



Long-Term Rural-Urban Trends in Tobacco Use, Cessation Interventions, and Lung Cancer Screening – 10-Year Retrospective Cohort Study

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INTRODUCTION

- Lung cancer remains the leading cause of cancer death in the US, with **80-90% of deaths linked to tobacco use**.^{1,2}
- Overall declines in lung cancer (LC) mortality is in tandem with declining smoking rates, but LC death rates remain **disproportionately high in rural areas**, potentially due to **higher smoking prevalence, lower use of prevention and early detection services**.³⁻⁸
- Data are limited** on **long-term rural-urban trends** within a well-defined geographic region on **smoking prevalence, smoking cessation interventions** and lung cancer **screening** with low-dose CT (LDCT).
- Study objective:** Compare trends in yearly cigarette smoking, cessation intervention, and LDCT use by rural-urban status over 10 years (2014-2023)

METHODS

- Data:** Retrospective cohort using Rochester Epidemiology Project (REP) clinical encounter data in a 27-county area in Minnesota and Wisconsin.⁹⁻¹¹
- Population:** Adults aged 40-80, excluding those with a history of lung cancer before the start of each calendar year.
- Predictor:** ZIP-code based RUCA (Rural-Urban Commuting Area codes) classification¹²: Urban (1.0/1.1), Highly Rural (10.0/10.3), and Rural (all other RUCA codes).
- Outcomes:** Smoking prevalence, and receipt of smoking cessation interventions (counseling/pharmacotherapy) and LDCT.
- Analysis:** Repeated cross-sectional, with generalized estimating equation models for trend; analysis performed using SAS 9.4.

RESULTS

514,881
Unique people in the 10-year cohort

36-38%
In urban area each year

56-57%
In rural area each year

6-7%
In highly-rural areas each year

- During 2014-2023, the annual sample size of people, ages 40-80 years, ranged from 305,530 to 340,411; mean age was 59-60 years (SD=10.7-11.6), 51% were female, and 89-92% were non-Hispanic White (**Table 1**).
- Overall, current smoking prevalence was 14.0% in 2014, 16.0% in 2017, and 12.0% in 2023 (p=0.06) with **consistently higher rates in rural and highly rural areas** (p<0.001, **Figure 1**).
- Among people who currently smoke, cessation interventions increased from 16% to 23% (p<0.001), with consistently lower rates in rural/highly rural areas than in urban areas (p<0.001, **Figure 2**). However, cessation counseling rates were similar between urban and rural areas and **lower in highly rural areas** (p<0.001).
- Among people aged 50-80 years who currently smoke, LDCT use increased from 2014 to 2023 (urban=0.1-8.0%; rural=0.0-5.7%; highly rural=0.1-6.1%, p<0.001) (**Figure 3**). LDCT use also increased among people who had ever smoked but remained low overall (3.1% in 2023).



