

# Tobacco use among Appalachian adolescents: An urgent need for virtual scale out of effective interventions

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## ABSTRACT

Tobacco use, typically initiated during adolescence, can escalate into young adulthood, even among experimenting or intermittent users. Despite declines in cigarette smoking among US adolescents, use of other tobacco products and poly-tobacco are on the rise among Appalachian adolescents. Unfortunately, Appalachian adolescent tobacco users also are less likely to receive effective tobacco interventions due to various barriers: a) accessibility (e.g. service and provider shortages, affordability, and transportation; b) acceptability (e.g. issues of privacy and stigma); and c) cultural relevance. The present review provides critical considerations synthesized from an extensive body of literature on the suitability of virtual tobacco interventions, the need for well-timed interventions that address complex tobacco use, and the rationale for leveraging and scaling evidence-based interventions inform novel interventions for Appalachian adolescent tobacco users. Borrowing strength from existing in-person evidence-based adolescent tobacco interventions and state-of-the-art virtual health services, a well-planned virtual scale out of tobacco interventions holds potential to minimize barriers unique to Appalachia.

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## INTRODUCTION

In the US, nearly half of all adolescents report lifetime tobacco use (44.3%)<sup>1</sup>. Though statistics show declines over the past decade in adolescent cigarette smoking, the use of other tobacco products (i.e. cigar products, hookah, smokeless tobacco) and electronic nicotine delivery systems (ENDS) – all FDA-classified tobacco products<sup>2</sup> – are on the rise<sup>3-7</sup>. In 2020, 23.6% of high school students reported current use of any tobacco product, 9.4% any combustible tobacco product, and 8.2% multiple tobacco products<sup>8</sup>. Use was highest for ENDS (19.6%), followed by cigars (5.0%), cigarettes (4.6%), smokeless tobacco (3.1%), and hookahs (2.7%)<sup>8</sup>. Roughly 6% of adolescents (or a quarter of adolescent tobacco users) report using multiple tobacco products simultaneously (i.e. poly-tobacco use)<sup>9</sup>, elevating the risk for sustained nicotine dependence into adulthood<sup>10</sup>. More than half of these adolescents report that they want to quit; however, most who attempt to quit fail in those efforts<sup>11</sup>. Without tobacco intervention (i.e. means to disrupt escalation of, reduce, or stop tobacco product use), tobacco use can escalate to entrenched patterns in young adulthood, even among experimenting and intermittent users<sup>12,13</sup>.

Appalachian adolescents are a priority population because they: 1) have not experienced the declines in cigarette use seen nationally<sup>14-16</sup>; 2) have higher than average prevalence of most tobacco product use (i.e. cigarettes, cigars, smokeless,

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ENDS)<sup>16</sup> and poly-tobacco use<sup>17-19</sup>; 3) are more likely to be daily users<sup>20,21</sup>; and 4) start using and intend to use at younger ages<sup>20-22</sup>. While multiple factors contribute to these disparities and ultimately premature death among Appalachians, tobacco use, especially cigarette smoking, remains the most significant contributor to a greater loss of life in Appalachia than in the rest of the country<sup>15,20,21,23-25</sup>. Among those living in the economically distressed counties of Central Appalachia, these differences are even greater<sup>1,24,26-33</sup>. Central Appalachia, which includes West Virginia, Eastern Kentucky, Southwest Virginia, East Tennessee, and Western North Carolina, is characterized by disproportionate rates of economic scarcity, chronic disease, and premature mortality<sup>34</sup>. Adult tobacco use, particularly cigarette smoking, in Central Appalachia is among the highest in the US, and contributes to these inequities. The Appalachian Regional Commission reports that 45% of Appalachian counties are in the highest quintile of adult smoking prevalence in the nation<sup>25,34</sup>. The current tobacco prevalence rates among high school adolescents in Kentucky, North Carolina, Tennessee, West Virginia, Virginia, and Ohio, are 29.7%, 36.5%, 27.9%, 40.6%, 22.5%, and 36.7%, respectively<sup>35</sup>. Relatedly, cancer persists as the region's leading cause of death<sup>36,37</sup>. Because the 'tobacco culture', including tobacco production and use, runs deep in Central Appalachia, it is not surprising that tobacco use disproportionately impacts rural adolescents from this region<sup>14,38,39</sup>, contributing to one of the worst health profiles in the US<sup>24,26-33</sup>.

