Economic Evaluation of the Maine QuitLink

2015 - 2020

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Report Navigation

To maximize readability, direct links are provided in the report to a Glossary and to Supplemental Tables. Both can be accessed by clicking on links in the text. These are words that are blue and underlined.

The Glossary provides descriptions of terms and concepts used in the report.

The Supplemental Tables provide additional data calculations and analysis.

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EXECUTIVE SUMMARY

In 2017, 17.3% of Maine adults reported using cigarettes. This rate was higher among adults with less than a high school diploma (26.8%), uninured (38.7%), and/or experiencing poor mental health (31.9%)(BRFSS, 2017). Tobacco use is a known risk-factor for illnesses such as cancer, heart disease, stroke, lung disease, and diabetes, (American Cancer Society, 2021) and results in about 2,390 smoking-attributable deaths each year in Maine (American Lung Association, 2021). It is estimated that 112,977 Maine adults who use cigarettes are interested in quitting (BRFSS, 2017). Of these, approximately 50,163 used medications in the past year and/or called the Maine QuitLink in the past year (ibid). The Maine QuitLink is the statewide health service that offers telephone and online support for people who want to quit using tobacco. Evidence-based treatment services such as Nicotine Replacement Therapy and/or counseling provided by quitlines increase the chance of successful quits by 60% (US DHHS, 2008).

Measuring the costs and economic benefits of a quitline translate its impact into objective monetary terms and help make the case for investments that support cessation services (Berenbaum et al., 2019). In addition, mature programs (such as the Maine QuitLink) can use economic evaluations as an intuitive step forward in looking at ways to reduce costs while maintaining effectiveness.

Accordingly, in 2021, the Tobacco Prevention and Control Program within Maine Center for Disease Control and Prevention, contracted with Partnerships For Health to undertake a retrospective economic analysis of the Maine QuitLink services provided between July 2015 and June 2020. The analysis was conducted from a program perspective and

yielded the following findings:

- 18,911 individuals in Maine received tobacco cessation services from the Maine QuitLink between 2015-2020.
- <u>4,558-4,889¹</u> individuals who had received services from the Maine QuitLink reported not using tobacco in the last 30 days, at 7-month follow-up.
- The Maine QuitLink enrollees mirror the demographic characteristics of adults in Maine who use cigarettes with the exception of adults with lower education levels who are slightly under-represented.
- For every dollar invested in the Maine QuitLink, between <u>\$2.66-\$3.82</u> are saved in averted health costs and loss of productivity.
- For every dollar invested in the Maine QuitLink, between <u>\$24.77-\$26.57</u> per Quality-Adjusted Life Year (QALY) are saved.
- Maine's QuitLink reaches a higher proportion of adults who use cigarettes statewide than their peers (ME: 2.0% vs. National: 0.86%)
- Maine's quit rate (25.8%) is lower than the national average among quitlines (30.6%)
- Compared to the national average among quitlines, Maine QuitLink serves more individuals who are uninsured or enrolled in Medicaid/Medicare (64.4% vs 51.6%), and those with low educational attainment (52.8% vs 45.4%).

¹ Range reflects two quit rates used: (i) conventional products quit rates; and (ii) conventional and ENDS products quit rates.

Introduction



Adult Tobacco Use

National. Cigarettes continue to be the most commonly used tobacco² product in the United States (US), although use of other products, such as e-cigarettes³, is on the rise (Creamer et al., 2019). Most adults who use tobacco report using <u>conventional products</u> (cigarettes, cigars, or pipes), with 1-in-5 reporting use of two or more products (ibid). However, a significant increase in e-cigarette use among adults was detected in 2017-2018 (2.8%-3.2%) (ibid). This increase may be attributable to new types of e-cigarettes called pod mod devices, which use nicotine salts rather than free-base nicotine (ibid). Pod mod devices are favorable due to their enticing design, ease of function, and appealing flavors (Fadus et al., 2019). The most popular brand of pod mod devices, JUUL, increased its sales by an estimated 600% between 2016 (2.2 million) and 2017 (16.2 million) (Creamer et al., 2019; King et al, 2018).

Maine. In 2017, 21.5% of adults in Maine reported current use of any tobacco product, including ecigarettes (Maine Behavioral Risk Factor Surveillance System [Maine BRFSS], 2017).

Tobacco-Related Health Disparities

Health disparities emerge from the overlap of complex and interconnected social, environmental, and economic systems which create political, social, and economic divisions among people and result in inequitable distribution of money, power, and resources (US Centers for Disease Control and Prevention [US CDC], 2014; Solar, 2010). These health disparities are often misattributed to personal and behavioral factors while overlooking the influence of systemic upstream effects (Broan, 2018).

National. While the national average for any tobacco product use from 2017-2018 was 19.7%, it was higher among males (25.8%); individuals aged 25-44 (23.8%); non-Hispanic American Indian/Alaska Native (32.3%); and adults who identified as lesbian, gay, or bisexual⁴ (29.2%) (Creamer et al., 2019). In addition, higher tobacco use was evident in adults who had a GED-level education (41.4%); an annual household income below \$35,000 (26.2%); or were uninsured (29.9%) or insured by Medicaid (27.8%) (ibid).

Maine. Similar to national trends, certain sub-populations in Maine are disproportionately impacted by tobacco use and tobacco-related adverse health outcomes. Despite the overall 17.3% smoking rate in Maine in 2017, 21.4% of adults in rural Aroostook County smoked cigarettes, compared with 11.4% of adults in the more urban Cumberland County (Maine BRFSS, 2017).

Furthermore, the smoking rate in Maine is highest among the American Indian or Alaskan Native population (39.6%) and multiracial populations (32.1%) compared with white Mainers (19.4%) (Maine BRFSS, 2011 - 2017). Low educational attainment is also correlated with higher smoking rates. Cigarette use is highest among Maine adults with less than a high school diploma (35.2%) and lowest among adults with a college degree (5.7%) (Maine BRFSS, 2017). Adults experiencing poverty also have a higher

² Throughout the report, the term 'tobacco use' refers solely to commercial tobacco use, i.e., the periodic or habitual use of tobacco products manufactured and sold for personal recreation use. The findings reflected in the report do not pertain to the sacred and traditional, ceremonial, religious, or medicinal tobacco use practiced in Maine's Tribal Communities.

³ E-cigarettes and Electronic Nicotine Delivery Systems (ENDS) are used interchangeably throughout this document.

⁴ More recent reports have expanded this demographic to include lesbian, gay, bisexual, transexual, queer/questioning individuals, and all gender identities and sexual orientations. Throughout the report, the term 'LGBTQ+' will be used to refer to this population.

prevalence of smoking. Compared with the general prevalence of 17.3% in 2017, the smoking rate was highest among people with a household income less than \$15,000 (31.9%) and lowest among people with incomes over \$50,000 (10.6%) (ibid). Health insurance is often used as a proxy for income levels. In 2017, 38.7% of uninsured adults reported currently smoking, compared with 37.5% of MaineCare beneficiaries, and 12.1% of adults with private insurance (ibid).

