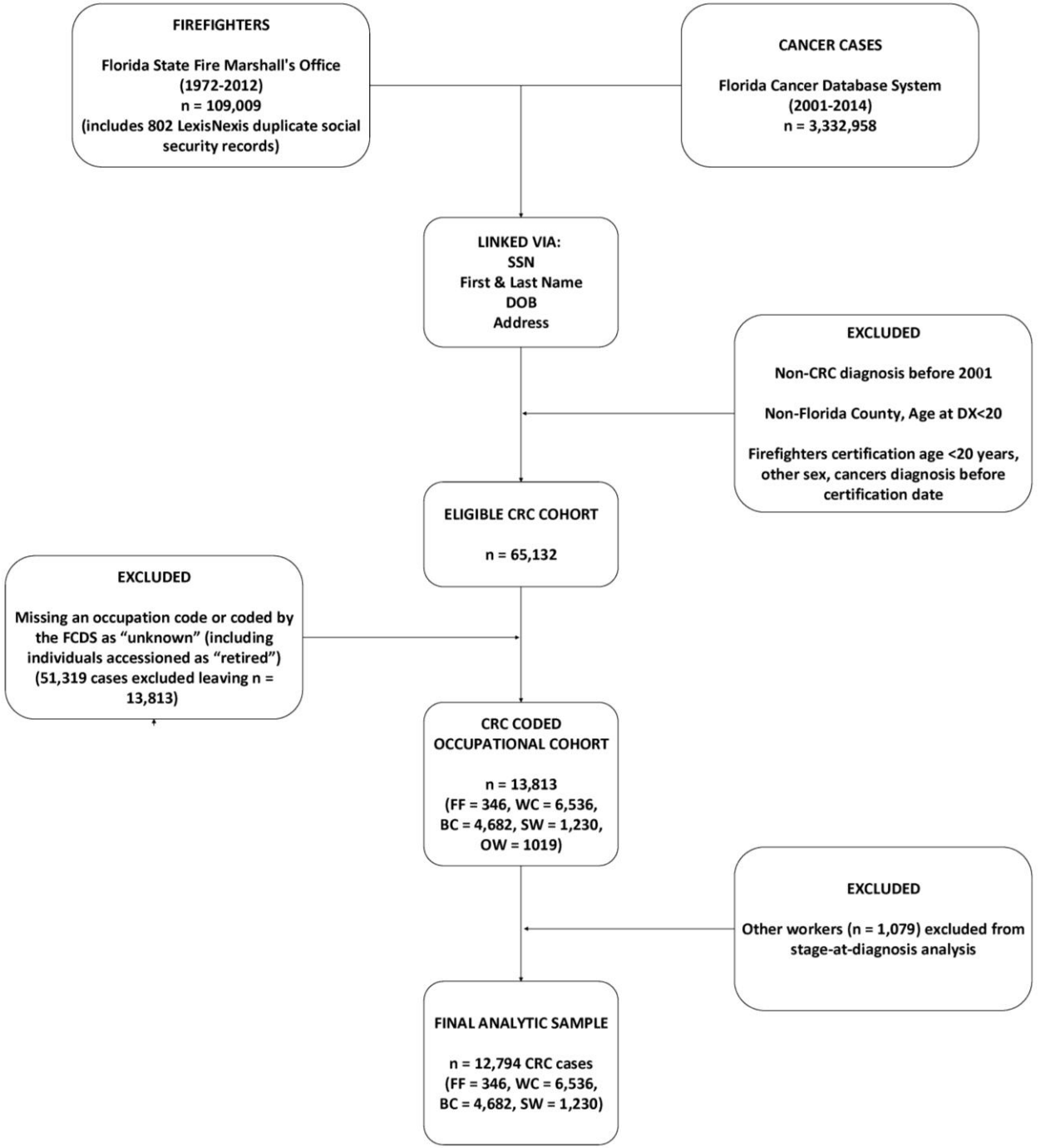
SYLVESTER COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM

[5]Siegel RL, et al. Cancer statistics, 2025. *CA Cancer J Clin*. 2025;75:10-45.20.
[6]Siegel R, et al. Cancer statistics, 2014. *CA Cancer J Clin*. 2014;64:9-29.