Unfortunately, Appalachia experiences weaker tobacco control policies (e.g. smoke-free air, tobacco taxes, youth access)<sup>20,21,23</sup>, leading to greater youth access and exposure to tobacco (including secondhand smoke)<sup>20,21,23,39-41</sup>. Appalachian adolescents also experience greater exposure to tobacco advertising<sup>20,21,23</sup>, particularly targeted advertising<sup>20,21,23,42,43</sup> (e.g. using images of cowboys and race car drivers to target rural males<sup>18,20,44</sup>). The comparatively higher tobacco use rates within these communities and at home (e.g. among parents, peers, and other social influences) also impact adolescents' favorable perceptions of social/cultural norms. Rural adolescents are also more likely to engage in other health risk behaviors such as alcohol use<sup>45,46</sup>, which coincides with higher tobacco use<sup>47</sup>. Additionally,

because rural populations experience more barriers to healthcare (e.g. distance and provider shortages) and lower utilization, effective tobacco interventions are limited<sup>20,21,23,32,46</sup>. Research shows that these dynamic multilevel factors correlate with Appalachian adolescent tobacco use and progression<sup>19,22,42,48</sup>. Building on the growing demand and sophistication of telehealth for youth and young adults<sup>49</sup>, we posit that virtual implementation of tobacco interventions will address many of the unique barriers to services among Appalachians adolescent. Specifically, the scaling out of evidence-based interventions virtually could address challenges of: 1) accessibility, including service and provider shortages, affordability, and transportation; 2) acceptability, including issues of privacy and stigma; and 3) cultural relevance. 'Scale-out is an extension of scale-up and refers to the deliberate use of strategies to implement, test, improve, and sustain an evidence-based intervention as it is delivered to new populations and/or through new delivery systems that differ from those in effectiveness trials<sup>50</sup>.

We acknowledge that these complex influences on tobacco use in Appalachia beg for multilevel, population-based approaches that intervene along the continuum of community, systems, family, and individual levels. Embedded within this approach, however, effective individual-level strategies must be widely available. As supported by recent calls from the NCI<sup>51</sup>, the scaling out of evidence-based individual-level interventions – provided in synergy with population-level interventions and in a range of contexts – offers greater assurances that individual behavior changes become a part of the cultural fabric for population-based outcomes.

In the sections that follow, we synthesize from an extensive body of literature the key considerations needed to rapidly scale out effective, virtually-based tobacco interventions to address unique service barriers among Appalachian adolescents<sup>50,52,53</sup>. The pillars of these considerations are based on: 1) the suitability of virtual services; 2) the need for well-timed interventions that address the complex tobacco use behaviors prominent in this adolescent population; and 3) the rationale for leveraging existing evidence-based tobacco cessation interventions primed to meet the unique needs of Appalachian adolescents.

## COMMENTARY

**Suitability of virtual tobacco interventions for Appalachian adolescents**

Lower population densities in rural areas result in fewer healthcare services and dampened communication of health information to residents<sup>54</sup>. Accordingly, Appalachian adolescent tobacco interventions must address access issues, especially in hard-to-reach areas. School-based settings are essential intervention sites for rural tobacco interventions; however, it is unrealistic to assume that in-person school-based interventions are reliable for the millions of US adolescent tobacco users. Focusing only on in-person school settings limits access to interventions in general, but also for high risk hard-to-reach Appalachian adolescents who attend school infrequently, hold negative attitudes toward school, drop out, are incarcerated/detained, or attend low-resource schools<sup>55</sup>. Moreover, such approaches have limited utility during natural disasters and national emergencies such as COVID-19 where in-person interventions are not possible. Ideally, programs for Appalachian adolescent tobacco users should include options for access via multiple settings and delivery modes, including virtually<sup>56</sup>. Among the limited empirically supported adolescent-focused tobacco interventions, most involve peer support groups and/or one-on-one brief interventions, with a few emerging self-paced mobile or Internet-based personal technology applications (though not extensively tested)<sup>57</sup>. Thus, research that updates and scales out these interventions within the context of the current social and technology environments is critical<sup>52</sup>.

Although personal technologies (e.g. telehealth) for lifestyle change have been tested in underserved urban populations, feasibility and impact in rural populations are understudied<sup>58,59</sup>. This inattention results largely from concerns about access to broadband or high-speed Internet service (cable, fiber optic, DSL, cellular, or satellite), including limited mobile phone reception<sup>60</sup>, smartphone ownership<sup>61</sup>, and Internet costs in some rural locations<sup>56</sup>. However, recent evidence suggests that rural residents, including Appalachians, increasingly use and are favorably oriented toward personal technology, including virtual healthcare delivery<sup>62</sup>. Of note, in light of COVID-19, many