Cigarette use is higher among those with a behavioral health condition⁵ than among the general population. Compared with the general prevalence of 17.3% in 2017, cigarette use was higher among adults who reported binge drinking (28.6%); heavy alcohol consumption (31.5%); depressive disorders (27.9%); and frequently experienced poor mental health (31.9%) (Maine BRFSS, 2017). Identifying as lesbian, gay, bisexual, transgender (LGBTQ+) can also be a risk factor for cigarette use. The rate of current smoking among homosexual⁶ and bisexual adults (29.7%) is significantly higher than that of heterosexual adults (19.5%) (Maine BRFSS, 2011 – 2015, 2017).

Cost Burden of Tobacco Use

Tobacco-related illnesses are associated with high health costs. Tobacco use is a known risk-factor for illnesses such as cancer, heart disease, stroke, lung disease, diabetes, and much more (American Cancer Society, 2021). Because of this, tobacco remains the leading cause of preventable death in the United States, causing more than 480,000 deaths each year (Campaign for Tobacco-Free Kids, 2021a). Annual public and private healthcare expenditures in the US caused by cigarette use are estimated at \$226.7 billion (ibid).

In addition to direct healthcare costs, smoking-related illness and premature mortality result in productivity costs to the economy caused by workplace absenteeism and workers who die prematurely during their working years (Ekpu & Brown, 2015). Studies report that US adults who use cigarettes are absent from work approximately 6.5 days more per year than their colleagues who do not use cigarettes (Ekpu & Brown, 2015). Nationally, annual productivity losses as a result of cigarette use are estimated at \$181 billion (Campaign for Tobacco-Free Kids, 2021a). Between 2000 and 2004, the annual value of lost productivity varied in states from \$10.35 billion in California to \$202.4 million in Wyoming (ibid). Maine ranked as the 17th lowest at \$647 million, despite having the 10th smallest population size (Campaign for Tobacco-Free Kids, 2021b) suggesting that Maine spends substantially more than states with a significantly larger population size and larger proportion of adults who use tobacco (Campaign for Tobacco-Free Kids, 2021a).

Adult Tobacco Cessation

According to the US Office on Smoking and Health (US Department of Health and Human Services [DHHS], 2020), the fastest method to reduce tobacco-related disease, death, and healthcare costs is to encourage adults who use tobacco to quit smoking. Most adults who use tobacco products want to quit, but the nicotine dependence makes cessation difficult (ibid). Nicotine dependence is a condition that often requires repeat treatments before cessation is achieved (ibid).

⁵ Behavioral health conditions refer to mental health conditions as well as substance use issues.

⁶ Homosexual adults include people who identify as gay or lesbian.

Evidence-based tobacco treatment services. Tobacco treatment services (also known as cessation programs) are community-based interventions aimed at educating, informing, and assisting adults who use tobacco in their quit attempts (Ekpu & Brown, 2015). Effective treatment can significantly increase rates of successful cessation. Individual, group, and telephone counseling are effective if containing both problem-solving/skills training and social supports (US DHHS, 2008). <u>Nicotine Replacement Therapy</u> (NRT), which includes nicotine gum, inhalers, lozenges, and patches as well as medications (e.g., bupropion, and varenicline) have been shown to increase long-term abstinence rates (ibid). While effective if used individually, the combination of counseling and cessation medications is most effective (US DHHS, 2008; US Preventive Services Task Force, 2021).

Quitlines, originating in the early 1980s, use phones to offer confidential and free evidence-based tobacco cessation services, including behavioral counseling and support, to help adults who want to quit tobacco use (North American Quitline Consortium [NAQC], 2010; US Preventive Services Task Force, 2021). A 2018 meta-analysis (US DHHS, 2008) compared quitline counseling to minimal/no counseling or self-help and found that the use of quitline counseling increases the chances of successful cessation by 60% (odds ratio= 1.0:1.6) and resulted in an increase in the cessation rate from 8.5% to 12.7%.

Quit attempts and cessation. Quit attempts refer to the successful effort of an adult who uses tobacco to purposefully⁷ abstain from tobacco for at least 24 hours (Babb, 2017). On average, adults who use tobacco make multiple <u>quit attempts</u> before <u>cessation</u> is successfully achieved. Tobacco cessation is the successful, purposeful, abstinence of tobacco products for a prolonged period of time (7 days, 30 days, 6 months, or 12 months) (Babb, 2017; NAQC, 2015).

Population-level quit rates are determined by the number of quit attempts and the odds that adults who use tobacco who try to quit will be successful. In 2015, almost two-thirds of adults who used cigarettes thought about quitting; however, only half (55.4%) made a quit attempt (Babb, 2017). Less than one-inten (7.4%) adults who used cigarettes successfully quit smoking (ibid). This may be partly because less than a third (31.2%) of adults who are trying to quit utilize evidence-based cessation treatments, such as medication and/or counseling (ibid). Studies suggest that approximately 3-7% of individuals who attempt to quit without the aid of cessation treatments or services successfully quit (Ekpu & Brown, 2015).

Cessation and tobacco-related health disparities. Younger adults who use tobacco, particularly Asian and Black youth, tend to make more quit attempts compared to older and/or white adults (Babb, 2017). The use of counseling and/or medication is lower amongst populations experiencing health disparities such as Hispanics, Asians, adults identifying as LGBTQ+, and those who are uninsured (ibid). Cessation rates are directly correlated to increasing levels of education and private health insurance (ibid).

⁷ Purposeful abstinence is used to differentiate cessation that is involuntary such as hospitalization.

Tobacco Cessation in Maine

Despite an overall decrease in cigarette use over the past decade, 112,977 Maine adults who used cigarettes were interested in quitting. Of these, 50,163 made a quit attempt using evidence-based treatments such as medication and/or counseling (BRFSS, 2017).

Recent studies estimated that 2,390 deaths in Maine adults could be attributed to cigarette smoking each year (American Lung Association, 2021).

Maine QuitLink

The Maine QuitLink, funded by the Fund for a Healthy Maine and a US Centers for Disease Control and Prevention (US CDC) grant, offers free evidence-based tobacco treatment services to Maine residents who are interested in becoming tobacco-free. Maine residents can enroll online or via phone to receive phonebased and/or digital services (Maine QuitLink, 2021). Services include tailored quit plans, phone or web coaching, counseling, referrals, mailed educational materials, web-based services, NRT (i.e., gum, lozenges, or patches), access to online communities, and unlimited support calls, emails, and text messages (ibid). Adults who use tobacco and who quit with the Maine QuitLink are estimated to be 2-3 times more successful than those who attempt to quit on their own (ibid).