# Methods and Materials

- **Colorectal cancer cases from the Florida Cancer Data System (FCDS)** (2001-2014) were linked with firefighter employment and certification records (1972-2012) from the Florida State Fire Marshal's Office or identified by mapping against firefighting SOCs (3720, 3740, 3750).
- White-collar, blue collar, and service workers were identified according to coded SOCs in FCDS, and stage at diagnosis was classified using SEER notation as localized, regional, or distant.
- Bivariate tabulations were calculated using contingency tables, and the association between stage at diagnosis and occupational group was determined by **multivariate multinomial logistic regression**.

# Linkage Flowchart



# Results

- **13,813 total male CRC cases** diagnosed in Florida were included in the analysis
- This included **346 firefighters**:
  - 272 firefighters were identified through FMO linkage
  - 74 firefighters identified using SOCs

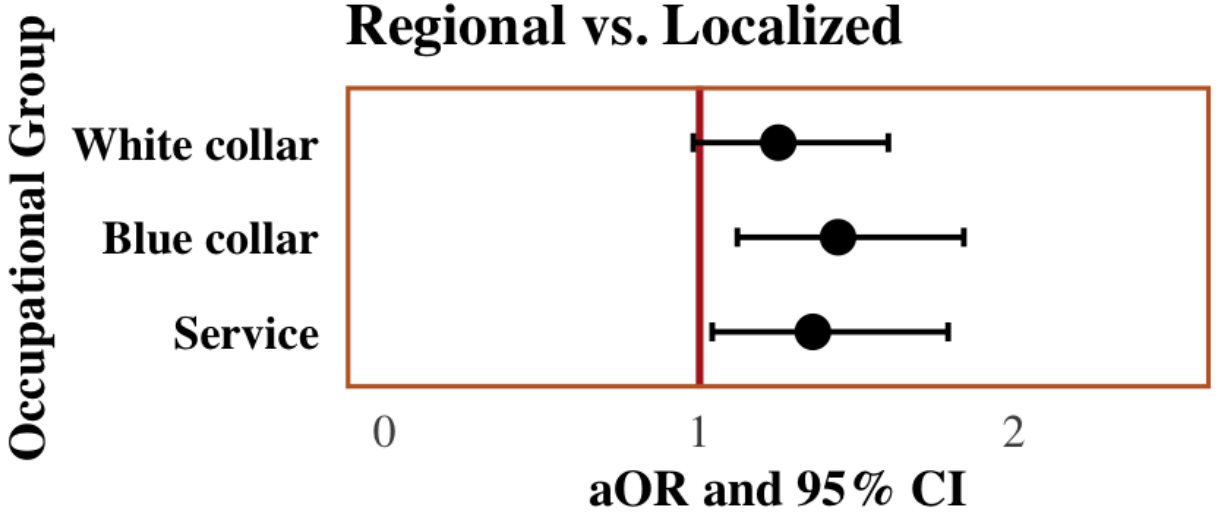
# Table 1. Distribution of clinic-demographic covariates by occupation class