federal agencies recently invested millions of dollars to advance rural distance learning infrastructure<sup>63</sup>. Even before COVID-19, 2019 data indicated that 86% of Appalachians have computer access, 74% have smartphones, and 78% have broadband subscriptions<sup>64</sup>; 85% use the Internet, nearly 70% of whom use the Internet to obtain health information<sup>65</sup>. Moreover, the vast majority of Appalachian residents view technology as vital to compensate for sparse or absent community resources, long-distance travel, and limited healthcare professionals<sup>66</sup>. Indeed, technology-based health and wellness interventions offer distinct promise for Appalachian communities that circumvent other access options<sup>59,67-70</sup>. Previous research shows the feasibility, acceptability, and efficacy of technology-based virtual intervention approaches (e.g. smartphone- and Internet-based) for tobacco<sup>67</sup> and other health behaviors<sup>59,68</sup>. Students report autonomy, engagement, peer interactions, privacy and comfort, and clearer behavioral expectations<sup>71-74</sup>. Virtual resources could broaden reach to adolescent tobacco users (particularly at-risk populations), reduce intervention barriers, and minimize costs<sup>75,76</sup>. Virtual delivery of interventions may be particularly useful in settings where intervention facilitators (e.g. teachers or counselors) are not available or willing to deliver 'extra' services given competing demands, and in accommodating facilitator schedules (e.g. before/after school, weekends). Unfortunately, this is relatively new intervention territory; thus, practitioners who facilitate or connect adolescents to these services have little guidance on how to administer new or alternative intervention modalities.

Research also suggests that the effectiveness of technology-based virtual interventions largely depends on customizing to the preferences of the target group, in this case adolescents, a group who generally exhibit a high level of competency with technology and increasingly use it to find health information<sup>71,72</sup>. Thus, virtual interventions must be responsive to adolescent preferences. Because adolescents continue to find value in receiving information from health professionals, interventions could consider the use of the Internet as a hybrid or supplementary means rather than a replacement

for services. Adolescents may also have concerns about on-line privacy and accuracy of information. They also expect on-line experiences that convey facts, compelling web designs, easy access, and content that is relevant to their lived experiences. To address these concerns and potential barriers, virtual adolescent tobacco interventions should give careful attention<sup>58</sup> to: 1) initial impressions of websites or other applications such that they are not only eye catching, but appear serious and trustworthy; 2) current verifiable and reputable events, facts, and statistics; 3) cultural and religious relevance; 4) ease of access as well as privacy assurances; and 5) education to support competent and appropriate Internet use. Finally, while nearly 80% of Appalachian households have a broadband subscription and smartphones, a 'digital divide' remains with 20% being without. As such, we must continue to find creative ways to reach these hard-to-reach adolescents who are likely to be at high risk for tobacco addiction. All said, the timing for virtual tobacco interventions that reach Appalachian adolescents is optimal.

### Need for well-timed interventions addressing complex tobacco use in Appalachian adolescents

Tobacco interventions traditionally focus on preventing adolescent initiation and cessation among adults. Few proven and scalable adolescent tobacco interventions are broadly available, with only two empirically supported cessation interventions for this group<sup>57</sup>. Providing a case example of a scalable EBI, the American Lung Association's (Not On Tobacco [N-O-T]) program is the only intervention persisting for two decades addressing both experimental and frequent tobacco use among adolescents<sup>57,77</sup> and that has been adapted to include the changing tobacco landscape of multiple tobacco product use<sup>57</sup>. Intervening during adolescence – for established users, intermittent, or for those just beginning to use<sup>78-81</sup> – provides opportunities to cease or reduce use before these use patterns become chronic, which is particularly crucial for Appalachian adolescents at risk of using multiple tobacco products<sup>8,82</sup>.

The specific needs of Appalachian adolescents make the limitations to the existing evidence base even more concerning. Given their higher tobacco use and poly-use rates, earlier age of initiation,

and higher intentions to use at earlier ages<sup>14-23</sup>, it is particularly critical that interventions combine features of ideally timed secondary prevention and cessation<sup>83</sup> and intervene on risks and trajectories that lead to their entrenched tobacco use behaviors<sup>84,85</sup>. The risk narratives of Appalachian adolescents differ from other adolescent sub-groups. For example, living in small rural communities and frequent contact with family and community can be protective but also risk-promoting during adolescence, making pro-tobacco role modeling and messaging from these groups highly impactful. With that, it is important to provide accurate information about tobacco use as early as possible, as Appalachian adolescents who receive tobacco information from families and friends are more likely to use multiple tobacco products. Certain socioecological factors within the Appalachians render adolescents particularly susceptible to tobacco risk behaviors. As part of a scaling out process, EBI's such as N-O-T can capitalize on opportunities for tailoring to Appalachian needs. Cessation interventions, for instance, must give careful attention to the socioecological dual functioning (i.e. assets and risks) of Appalachian culture in both implementation and content. However, as there is sparse research demonstrating the intervention strategies, content, and modalities feasible and efficacious for Appalachian adolescents, the field demands more research to better address these complex tobacco risk issues<sup>57</sup>.