Economic Analysis for Tobacco Cessation Strategies

Economic evaluations are unique in their ability to assess the cost-effectiveness of a program by weighing costs and benefits (US CDC, 2015). These costs and benefits include not only direct program outcomes, but also indirect impacts on



families, communities, funders, and society as a whole (ibid). Benefits can represent both monetary profits as well as the quantified value of health benefits.

Cost-of-illness studies. Also known as social cost studies, cost-of-illness studies focus on the cost of premature mortality, treatment costs, other healthcare expenditures, lost productivity, and absenteeism from work (Makate et al., 2020). These studies vary widely in methodology and perspective and are thus not readily comparable (ibid). In general, they emphasize three categorical costs: health, productivity, and death.

Internationally, smoking accounts for billions of dollars in tobacco-related costs: from \$2.18 billion⁸ in Thailand (2009) to \$36.5 billion in Russia (2008) (Makate et al., 2020). In 2012-2013, the range of costs was between \$2.18 billion in Indonesia and \$11-15.1 billion in Canada (ibid). Between 2000 and 2004, the US annual tobacco-related costs were \$226.7 billion, with state-level costs varying from \$505.2 million (Wyoming) to \$27.22 billion (California) - with Maine at \$1.71 billion (Campaign for Tobacco-Free Kids, 2021a).

Cost-effective comparison studies. Economic studies have previously looked at the effectiveness of treating nicotine dependence and showed that NRT prescriptions, combined with counseling, could yield between \$724 and \$1,380 in averted costs per <u>Quality-Adjusted Life Year</u> (QALY) saved (Stapleton et al., 1999). Similar modeling studies in Minnesota suggest that free NRT could result in 18,500 successful quits and yield \$4,440 per QALY saved (Ong & Glantz, 2005). This information is useful in deciding where to allocate funds based on budget restraints.

In the late 1980s, a seminal cost-effectiveness study, the Stanford Five City Project, analyzed the economic impact of three different tobacco cessation programs and found that the self-help quit program had the lowest total costs, lowest participant time, lowest quit rate, resulting in the lowest cost per quit at \$50 (Altman et al., 1987). In contrast, smoking cessation classes had a higher quit rate but required the most time from participants and was the least cost-effective at \$276 per quit (ibid). The study concluded that cost-effectiveness may not be an important measure if program costs are below their value and that high cost-effectiveness ratios do not necessarily equate to undesirability (ibid). Furthermore, different demographic groups may have unique preferences and needs best met by different cessation programs (ibid).

Economic impact of tobacco cessation programs. One of the first studies on the cost-effectiveness of quitlines was completed on the Swedish Quitline (Tomson et al., 2004). They found that the cost per person who successfully quit cigarette use ranged from \$311 -\$401. A quasi-experimental matched control study in Vermont and New Hampshire found the cost-effectiveness ratio for a multi-faceted, community-based project was \$1,156 - \$1,922 per life year saved when <u>discounted</u> at 3% and 5% respectively (Secker-Walker et al., 2005).

Van den Brand et al. (2017) undertook a Cochrane systematic review of eight studies that compared tobacco cessation interventions with varying levels of financial benefit to participant. Costs per additional adult who quit tobacco use ranged from \$97 to \$7,646. Using the standard metric of \$50,000 per QALY gained (Reisinger et al., 2019), one study in the review reported a cost of \$2,342 per additional QALY saved (van den Brand et al., 2017). Studies comparing tobacco cessation interventions have minimal comparability due to the variation in types of services and delivery methods.

Another systematic review of published cost-effectiveness analyses of community-based tobaccocessation interventions found that study participants were predominately English speaking, white, and middle aged (Reisinger et al., 2019). All nine of these studies had a cost per quit at or below \$2,040; however, the absence of QALYs or similar standard outcomes negates direct comparison with other studies.

⁸ All dollar amounts reflect US dollars.

Need for Evaluation

"Our review revealed a lack of focus on economic evaluation of community-based tobacco dependence treatment programs in the United States. ... It is vital to expand this literature given the effect of tobacco on health and costs. To improve the state of the science and understanding the results, as well as identify potential opportunities for uptake of interventions, such studies should be conducted." (Reisinger et al., 2019)

Measuring the costs and economic benefits⁹ of a quitline translate its impact into objective monetary terms and help make the case for investments that support cessation services (Berenbaum et al., 2019). Cost analyses can also be used to inform public policy (American Lung Association, 2015), advise resource allocation, and refine strategy implementation (World Health Organization [WHO], 2011).

It is important that evaluations of public health programs such as the Maine QuitLink consider the economic impact of the program over time and identify efficient means to achieve a tobacco-free Maine. While economic evaluations are an important way for new programs to assess operational costs, mature programs where effectiveness is well-established, such as the Maine QuitLink, can use economic evaluations as an intuitive step forward in looking at ways to reduce costs while maintaining effectiveness.

⁹ This report uses 'economic benefits' as an umbrella term to refer to adverted healthcare and non-healthcare costs resulting from successful quits.





Study Design

This study is a retrospective economic analysis of the Maine QuitLink between July 2015 and June 2020. It was conducted from a programmatic <u>perspective</u> and aims to answer the following questions:

- Who uses the Maine QuitLink?
- How much is invested in the Maine QuitLink?
- What is the Maine QuitLink's return on investment?
- To what extent does the Maine QuitLink serve populations with tobacco-related health disparities?
- How does the Maine QuitLink compare with national benchmarks?

Perspective

Perspective is important in economic evaluations as it determines which costs and benefits to include.

This study was done from a program perspective, meaning it looked at the costs and benefits of providing Maine QuitLink services .

Economic analysis can also be conducted from a societal perspective, payer's perspective, or participant's perspective.

Data Sources

MaineHealth Center for Tobacco Independence (CTI). The majority of Maine-specific data was provided by CTI in the form of completed annual NAQC surveys for fiscal years FY16 through FY20. The surveys include information about quit rates, quitline financing, counseling interventions, medication provisions, utilization, staffing, and evaluation activities.

North American Quitline Consortium (NAQC). In addition to the completed Maine annual surveys, the national annually aggregated survey data presentations from <u>NAQC</u> were used for benchmarking (NAQC, n.d.-a). These presentations, from FY16 through FY20, provided data on quit rates, demographics, and treatment reach broken down by sub-population.

US Department of Labor Statistics. US Department of Labor Statistics' Consumer Price Index Inflation Calculator (US Department of Labor, 2020) was used to adjust all costs to 2020 United States Dollar (USD).

Behavioral Risk Factor Surveillance System (BRFSS). <u>BRFSS</u> is a national health-related telephone survey that asks US residents about their health-related risk behaviors, chronic disease conditions, and use of preventive services (BRFSS, 2019). Adults who smoke cigarettes prevalence data was used when calculating the Maine QuitLink reach, investment per adult who uses cigarettes, and the smoking-attributable expenses (SAE).