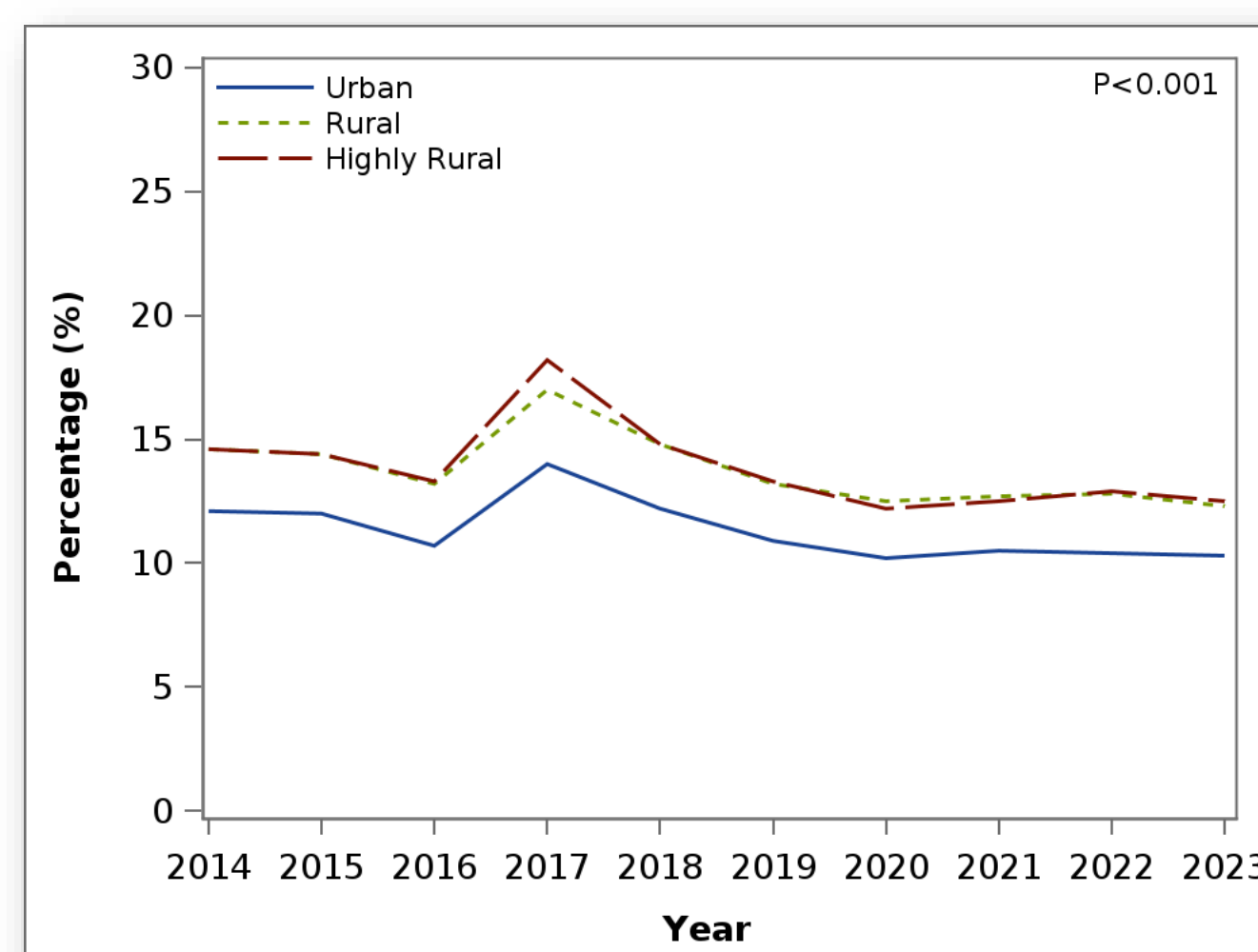
Table 1. Overall Characteristics of Rochester Epidemiology Project Participants, Age 40-80 Years, 2014-2023

Variables	2014 n = 313,780				2017 n = 319,478				2023 n = 305,530			
	Urban n = 112,398	Rural n = 177,675	Highly Rural n = 21,081	Missing n = 2,626	Urban n = 115,827	Rural n = 181,865	Highly Rural n = 21,152	Missing n = 634	Urban n = 114,720	Rural n = 171,194	Highly Rural n = 18,001	Missing n = 1,615
Age in years (mean, SD)	57 (11)	58 (11)	59 (11)	56 (11)	58 (11)	58 (11)	59 (11)	57 (11)	59 (12)	59 (11)	61 (11)	58 (11)
Female (n, %)	58,345 (52)	90,453 (51)	105,96 (50)	1,317 (50)	60,203 (52)	92,986 (51)	10,682 (51)	296 (47)	59,797 (52)	88,207 (52)	9,247 (51)	762 (47)
White (n, %)	100,244 (89)	166,016 (93)	19,798 (94)	1,900 (72)	101,590 (88)	168,351 (93)	19,833 (94)	458 (72)	97,957 (85)	156,982 (92)	16,889 (94)	1,395 (86)
Never smoked (n, %)	56,166 (50)	81,830 (46)	9,295 (44)	148 (6)	61,578 (53)	89,916 (49)	10,078 (48)	146 (23)	63,694 (56)	87,918 (51)	9,090 (51)	775 (48)
Formerly smoked (n, %)	31,391 (28)	53,639 (30)	6,257 (30)	103 (4)	29,203 (25)	49,788 (27)	5,524 (26)	84 (13)	35,486 (31)	57,992 (34)	6,071 (34)	506 (31)
Currently smoked (n, %)	12,076 (11)	23,127 (13)	2,651 (13)	21 (1)	14,729 (13)	28,714 (16)	3,481 (17)	45 (7)	11,370 (10)	20,510 (12)	2,160 (12)	141 (9)
Missing (n, %)	12,765 (11)	19,079 (11)	2,878 (14)	2,354 (90)	10,317 (9)	13,447 (7)	2,069 (10)	359 (57)	4,170 (4)	4,774 (3)	680 (4)	193 (12)

Note: Table has been abbreviated to display selected time points (2014, 2017, and 2023).



