



# Trends in Rural and Urban Cigarette Smoking Quit Ratios in the US From 2010 to 2020

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## Introduction

Cigarette smoking prevalence is higher in rural than urban US communities. This disparity has increased over time.<sup>1</sup> People in rural vs urban areas are more likely to die prematurely,<sup>2</sup> which has been associated with reduced health care access and smoking cessation barriers.<sup>3</sup> Lower smoking cessation rates<sup>4</sup> could also be factors in increased morbidity and mortality burden in rural residents.<sup>2</sup> Herein, we estimated trends in cigarette quit ratios for adults ( $\geq 18$  years) in rural and urban areas from 2010 to 2020.

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## Methods

Publicly available, deidentified data were obtained from 2010-2020 National Survey on Drug Use and Health (NSDUH). Adults who had smoked 100 or more cigarettes were included in the analyses. This cross-sectional study followed the STROBE reporting guideline and was considered to be non-human participant research by Indiana University Institutional Review Board.

Rurality was defined using US Office of Management and Budget Rural-Urban Continuum Codes. For 2010-2014 NSDUH, definitions were based on 2003 metropolitan or nonmetropolitan statistical area county-level groupings; for 2015-2020 NSDUH, updated 2013 groupings were used. Lifetime cigarette smoking was defined as having smoked at least 100 cigarettes in a lifetime, current smoking as 1 or more cigarettes in past month, and former smoking as no cigarettes in the past year. Overall and annual quit ratios were estimated as proportions of former smokers among lifetime smokers.

Current smoking and quit ratios were estimated by rural or urban residence annually. Weighted, stratified logistic regression models tested linear time trends in quit ratios by rural or urban residence using year as a continuous variable. Models were unadjusted and then adjusted for sex, race and ethnicity, educational level, and income. Adjusted models, including year by rurality and year by age, were estimated separately to explore differential rural or urban and age time trends in quit ratios using the R survey package.  $\alpha = .05$  indicated significance.

## Results

Of the 161 348 lifetime cigarette smokers analyzed, 54 080 (33.5%) were former smokers. Participants ranged in age (14.2% were 18-25 years; 15.9%, 26-34 years; 25.3%, 35-49 years; 44.6%,  $\geq 50$  years) and included 48.2% women and 51.8% men; 64.9% White individuals; and 35.8% individuals with more than \$75 000 annual income.

In 2020, current smoking prevalence was higher in rural (19.2%; 95% CI, 16.9%-21.7%) than urban areas (14.4%; 95% CI, 13.3%-15.5%;  $P < .001$ ), whereas quit ratios were similar in rural (52.9%; 95% CI, 48.3%-57.4%) and urban areas (53.9%; 95% CI, 51.4%-56.5%;  $P = .70$ ). From 2010 to 2020, odds of quitting were lower in rural vs urban areas (odds ratio [OR], 0.85 [95% CI, 0.81-0.88;  $P < .001$ ]; adjusted OR [AOR], 0.93 [95% CI, 0.89-0.98;  $P = .008$ ]). Quit ratios increased over time (OR, 1.03 [95% CI, 1.03-1.04;  $P < .001$ ]; AOR, 1.01 [95% CI, 1.01-1.02;  $P < .001$ ]) (**Figure 1**), and no

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significant interaction was observed between rural or urban residence and time ( $\chi^2 = 0.027$ ;  $P = .89$ ). However, the interaction between age and time was significant ( $\chi^2 = 75.90$ ;  $P < .001$ ) (Figure 2); odds of quitting were still lower in rural vs urban areas (AOR, 0.93;  $P = .006$ ).

Figure 1. Smoking Quit Ratios for Individuals in Rural vs Urban Areas From 2010 to 2020