The University of Southern Maine Chronic Disease Epidemiology Team (USM Epi Team). Using BRFSS data, the USM Epi Team provided data tables for the percent of Maine adults who are currently cigarette smokers (have smoked at least 100 cigarettes in their lifetime and are current smokers). Tables included data for general demographic characteristics such as education and healthcare coverage (2016 and 2017) and specialized analysis for characteristics such as race, ethnicity, and sexual orientation (2011 – 2016 and 2011 -2017).

QALY Tables. In a study looking at cost-effectiveness of transdermal nicotine patches compared to smoking cessation counseling by a physician, Fiscella and Franks (1996) created a decision analytic

model evaluating the costs and benefits in <u>QALYs</u> saved. The standardized tables in this peer-reviewed article are considered the gold standard in tobacco-related cost-effectiveness analysis and accordingly were used in this evaluation.

Health Utilities Index (HUI). The HUI is a system for measuring and reporting on health status and health-related quality of life by assigning standardized utility scores (Horsman et al., 2003). The scoring system scales from 0 (dead) to 1 (perfect health) and is often used in economic evaluations as a way to quantify an individual's quality of life (ibid). The standardized tables were used when calculating the QALYs.

Smoking-Attributable Mortality, Morbidity, and Economic Costs (SAMMEC) System. The <u>State Tobacco</u> <u>Activities Tracking and Evaluation (STATE) System</u> is developed and maintained by the US CDC and includes the <u>SAMMEC database</u>. The latter analyzes data from the National Health Interview Survey and death certificate data from the National Center for Health Statistics (US CDC, 2008). The results estimate <u>smoking-attributable mortality (SAM)</u>, <u>years of potential life lost</u>, and productivity losses due to smoking between 1997-2001. For this study, 2009¹⁰ SAMMEC data were used and adjusted to 2020 USD values (US CDC, 2020).

Although the prevalence of tobacco use has declined over time, the number of smoking-attributable deaths has remained relatively unchanged (US CDC, 2008). This is primarily due to an increase in population size and an aging population (ibid). The relative risk estimates used to calculate SAM have remained static over time and may be understated as they are based on a 1982-1988 cohort of adults who use tobacco who may have a different histology than current or former adults who use tobacco today (ibid).

The tobacco industry often points out that the reduction in premature deaths due to cessation may impose additional healthcare costs as people live longer. This argues the preference to use net costs in economic analyses. However, Miller et al. (2010) concluded that the extra years of costs experienced by a longer living, non-smoking cohort balanced out the higher costs during each year of the shortened lives of adults who smoked. Accordingly, gross healthcare expenses were used in this analysis.

Panel on Cost-Effectiveness in Health and Medicine. Since 1996, the panel has advised on methodology and policy relating to cost-effectiveness evaluations, with the objective of improving the quality of such analyses (Sanders et al., 2016). This evaluation follows the panel's recommendation that future benefits in QALY saved be discounted by 3% per annum (ibid).

¹⁰ 2009 SAMMEC data is the most recent available.

Analysis

Using the aforementioned data, the following metrics were calculated to provide answers to the evaluation questions:

QuitLink utilization. Utilization over the five-year period was measured in terms of volume, <u>enrollee</u> demographic characteristics, and <u>treatment reach</u>. Results were disaggregated by known <u>social</u> <u>determinants of health</u> and compared with the national annual average among quitline programs.

Resource allocation. To determine the cost per QuitLink user, both total costs and treatment-only costs were used. All cost data were adjusted to 2020 USD values using the Consumer-Price Index. While the cost per person who uses QuitLink services provides insights into efficiency, the spending per adult who uses cigarettes provides an indicator of statewide investment. The latter was calculated using adult smoking prevalence data from BRFSS and assuming an average cost per QuitLink enrollee.

Tobacco-related health disparities analysis. Due to the absence of detailed information on spending allocations for sub-populations with health disparities, it was assumed that no special spending was undertaken to engage sub-populations with known disparities. As such, treatment reach was compared to smoking prevalence for each sub-population. Proportionate adjustments were made for unreported data (e.g., when race was not disclosed).

Cost benefit analysis. The cost of cigarette use is the difference in costs that occur due to cigarette use and those that would occur if there was no smoking. The economic consequences of cigarette use are divided into <u>direct costs</u> (e.g., healthcare costs) and <u>indirect costs</u> (e.g., loss of productivity). Benefits associated with reduced prevalence of cigarette use (i.e., successful quits) as a result of QuitLink services were calculated. Benefits were calculated as SAE averted. Both total costs and treatment-only QuitLink costs were used. The result is a cost benefit return on investment ratio in 2020 USD.

Cost utility analysis. While cost benefit analysis looks at averted expenses, cost utility focuses on the change in morbidity and mortality that arises from tobacco cessation. These changes are expressed in terms of life years and QALYs saved. A standard discount rate of 3% was used. The result is a cost utility Return on Investment ration in 2020 USD.

Limitations

Perspective. Perspective is important in economic evaluations, as it assesses costs from a certain vantage point. This study was done from a program perspective, meaning it looked at costs and benefits from the perspective of the Maine QuitLink program. Participant or societal perspectives may have yielded different utility and benefits.

Data source consistency over time. Some potential data limitations arose throughout the evaluation, largely due to inconsistencies between state and national data and changes in standards and definitions overtime.

Confounders. Estimates were adjusted for the effects of age but not for other potential confounders. This decision was based on research suggesting that confounders, such as education, alcohol consumption, etc., have a negligible influence on estimated SAM (US CDC, 2008).

Cost data granularity. The NAQC survey data only provided overall cost data. No detailed information was available on spending for special populations, such as those experiencing known health disparities.

Service data granularity. The NAQC survey data focuses on quitline enrollees who received NRT and/or counseling. Accordingly, individuals who engaged with the Maine QuitLink and received other services and supports are excluded.

Data verification. In the absence of evaluation reports, the quit rates derived from seven-month followup surveys and detailed in the Maine FY17 and FY18 NAQC surveys were used. The validation/verification of the data provided, including the review of evaluation activities, was beyond the scope of this analysis.

Gender. Most economic models disaggregate gender and level of tobacco use. However, Maine-specific data, particularly quit rate, was not broken into these categories and was instead averaged. This may have resulted in a misrepresentation of costs compared to national benchmarks.

Indicators inclusive of all tobacco products. The amount of tobacco products available continues to diversify. While attempts are made to be inclusive, the most comprehensive data available are for cigarette use. In particular, the indicator on current, every day, or someday smoking is used throughout because it enables sub-population analysis (e.g., disparate populations).