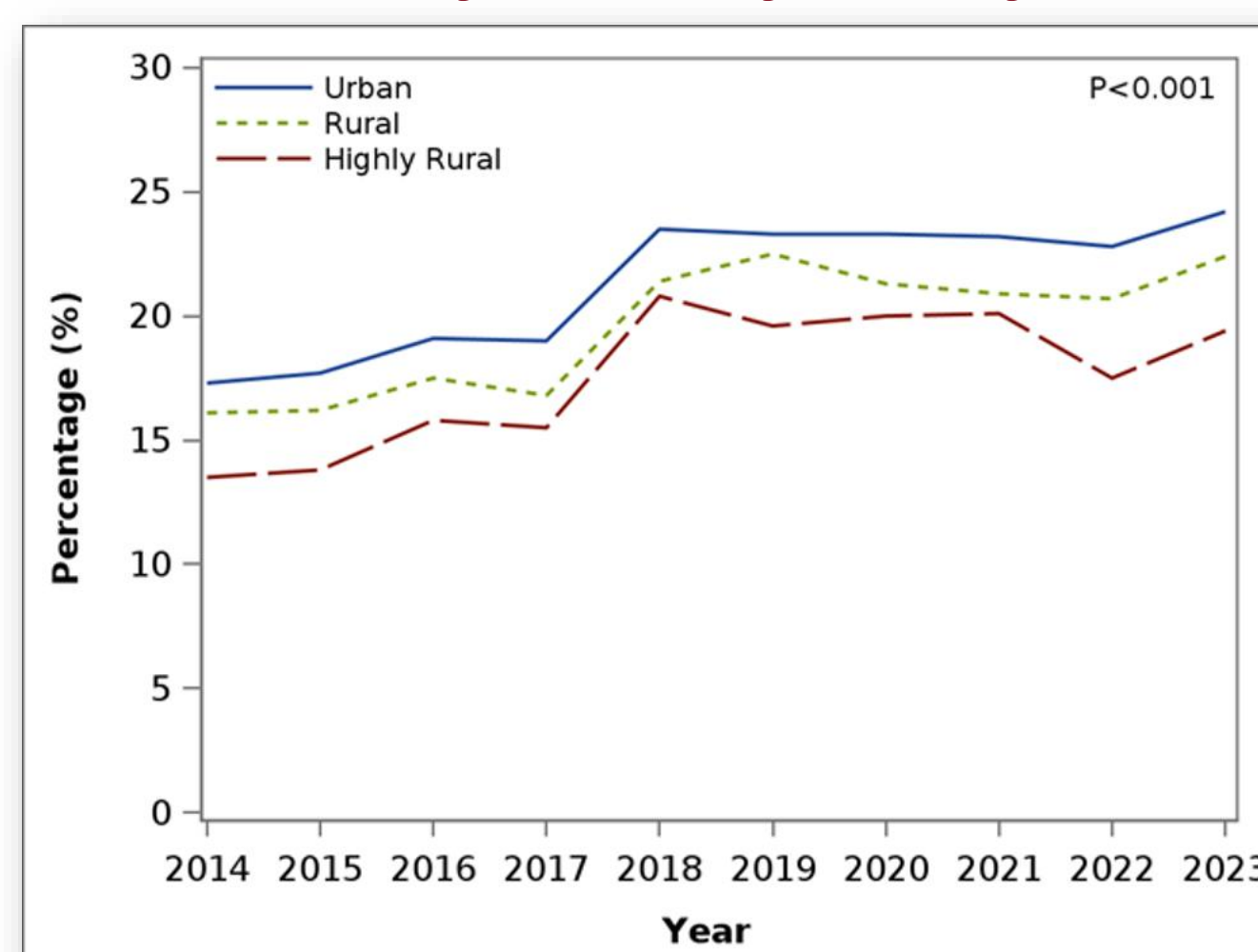
Figure 1. Trends in Current Smoking by Rurality



Note: Figure 1 shows the prevalence of current smoking among people aged 40-80 years in the REP data. Smoking prevalence was defined for each year, and categorized as people who currently smoke, formerly smoked, or never smoked cigarettes.