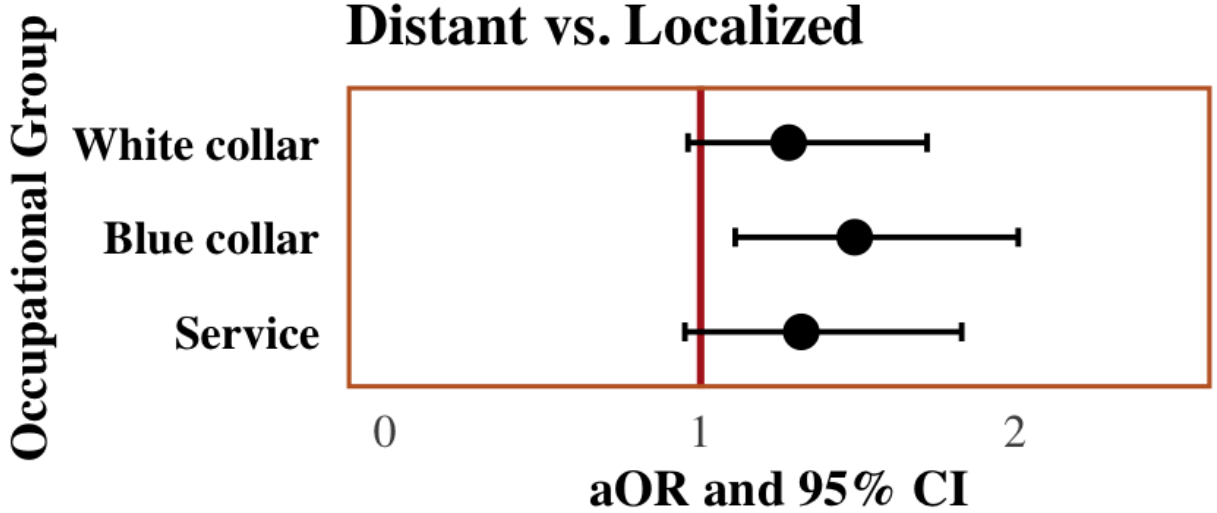
| Covariate | Total (n=13,813) | Firefighters (n=346) | White Collar (n=6,536) | Blue Collar (n=4,682) | Service (n=1,230) | Other[a] (n=1,019) |
|---|---|---|---|---|---|---|
| Year of diagnosis | | | | | | |
| 2001-2007 | 7,078 (51.2%)[b] | 178 (51.4%) | 3,484 (53.3%) | 2,374 (50.7%) | 564 (45.9%) | 478 (46.9%) |
| 2008-2014 | 6,735 (48.8%) | 168 (48.6%) | 3,052 (46.7%) | 2,308 (49.3%) | 666 (54.1%) | 541 (53.1%) |
| | | | | | | |
| Age at diagnosis (years) | | | | | | |
| 20-44 | 923 (6.7%) | 26 (7.5%) | 393 (6.0%) | 279 (6.0%) | 116 (9.4%) | 109 (10.7%) |
| 45-49 | 935 (6.8%) | 31 (9.0%) | 375 (5.7%) | 351 (7.5%) | 96 (7.8%) | 82 (8.0%) |
| 50-75 | 9,178 (66.4%) | 228 (65.9%) | 4,189 (64.1%) | 3,184 (68.0%) | 819 (66.6%) | 758 (74.4%) |
| 76+ | 2,777 (20.1%) | 61 (17.6%) | 1,579 (24.2%) | 868 (18.5%) | 199 (16.2%) | 70 (6.9%) |
| Race and ethnicity | | | | | | |
| Non-Hispanic White | 10,982 (79.5%) | 315 (91.0%) | 5,626 (86.1%) | 3,577 (76.4%) | 874 (71.1%) | 590 (57.9%) |
| Non-Hispanic Black | 1,428 (10.3%) | 16 (4.6%) | 375 (5.7%) | 600 (12.8%) | 205 (16.7%) | 232 (22.8%) |
| Hispanic | 1,403 (10.2%) | 15 (4.3%) | 535 (10.8%) | 505 (10.8%) | 151 (12.3%) | 197 (19.3%) |
| | | | | | | |
| Tobacco use | | | | | | |
| Never | 5,009 (36.3%) | 138 (39.9%) | 2,652 (40.6%) | 1,402 (29.9%) | 429 (34.9%) | 388 (38.1%) |
| Former | 3,971 (28.7%) | 79 (22.8%) | 1,905 (29.1%) | 1,444 (30.8%) | 343 (27.9%) | 200 (19.8%) |
| Current | 1,958 (14.2%) | 45 (13.0%) | 673 (10.3%) | 847 (18.1%) | 188 (15.3%) | 205 (20.1%) |
| Unknown | 2,875 (20.8%) | 84 (24.3%) | 1,306 (20.0%) | 989 (21.1%) | 270 (22.0%) | 226 (22.2%) |
| | | | | | | |
| Sequence of CRC diagnosis | | | | | | |
| Single primary cancer | 8,250 (59.7%) | 264 (76.3%) | 3,850 (58.9%) | 2,788 (59.5%) | 699 (56.8%) | 649 (63.7%) |
| 1st of multiple primary cancers | 2,617 (18.9%) | 55 (15.9%) | 1,237 (18.9%) | 904 (19.3%) | 249 (20.2%) | 172 (16.9%) |
| 2nd of multiple primary cancers | 2,946 (21.3%) | 27 (7.8%) | 1,449 (22.2%) | 990 (21.1%) | 282 (22.9%) | 198 (19.4%) |