Omitted costs. Deaths attributable to tobacco use may have been understated because of the exclusion of deaths attributable to cigar smoking, pipe smoking, and smokeless tobacco. Estimated costs for productivity lost may also have been understated since costs associated with smoking-related disability, employee absenteeism, and secondhand smoke were not included due to lack of available data. The analysis is comparable to preceding economic analyses on cessation services (Cadham et al., 2021; Kahende et al., 2009; Kaper et al., 2006; Mundt et al., 2020).





QuitLink Utilization

Volume

While each state quitline operates within a unique context, it is useful to compare utilization across quitlines. On average, the Maine QuitLink received approximately 10,950 direct calls¹¹ and 5,685 referrals from professionals annually. The latter includes health professionals (e.g., health care providers, dentists, and pharmacists), as well as state and community-based service organizations (e.g., WIC, Head Start programs, and workforce development). Referrals typically generate outbound calls. See <u>Supplemental Table 7</u> for cumulative direct calls and referrals.

These inbound and outbound calls resulted in an annual average of 4,727 unique tobacco users registered to receive tobacco cessation services. Unique tobacco users are defined as people who use any tobacco product (e.g., cigarettes, chew, and/or e-cigarettes) who are interested in tobacco cessation services, and who enroll for quitline services (NAQC, n.d-a). Eight-inten (3,782) people who registered with the QuitLink received cessation medication and/or phone counseling from the quitline¹². See <u>Supplemental Table 8</u> for an annual services summary.

Based on a 7-month follow-up survey, the Maine QuitLink estimated an average quit rate of 25.8% for conventional tobacco products (e.g., cigarettes, snuff, and/or cigars)¹³ and 24.1% for conventional tobacco products and Electronic Nicotine Delivery Systems (ENDS)¹⁴. Using these quit rates, it is estimated that between 2015 and 2020, approximately 4,558 to 4,889 adults successfully quit using tobacco products for at least 30 days as a result of using the Maine QuitLink. See <u>Supplemental Table 9</u> for the quit rate calculations.



Unique tobacco users who used the quitline services and successfully quit smoking cigarettes and/or using ENDS for 30 days at 7 months follow-up.

Data source: Maine NAQC Annual Surveys FY16 - FY20

¹¹ Direct calls refer to any inbound call to the Maine QuitLink.

¹² In accordance with NAQC guidelines, self-help materials were not included in the count of people receiving tobacco cessation services.

¹³ The Conventional quit rate is based on answers to the 7-month follow-up survey: "have you used any tobacco, even a puff or a pinch, in the last 30 days?"

¹⁴ The ENDS quit rate is based on answer to the 7-month follow-up survey: "have you used an e-cigarette or other electronic 'vaping' product in the past 30 days?"

Estimated Maine quit rates are below the national average for both conventional (National: 30.6% vs ME: 25.8%) and for conventional and ENDS (National: 28.4% vs ME: 24.1%) for the same time period (NAQC, 2021).

Enrollee Demographic Characteristics

Table 1 summarizes the demographic profile of Maine QuitLink enrollees between 2015 and 2020 and compares it to the national average of quitlines. Maine is the second least racially diverse state in the US (World Population Review, 2021a), which may account for the relatively low proportion of non-white and Hispanic/Latino enrollees. The Maine QuitLink serves a higher proportion of enrollees who are uninsured or enrolled in Medicaid/Medicare than the national average (ME: 64.4% vs US: 51.6%) as well as a higher proportion of enrollees with low educational attainment (i.e., GED or high school diploma or less) (ME: 52.8% vs US: 45.4%). See <u>Supplemental Table 10</u> for selected Maine QuitLink demographic calculations.

DEMOGRAPHIC CHARACTERISTICS	ME QUITLINK ENROLLEES ^a	US QUITLINES ENROLLEES ^b		
	Annual Average	Annual Average		
Female	52.9%	57.0%		
Median age	52 years	49.8 years		
Uninsured or enrolled in Medicaid / Medicare	64.4%	51.6%		
GED or lower education level	52.8%	45.4%		
Identified as LGBTQ+	4.8%	4.8%		
Self-reported behavioral health conditions	38.4%	43.8%		
Race: 15				
White	91.1%	74.4%		
Non-white	5.6%	18.7%		
Ethnicity:				
Hispanic / Latino	1.6%	8.8%		
Data sources:				
^a Maine NAQC Annual Surveys: FY16 – FY20				
^b NAQC FY20 Annual Survey: Progress Update on State Quitlines Presentation May 5, 2021				

Tahle	1 (Comparison	hetween	the Maine	Ouitl ink	Fnrollees	and the	National	Annual	Averanes	(2015 -	2020)
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Overall Maine QuitLink Treatment Reach

Treatment reach. This measure quantifies the number of people who received quitline treatment services (medication and/or counseling) as a proportion of adults who use tobacco in the state.

In 2019, is estimated that approximately 192,813 adults used cigarettes annually¹⁶. Given the uptake of treatment services by 18,911 individuals between 2015 and 2020, the average annual Maine QuitLink treatment reach during that time frame is approximately 2.0%. This is significantly higher than the national average of $0.9\%^{17}$ yet is still short of the NAQC goal of $\geq 6\%$ (see Table 2). The NAQC goal was

¹⁵ Percentages may not total 100% due to non-reporting (e.g., participants may have chosen not to identify race during enrollment). Additional breakdown is provided in Table 10.

¹⁶ Total number of adults using cigarettes is based on the 2019 population and 2019 BRFSS rate of 17.6%. See <u>Table 11</u> for more details.

¹⁷ National average is the average of FY18, FY19, FY20 as reported by NAQC in May 2021.

developed in 2009 and is based on US CDC's 2007 Best Practices for Comprehensive Tobacco Control Programs (NAQC, 2021). See <u>Supplemental Table 11</u> for a description of how the total number of adults who use cigarettes in Maine was calculated.

Treatment Reach Among Disparate Sub-Populations in Maine

Comparison of the Maine QuitLink to the adult prevalence of cigarette use in Maine. Calculations for populations with tobacco-related health disparities are based on the BRFSS 2016 and 2011-2016 data tables provided by the USM Epi Team. As shown in Figure 1, the distribution of QuitLink enrollees aligns with the state tobacco use prevalence among disparate populations. The exception is among adults who smoke cigarettes with lower education levels¹⁸ who are under-represented among QuitLink enrollees (QuitLink: 52.8% vs BRFSS: 60.1%). See <u>Supplemental Table 12</u> for details on the treatment reach calculations.





Comparison of the Maine QuitLink to the national average. The Maine QuitLink reached a greater proportion of disparate populations than the national average, particularly among enrollees with low education levels (ME: 1.6% vs US: 0.6%). Maine additionally has a higher average annual treatment reach for individuals who identified as white (ME: 1.8% vs US: 0.7%). This may be due to the demographic characteristics of Maine adults, who are predominately white. It is important to note that an enrollee may identify with more than one characteristic summarized in Table 2. See <u>Supplemental Table 13</u> for details on how the treatment reach was calculated.