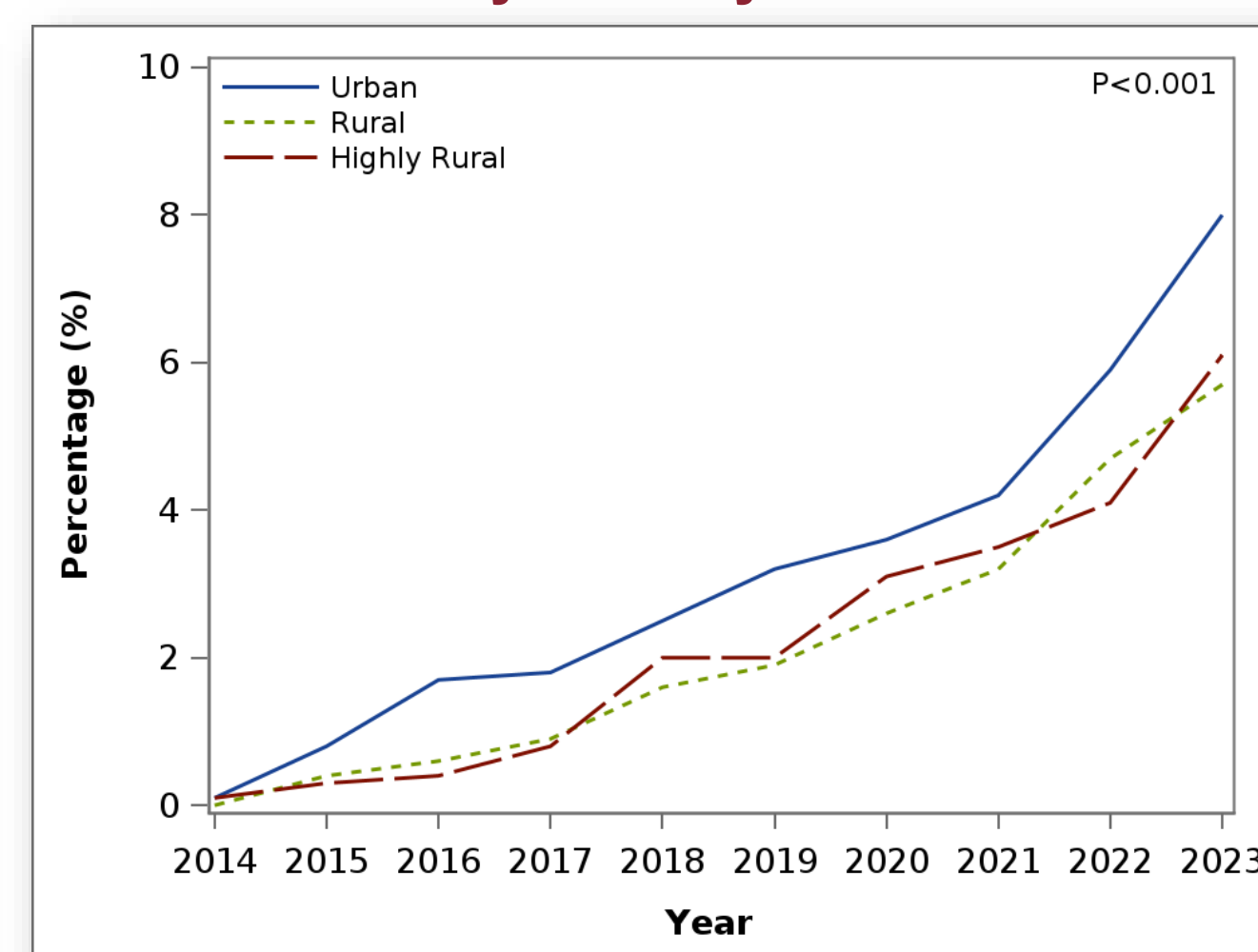
Figure 2. Evidence-based Cessation Therapy Trends Among People Who Currently Smoke by Rurality



Note: Smoking cessation therapy was assessed among people aged 40-80 years who currently smoke (excluding those with a history of lung cancer before the start of each calendar year) and included cessation counseling, NRT, and Varenicline and/or Bupropion prescriptions.



Figure 3. LDCT Screening Trends Among People Who Currently Smoke by Rurality



Note: LDCT receipt was assessed among people who currently smoke aged 50-80 years (excluding those with a history of lung cancer before the start of each calendar year), because the detailed smoking history needed to determine USPSTF eligibility under the 2013 or 2021 criteria was inconsistently captured in the EHR.

DISCUSSION AND CONCLUSION

Actionable Take Away Message

- Over the 10-year study period, current smoking prevalence declined and use of lung cancer risk-reduction and early-detection interventions increased, although uptake remained low.
- Rural and highly rural populations had persistently higher smoking prevalence and lower use of evidence-based interventions than urban populations, highlighting persistent disparities over the decade.
- There is a need to reduce barriers to smoking cessation and lung cancer screening, especially in rural communities where access to preventive services may be limited, and
- Strengthen data systems to better capture prevention, screening, and care delivery in rural areas beyond the limitations of routinely collected clinical data.

Future Direction for Research

- There is a need to reduce barriers to smoking cessation and lung cancer screening, especially in rural communities where access to preventive services may be limited, and
- Strengthen data systems to better capture prevention, screening, and care delivery in rural areas beyond the limitations of routinely collected clinical data.

REFERENCES & ACKNOWLEDGEMENTS



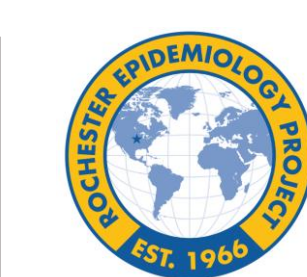
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