# Table 2. Multivariable odds ratios for stage at diagnosis

| Covariate | Regional vs. Localized aOR (95% CI) | p value[b] | Distant vs. Localized aOR (95% CI) | p value |
|---|---|---|---|---|
| Occupational group | | | | |
| Firefighters | Ref. | | Ref. | |
| White collar | 1.25 (0.98 to 1.60) | 0.07 | 1.28 (0.96 to 1.72) | 0.10 |
| Blue collar | 1.44 (1.12 to 1.84) | 0.004 | 1.49 (1.11 to 2.01) | 0.008 |
| Service | 1.36 (1.04 to 1.79) | 0.03 | 1.32 (0.95 to 1.83) | 0.09 |
| Year of diagnosis | | | | |
| 2001-2007 | Ref. | | Ref. | |
| 2008-2014 | 1.07 (0.99 to 1.16) | 0.10 | 1.24 (1.13 to 1.36) | <0.001 |
| Age at diagnosis (years) | | | | |
| 20-44 | Ref. | | Ref. | |
| 45-49 | 0.84 (0.67 to 1.07) | 0.16 | 0.89 (0.68 to 1.15) | 0.36 |
| 50-75 | 0.67 (0.56 to 0.80) | <0.001 | 0.66 (0.54 to 0.80) | <0.001 |
| 76+ | 0.54 (0.44 to 0.65) | <0.001 | 0.41 (0.33 to 0.51) | <0.001 |
| Race and ethnicity | | | | |
| Non-Hispanic White | Ref. | | Ref. | |
| Non-Hispanic Black | 1.16 (1.00 to 1.34) | 0.05 | 1.23 (1.05 to 1.45) | 0.01 |
| Hispanic | 1.04 (0.90 to 1.20) | 0.59 | 1.07 (0.91 to 1.26) | 0.39 |
| Tobacco use | | | | |
| Never | Ref. | | Ref. | |
| Former | 1.03 (0.93 to 1.14) | 0.60 | 1.03 (0.92 to 1.16) | 0.60 |
| Current | 1.10 (0.96 to 1.25) | 0.17 | 1.14 (0.98 to 1.33) | 0.09 |
| Unknown | 0.92 (0.83 to 1.03) | 0.14 | 0.98 (0.87 to 1.12) | 0.80 |
| Sequence of CRC diagnosis | | | | |
| Single primary cancer | Ref. | | Ref. | |
| 1st of multiple primary cancers | 0.84 (0.76 to 0.93) | <0.001 | 0.59 (0.52 to 0.67) | <0.001 |
| 2nd of multiple primary cancers | 0.84 (0.75 to 0.93) | <0.001 | 0.92 (0.82 to 1.04) | 0.18 |