¹⁸ Lower education levels include adults with a high school diploma, a General Education Diploma, or less than a high school diploma.

DEMOGRAPHIC CHARACTERISTICS	ME QUITLINK AVERAGE ANNUAL	US QUITLINES AVERAGE ANNUAL TREATMENT		
	TREATMENT REACH ^a	REACH ^b		
Health Insurance:				
Uninsured	2.2%	NA		
Public coverage	2.2%	NA		
Education:				
GED or lower education level	1.6%	0.64%		
Sexual Orientation:				
Identified as bisexual, lesbian, or gay	1.8%	NA		
Race:				
White	1.8%	0.74%		
Ethnicity:				
Hispanic / Latino	1.9%	0.51%		
Data sources:				
^a Maine NAQC Annual Surveys: FY16 – FY20				
^b NAQC FY20 Annual Survey: Progress Update on State Quitlines Presentation May 5, 2021				

Table 2.	reatment Reach of Disparate Populations: Comparison of the Annual Maine QuitLink to the National
Average	2015-2020)

Resource Allocation per QuitLink User

Overall costs per QuitLink user. Cost analysis estimates the cost of each unique Maine QuitLink user by dividing the total costs by the total number of QuitLink users. Two different costs were used: the total QuitLink cost and the treatment-only cost. Both costs were adjusted for inflation and Table 3 reflects the adjusted 2020 USD value. Total adjusted costs of the Maine QuitLink between FY16 and FY20 were \$16,006,522. Removing media, promotions, and evaluation costs resulted in the treatment-only cost of \$11,957,762. See <u>Supplemental Table 14</u> (total costs) and <u>Table 15</u> (treatment only costs) for details of the annual costs for the Maine QuitLink. As summarized in Table 3, the cost per person registering for QuitLink cessation services was estimated at \$572. This increases to \$632 - \$846 when calculating the cost per person receiving evidence-based cessation services. When considering cost per person quitting tobacco use (i.e., conventional/ ENDS tobacco products), the cost increases considerably to \$2,623 - \$3,512.

Table 3. Costs	per Maine G	uitLink User	(2015 – 2020)
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METRICS	TOTAL COSTS	TREATMENT-ONLY COSTS
Cost per person registering to receive treatment services:	\$572 ¹⁹	NA
Cost per person receiving treatment services:	\$846	\$632
Cost per person quitting conventional tobacco products:	\$3,274	\$2,446
Cost per person quitting conventional / ENDS tobacco		
products:	\$3,512	\$2,623

¹⁹ Medication costs detailed in overall budget were excluded when calculating cost per enrollee as they did not receive treatment services.

Annual overall spending per adult who uses cigarettes. The Maine QuitLink spent an annual average of \$12.40 - \$16.60 per adult who smokes cigarettes in Maine. This is significantly higher than the national average of \$1.95 per adult who smokes cigarettes and exceeds the NAQC goal of \$10.53 per adult (see Table 4).

Table 4. Investment per Adult Who Uses Cigarettes in Maine

METRICS	TOTAL COSTS	TREATMENT-ONLY COSTS
Maine QuitLink annual average costs	\$3,201,304	\$2,391,552
Total number of adults who smoke cigarettes in Maine	192,813	192,813
Annual spending per adult who smokes cigarettes in Maine	\$16.60	\$12.40

Cost Benefit Analysis

Cost benefit analyses provide a measure of how many benefits result from spending \$1. This is expressed as a ratio of *\$1 cost: \$ benefit* and represents Return on Investment (ROI). For this evaluation, the benefits were defined as averted SAE, which includes expenses such as health consequences, health costs, and loss of productivity from premature deaths. If a person is able to successfully quit cigarette use, these expenses will be averted (i.e., costs saved).

Smoking-Attributable Expenses (SAE). In 2009, annual gross SAE for adults who smoked cigarettes in Maine was estimated at approximately \$1,458,000 in 2009 USD. Using the BRFSS 2009 smoking rate (17.3%) and adjusting for inflation, the adjusted SAE is approximately \$9,334 in 2020 USD per adult who smoked cigarettes in Maine. See <u>Supplemental Table 16</u> (estimates per adult who uses cigarettes) and <u>Table 17</u> (estimates by quit rate).

Return on Investment. Table 5 distinguishes the range of ROI ratios. For \$1 spent on programmatic costs, it is estimated that between \$2.66 to \$3.82 is saved from averted SAE. Between FY16 and FY20, over 16 million dollars was invested in the Maine QuitLink, which resulted in a potential return on investment/cost savings of \$42,542,345 - \$45,631,752.

		MAINE QUITLINK COSTS		
BENEFITS		Total Costs:	Treatment-Only Costs:	
		\$16,006,522	\$11,957,762	
Conventional Quit	Averted S-AE:	¢1 · ¢2 82	¢1 · ¢2 87	
Rate: 25.8%	\$45,631,752	ŞI.Ş2.05	ŞT . ŞS.02	
Conventional and ENDS Averted S-AE:		¢1, ¢2, cc	61.62.FC	
Quit Rate: 24.1%	\$42,542,345	ξΙ. ξΖ.00	סכ.כל י דל	

Table 5. Maine QuitLink Cost : Benefit Return on Investment (2015 - 2020)

Cost Utility Analysis

Another method of cost analysis is cost utility. Cost utility looks at decreased morbidity and mortality due to tobacco cessation as the benefit, which can be monetized to produce an ROI ratio.

Discounted Life Years. <u>Life Years</u> (LYs) are a modified mortality measure that look at deaths averted and adjusts the value of a year according to the age of a person (e.g., the LYs saved for a 20-year-old will be weighted more than the life years saved for a 40-year-old). LYs are <u>discounted</u> between 3% and 5% so to place higher value on immediate health outcomes than those that may happen in the future (Sanders et al., 2016).

Using the life tables from Fiscella and Franks (1996) for persons aged 50-54 years old (the average age of QuitLink enrollees) and assuming the standard 3% <u>discount</u> rate (Sanders et al., 2016), it is inferred that the use of the Maine QuitLink resulted in approximately 3.65 LYs saved (and 1.77 discounted LYs) per person who successfully quit tobacco use between 2015 and 2020. See <u>Supplemental Table 18</u> for life table estimates by gender.

Discounted Quality of Life Years. <u>Quality-adjusted Life Years</u> (QALYs) provide a more nuanced measure that represents the trade-off between quantity of LYs and the quality of well-being during those years. Premature death (mortality) is combined with morbidity by attaching a quality score to the number of LYs ranging between 0 (death) and 1 (full health). Similar to LYs, these rates are <u>discounted</u> between 3% and 5%.