### Rationale for leveraging and scaling evidence-based interventions to address Appalachian adolescent tobacco use

Collectively, the literature identifies the general limitations to cessation interventions for adolescents, and for Appalachian adolescents in particular, but also underscores the evidence base for adolescent tobacco cessation interventions from which future research can build<sup>86-90</sup>. Starting from scratch is not necessary. Instead, we must maximize the impact of evidence-based interventions by scaling them out<sup>50,53</sup> through new state-of-the-art delivery systems, even if they differ from those in original effectiveness trials<sup>50</sup>. Going a step further, we can borrow from strategies demonstrated as effective for scaling out innovations from a broad range of disciplines. For instance,

the Scaling Up Management (SUM) Framework<sup>91</sup>, derived from strategic management principles, has been applied to government-led, non-governmental organization, and commercial interventions in maternal and child health, family planning, early childhood development, dropout prevention, literacy development, judicial reform, community policing, among other program areas. SUM recommends several key checkpoints to determine an intervention's readiness for scale out. These are highly applicable to tobacco innovations including: 1) clear and compelling strategy for scaling out, notably with clear and replicable technology and means to generate financial resources to expand; 2) intervention credibility based on sound evidence presented by respected persons or institutions; 3) support and urgency to change problems at multiple user levels; 4) relative advantage over existing implementation practices; 5) ease of implementation and adoption such that potential users can see the results in practice; 6) goodness of fit for the target population's established values and norms; and 7) sustainability processes easy to transfer and adopt<sup>91</sup>.

In preparing for tobacco intervention scale out, as outlined by the SUM framework<sup>91</sup>, it is important to anticipate and prepare for the following challenges: 1) Program models must be simple enough to use, without the risk of losing the basis for effectiveness. It is critical that programs such as N-O-T include structured and packaged facilitator implementation guidance to promote implementation fidelity; 2) Programs should have explicit strategies for integration into commercial markets, including professional branding, marketing, packaging, and social media presence. The American Lung Association, for instance, has prioritized N-O-T brand recognition since the program began over 20 years ago. As importantly, marketing plans allow for changes in style and form to keep pace with changing trends; 3) Do not underestimate the importance of social, political, cultural, and economic contexts, including nuances in localities, states, and countries. Tobacco control policies are ever changing and as such it is especially important to have mechanisms for quickly updating content and for offering flexibility to users in the changing tobacco landscape. For instance, with its recent updates N-O-T now offers all materials and training

on-line, making modifications easy and quick for the American Lung Association; 4) Lack of support for and investment in a program's administrative oversight can be fatal. N-O-T, for example, is aligned with the American Lung Association, an institutionalized backbone organization, and is guided by a National N-O-T Advisory Board – both of which increase the likelihood of continued buy-in and support as the program grows and changes; 5) Invest heavily in respected and reliable modes of information and communication, especially social media, learning and meeting platforms, and other major information technologies (IT) related to data retrieval, transmission, and networking. As an example, through the American Lung Association, the N-O-T program administration benefits from state-of-the-art IT services, making virtual scale out feasible; and 6) Carefully consider program costs and implications for current program providers from different sites and localities. Administrative costs for N-O-T, for instance, are flexible with a low resource burden and never prohibit adolescent participation. Importantly, there are tobacco interventions (e.g. N-O-T) that are primed for scale out because they meet certain checkpoints, including virtual readiness, respectable evidence base, sustained infrastructure, processes for adaptation, and portable implementation and evaluation tools<sup>77</sup>. In these circumstances, it is reasonable to believe virtual scale out could enhance their unique suitability for high risk rural adolescents.

## CONCLUSION

Appalachian adolescents show higher use rates across all tobacco products, relative to non-rural adolescents, coinciding with various socio-environmental hurdles<sup>20,21,28,32,92</sup>. Confounding these disparities, rural populations have a lower likelihood of receiving effective tobacco interventions<sup>93</sup>. Thus, there is an urgent need for easily accessible, effective tobacco interventions that disrupt escalation of, reduce, or stops tobacco use among Appalachian adolescents. There are a few proven adolescent tobacco interventions that are primed for virtual scale out<sup>57</sup> as means to offset disparities in cancer and other chronic health conditions among this vulnerable population<sup>57</sup>. Indeed, scaling out is challenging – the average time for scaling a successful innovation to application

is 15 years<sup>91</sup>. However, by starting with lessons learned from the scaling out, with a broad range of innovations capitalizing on today's expanding virtual technology, and building on tobacco interventions already grounded in evidence, that time frame can be significantly shortened.

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#### ETHICAL APPROVAL AND INFORMED CONSENT

Ethical approval and informed consent were not required for this study.

#### DATA AVAILABILITY

Data sharing is not applicable to this article as no new data were created.

#### PROVENANCE AND PEER REVIEW

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