# Multivariable odds ratios for stage at diagnosis by occupational group

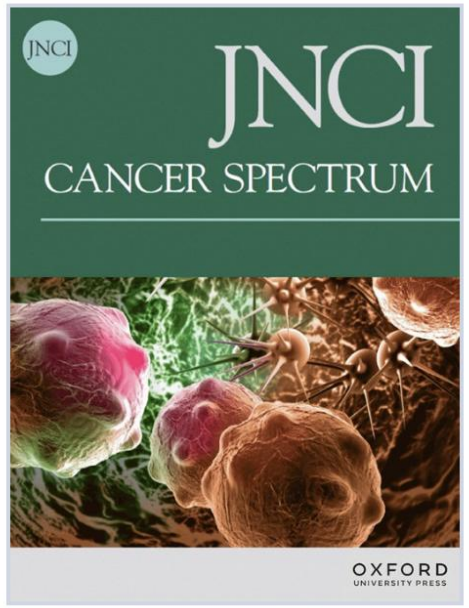



(aOR: Adjusted Odds Ratio; 95% CI: 95% confidence interval)

# Conclusions

- Although firefighters have an increased CRC risk, they tend to be **diagnosed at a more localized stage**.
- **Higher stage at diagnosis** among blue-collar workers might be due to:
  - Lower health literacy.
  - Lower job flexibility to comply with screening.
    - Colonoscopies, by removing premalignant lesions, can also be therapeutic.
- **Improved screening** across worker groups can increase the percentage of localized CRCs.
- Later-state CRC, especially in blue-collar workers, underscores the need for equitable CRC screening.




Volume 9, Issue 6
December 2025

OXFORD

*JNCI Cancer Spectrum*, 2025, **9(6)**, pkaf107
https://doi.org/10.1093/jncics/pkaf107
Advance Access Publication Date: November 5, 2025
**Article**

# Colorectal cancer stage at diagnosis in male Florida firefighters

Bonnie E. Gould Rothberg, MD, PhD, MPH, MMM*[,1], Tulay Koru-Sengul, PhD, MHS[1,2], Wei Zhao, MD, MS[1], Monique N. Hernandez, PhD[3], Stephanie Negron, MPH[2], Victoria Pinilla, MPH, MA, CPH[2], Natasha Schaefer Solle, RN, PhD, MSN[1,2,4], Erin N. Kobetz, PhD, MPH[1,2,4], Paulo S. Pinheiro, MD, PhD[1,2], David J. Lee, PhD[1,2,3]

[1]Sylvester Comprehensive Cancer Center, University of Miami Miller School of Medicine, Miami, FL, United States
[2]Department of Public Health Sciences, University of Miami Miller School of Medicine, Miami, FL, United States
[3]Florida Cancer Data System, Sylvester Comprehensive Cancer Center, University of Miami Miller School of Medicine, Miami, FL, United States
[4]Department of Medicine, University of Miami Miller School of Medicine, Miami, FL, United States

*Corresponding author: Bonnie E. Gould Rothberg, MD, PhD, MPH, MMM, Sylvester Comprehensive Cancer Center, Leonard M. Miller School of Medicine, University of Miami, Don Soffer Clinical Research Center, Rm 1228, 1120 NW 14th Street, Miami, FL 33136, United States (beg72@miami.edu).

https://academic.oup.com/jncics/article/9/6/pkaf107/8315150?login=false

FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION > PREVENTION

SYLVESTER COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM

# Thank you!

dlee@med.miami.edu

Research reported in this presentation was supported in part by a grant award from the State of Florida appropriation #2382A to the University of Miami (UM) Sylvester Comprehensive Cancer Center and by the National Cancer Institute of the National Institutes of Health under Award Number P30CA240139. The content is solely the responsibility of the authors and does not necessarily represent the official views of the State of Florida nor the National Institutes of Health.

FIREFIGHTER CANCER INITIATIVE

RESEARCH > EDUCATION > PREVENTION

SYLVESTER COMPREHENSIVE CANCER CENTER
UNIVERSITY OF MIAMI HEALTH SYSTEM