Return on Investment. Each LY saved is estimated to cost \$50,000 (Reisinger et al., 2019). When viewed in these terms, the Maine QuitLink yields a benefit of \$25.20 – \$27.03 for every \$1 spent in total costs or \$33.73 - \$36.18 for every \$1 spent on treatment-only costs (See Table 6, below).

This ROI is lower for the discounted QALYs saved. For every \$1 spent on Maine QuitLink services, \$24.77 - \$26.57 is saved per QALY. Using treatment-only costs, the ROI is \$33.16 - \$35.57. See Table 6 for a summary of the ROI and <u>Supplemental Table 19</u> and <u>Table 20</u> for details on how the costs per LY and QALY saved were calculated, respectively.

		MAINE QUITLINK COSTS		
BENEFITS		Total Costs:	Treatment-Only Costs:	
		\$16,006,522	\$11,957,762	
Conventional Quit	Discounted LYs: 1.77	\$1:\$27.03	\$1:\$36.18	
Rate: 25.8%	Discounted QALYs: 1.74	\$1:\$26.57	\$1:\$35.57	
Conventional and	Discounted LYs: 1.77	\$1:\$25.20	\$1:\$33.73	
24.1%	Discounted QALYs: 1.74	\$1:\$24.77	\$1:\$33.16	

Table 6. Maine QuitLink Cost : Util	ity Return on Investment	(2015 - 2020)
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Discussion



Answering the Evaluation Questions

Tobacco use has an adverse impact on society, both through loss of life and productivity years and through the financial burden borne by adults who use tobacco, health systems, taxpayers, and employers. Studies have shown that the fastest method to reduce tobacco-related disease, death, and healthcare costs is to encourage adults who use tobacco to quit (US DHHS, 2020).

While a high proportion of adults who use tobacco are interested in quitting, roughly two-thirds attempt to quit. A third of those who try to quit use a proven cessation treatment, and less than one-in-ten individuals successfully quit tobacco use for at least 6 months (Babb, 2017). Low quit rates are particularly prevalent for adults who identify as Hispanic, Asian, LGBTQ+, and/or uninsured (ibid).

Of the approximately 4,727 adults who annually registered to receive cessation services from the Maine QuitLink, 3,782 received evidence-based services (NRT and/or phone counseling). As a result, an estimated 911 – 978 adults successfully quit for at least 30 days every year.

To determine the cost-effectiveness of the Maine QuitLink in reducing tobacco use prevalence and to examine how it compares with national benchmarks, a retrospective economic analysis from a programmatic perspective was undertaken for the period July 2015 through June 2020 (FY16 -FY20).

Who uses the Maine QuitLink?

QuitLink volume. During the study period, an average of 10,950 direct calls and 5,685 provider referrals were made to the Maine QuitLink each year. Almost a third (28.4%) resulted in an enrollment for evidence-based treatment services, which include NRT and/or counseling. The retention rate from enrollment to receiving services is approximately 80.0%, with about 3,782 adults receiving QuitLink treatment services every year. This is on par with the national annual average of 3,993 adults across quitlines.

Of the 3,782 Maine adults who receive QuitLink services each year, approximately 911 - 978 reported not using tobacco products in the past 30 days at 7-months follow-up. Maine quit rates (conventional: 25.8%; conventional and ENDS: 24.1%) are below the national average (conventional: 30.6%; conventional and ENDS: 28.4%).

Enrollee demographic characteristics. The average age of a person enrolling in QuitLink services is 52 years and slightly more females use the services than males. Most enrollees are white (91.1%), are uninsured or enrolled in Medicaid/Medicare (64.4%) and/or have a low education level²⁰ (52.8%).

QuitLink Treatment Reach. Viewed as a proportion of adults who smoke cigarettes in Maine, the QuitLink's treatment reach is approximately 2.0%, meaning that 2.0% of all adults who smoke in Maine receive QuitLink treatment services. This is significantly higher than the national average of 0.86% yet falls short of the NAQC goal of ≥6.0%.

²⁰ Low educational attainment is defined as obtaining a General Education Diploma, High School Diploma, or less education.

How much is invested in the Maine QuitLink?

There are two ways of looking at resource allocation: (i) cost per QuitLink user; and (ii) investment per adult who smokes cigarettes in Maine.

Cost per QuitLink user. Between FY16 and FY20, the Maine QuitLink spent an estimated \$632 - \$846 per person receiving treatment services each year. Based on the average quit rate this converts to \$2,446 - \$3,512 per person who successfully quits. This is on par with studies estimating \$2,342 (van den Brand et al., 2017) and \$2,040 (Reisinger et al., 2019) per quit, but substantially higher than the Swedish Quitline study (\$311 - \$401) and the Vermont and New Hampshire studies (\$1,156 - \$1,922). However, due to the variability in types and delivery of services in each evaluation, direct comparison is not feasible.

Investment per adult who smokes cigarettes. Viewed as a public health investment, the Maine QuitLink spends approximately \$12.40 – \$16.60 per year per adult who smokes cigarettes in Maine.

What is the Maine QuitLink's Return on Investment?

A prevalence-based, cost of illness approach was used to estimate the cost of providing services in terms morbidity and mortality costs averted by tobacco cessation.

Morbidity costs are direct and indirect expenses encumbered by persons who are ill or disabled from smoking-related diseases. When viewed in terms of gross averted SAE, the ROI was \$1: \$2.66 -\$3.82, suggestive that \$2.66 -\$3.82 are averted in smoking-related costs per \$1 invested in the Maine QuitLink.

The benefit (costs averted) was higher when calculated as potential QALY an individual would have lived had they not died of a smoking-attributable disease. Viewed in terms of QALYs, the ROI was \$1: \$24.77 - \$26.57. If only using treatment costs, the ROI increases to \$33.16-\$35.57 in costs averted for each dollar spent by the Maine QuitLink.

To what extent does the Maine QuitLink serve populations with tobacco-related health disparities?

QuitLink enrollees. The majority of the QuitLink enrollees identify with at least one disparate population, particularly being uninsured or enrolled in Medicaid/Medicare (64.4%) and having a high school or lower educational level (52.8%). Only one-in-twenty (5.6%) of enrollees are non-white. This reflects the demographic composition of Maine.

Treatment reach. Treatment reach compares the number of people who receive quitline treatment services with the proportion of adults who use tobacco in the state. Treatment reach among populations with tobacco-related health disparities suggest that tobacco cessation treatment provided by the Maine QuitLink aligns with the state cigarette use prevalence. Adults who use cigarettes with lower education levels are slightly under-represented.

How does the Maine QuitLink compare with national benchmarks?

Quit rate. Compared to the national average, the Maine QuitLink has a lower quit rate for both conventional tobacco products (ME: 25.8% vs US: 30.6%) and conventional and ENDS products (ME: 24.1% vs US: 28.4%).