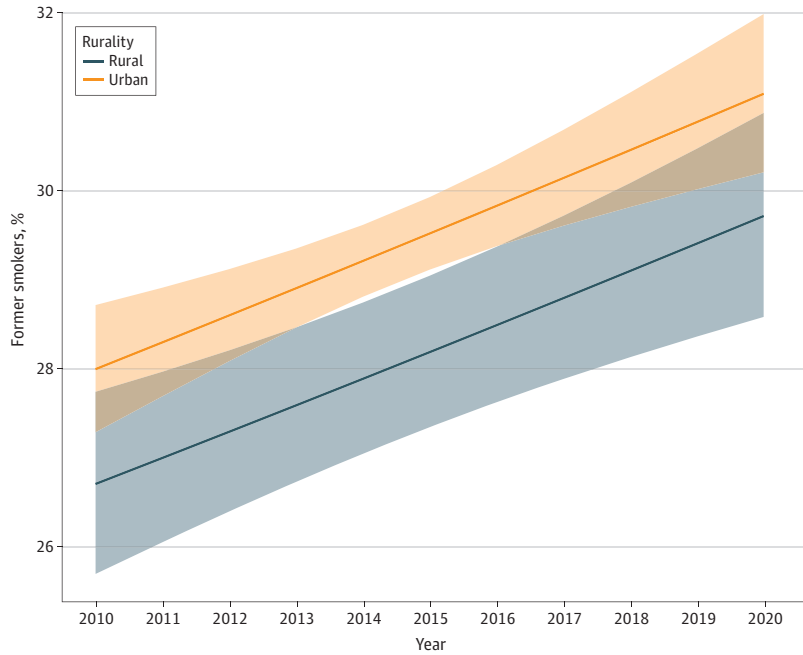
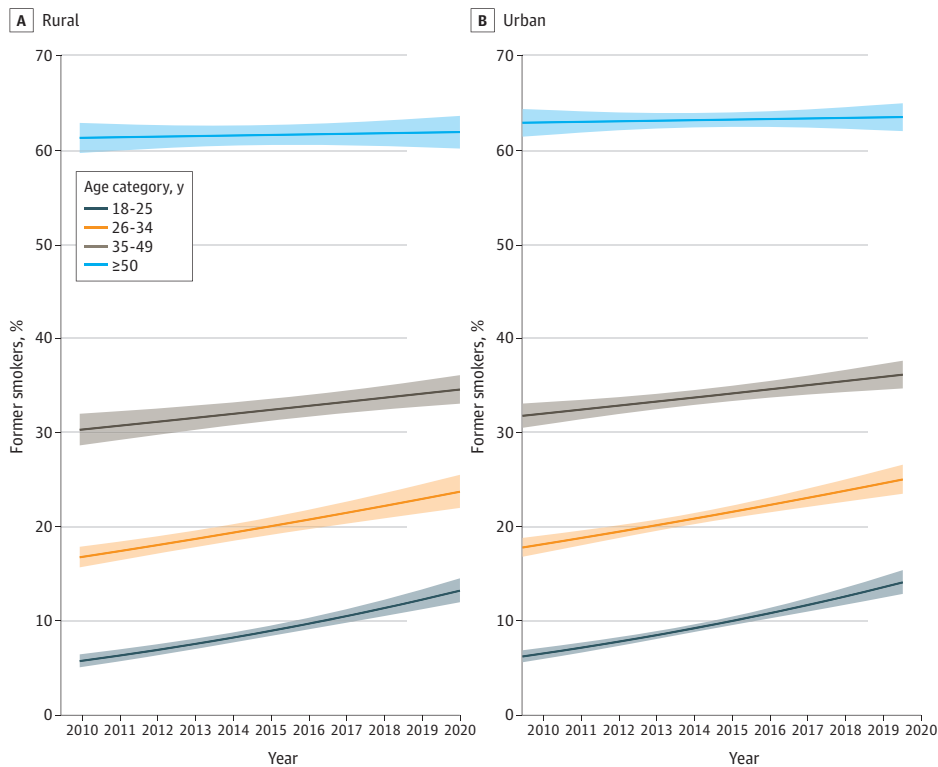


Figure 2. Smoking Quit Ratios by Age for Individuals in Rural vs Urban Areas From 2010 to 2020



## Discussion

Findings from 2010-2020 NSDUH data support a persistent rural-urban disparity. Higher smoking prevalence and lower quit ratios were observed in rural vs urban areas after adjusting for sociodemographic characteristics. These results may reflect an earlier stage of motivation to quit<sup>5</sup> and reporting of higher nicotine dependence and heaviness of smoking among rural vs urban residents.<sup>6</sup> Rural residents may also face structural barriers to cessation services, including lower rates of insurance coverage and fewer available health care practitioners,<sup>3</sup> which warrant future research.

A study strength is its high external validity. Limitations include its cross-sectional design, although we used multiple years of data, and potential measurement error from self-reported data.

Intervention at the clinical setting, health system, or population level might improve reach and sustainability of cessation services for rural, especially older, residents. Leveraging existing quit lines and telehealth solutions may minimize barriers to accessing cessation services.<sup>3</sup>

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### ARTICLE INFORMATION

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**Author Contributions:** Dr Parker had full access to all of the data in the study and takes responsibility for the integrity of the data and the accuracy of the data analysis.

*Concept and design:* M. A. Parker.

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*Drafting of the manuscript:* M. A. Parker, Eggers, E. S. Parker.

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*Statistical analysis:* E. S. Parker.

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