Enrollee characteristics. Maine is the second least racially diverse state in the US, which is reflected in the high proportion of white adults enrolling in QuitLink services (ME: 91.1% vs US: 74.4%). Compared to other quitlines, the Maine QuitLink has a lower percentage of enrollees who have a self-reported behavioral health condition (ME: 38.4% vs US: 43.8%), identify as non-white (ME: 5.6% vs US: 18.7%), and/or identify as Hispanic/Latino (ME: 1.6% vs US: 8.8%). However, the Maine QuitLink serves a higher portion of enrollees who are uninsured or enrolled in Medicaid/Medicare compared to other quitlines (ME: 64.4% vs US: 51.6%) and those with low educational attainment (ME: 52.8% vs US: 45.4%).

Treatment reach. The Maine QuitLink has a higher treatment reach than the national average (ME: 2.0% vs US: 0.86%), despite the fact that both are well below the NAQC goal (6.0%). This demonstrates that the Maine QuitLink provides treatment for a higher proportion of adults that use cigarettes than their peers. In addition, Maine QuitLink provides treatment for a high proportion of enrollees from sub-populations experiencing health disparities than national quitline averages.

Investment per adult who smokes cigarettes. Maine's investment of \$12.40 - \$16.60 is above the NAQC goal of \$10.53 per adult who uses cigarettes and far surpassing the national average of only \$1.95 per adult.

Conclusion and Recommendations

Utilization

The findings highlight two important indicators of utilization: (1) less than a third (28.4%) of individuals engaging with the QuitLink (through direct calls or referrals) enroll in treatment services²¹; and (2) roughly 2% of adults who use cigarettes in Maine receive services from the Maine QuitLink. While this is higher than its national peers, it is lower than the NAQC goal of 6%.

Recommendation. The findings suggest that there is an opportunity to expand treatment reach by encouraging more engagement with the QuitLink through mass communication, outreach, education, and/or by motivating more callers to enroll in treatment services.

Resource Allocation

Expanding treatment reach has the potential to also decrease the cost per enrollee. The extent of this change is unknown as the marginal cost of additional enrollees was beyond the scope of this analysis.

Investment trends indicate that the Maine QuitLink invests more per adult who smokes cigarettes (\$12.40-\$16.60) than the national average (\$1.95) and exceeds the NAQC goal (\$10.53). In part, this may be due to the prioritization of investment in disparate populations, particularly adults who are enrolled in Medicaid/Medicare and/or have lower educational levels.

Recommendation. Maintenance of funding levels will ensure continued prioritization of adults who use tobacco, particularly among populations with tobacco-related health disparities.

Return-on-Investment

Overall, these findings suggest that the Maine QuitLink is responsible for averting a significant amount of smoking-attributable direct and indirect costs. Both ROIs highly suggest that the resources spent on the Maine QuitLink are cost-effective. For each \$1 invested in the QuitLink, Maine can expect a minimum return of \$2.66 and potentially more than \$36.18.

Recommendation. The findings suggest that with continued allocation of comparable resources, the Maine QuitLink may continue to avert both direct and indirect costs attributable to smoking in coming years.

²¹ Given that there is unlimited inbound call support, a proportion of direct calls may be from individuals already enrolled in QuitLink services. Accordingly, the 28.4% may be underestimated.

Glossary & Supplemental Tables



GLOSSARY

Behavioral Risk Factor Surveillance System (BRFSS)

System of health-related telephone surveys that collect state data about US residents on health-related risk behaviors, chronic health conditions, and use of preventative services (BRFSS, 2019).

Center for Tobacco Independence (CTI)

A MaineHealth program that works to address tobacco use and exposure through education, prevention, policy, treatment, and training initiatives (Center for Tobacco Independence, 2021).

Conventional Tobacco Products

Tobacco products that are designed to be smoked, including cigarettes, cigars, cigarillos, little cigars, blunts, and bidis (Campaign for Tobacco-Free Kids, 2021b).

Cost-Effective Analysis

Analysis which measures cost savings by linking the costs of an intervention to the resulting health improvements (Ekpu & Brown, 2015). It includes measures such as hospitalization avoided, deaths averted, life-years saved.

Cost Benefit Analysis

Analysis that measures economic soundness or feasibility of an intervention. It measures both the costs and monetary benefits discounted at their present value (Ekpu & Brown, 2015).

Cost Utility Analysis

An economic analysis comparing the cost of a program from a particular point of view to the health improvement expressed as a unit of quality-adjusted life years (National Center for Environmental Health, 2015).

Direct Costs of Smoking

The value of goods and services consumed as a result of tobacco use and tobacco-related illnesses. Examples include healthcare costs (e.g. hospitalization, medications) and non-healthcare costs (e.g. caregiving, property losses, cleaning clothes) (WHO, 2011).

Discounting

Discounting converts future dollars and health outcomes to their present values (Sanders et al., 2016). This process promotes comparability across different studies and programs. Three percent is the recommended appropriate discount rate (ibid).

E-Cigarettes

Also referred to as Electronic Nicotine Delivery Systems (ENDS). Battery operated tobacco products that vaporize an 'e-liquid' almost always containing nicotine, into an aerosol form that is inhaled by the user. Examples include e-cigs, vape pens, vaporizers, or e-hookahs (FDA, 2020). Other slang terms and brand names may be used to describe the products, like JUUL, Puff Bar, Stig, and Smok.

Enrollee

A person who registers for evidence-based services offered by a quitline.

Health-related quality of life assessments (HRQoL)

Surveys used to measure an individual's or a group's perceived physical and mental health over time (OSH, 2020).

Indirect Costs of Smoking

Losses (expenses) that involve a loss of resources such as time lost from activities, value of lives lost prematurely, etc. (WHO, 2011). Indirect costs include morbidity costs, mortality costs, and disability adjusted life years.

Life Years (LYs)

A modified measure of mortality looking at years of life saved by averted death (e.g., tobacco cessation) adjusted by life expectancy of the individual (Robberstad, 2005).

Morbidity Costs

Indirect costs resulting from lost productivity by persons who are ill or disabled from tobacco-related illnesses (WHO, 2011).

Mortality Costs

The value of life lost which is often measured by the value number of years of potential life lost because of premature death. One measure of the value of life is based on assigning a monetary value to a life year. This can be done using the human capital approach, which values life according to what an individual produces, or the willingness-to-pay approach, which values life according to what someone would pay to avoid illness or death. This is referred to as <u>years of potential life lost (YPLL)</u> (Gardner & Sanborn, 1990).

North American Quitline Consortium (NAQC)

An international, non-profit membership organization that seeks to promote evidence-based Quitline services across diverse communities in North America (NAQC, n.d.-b).

Nicotine Replacement Therapy (NRT)

A type of medication that uses small, steady doses of nicotine to help stop cravings and relieve symptoms that occur when a person is trying to quit smoking (NIH, n.d.). These products include gum, inhalers, nasal sprays, lozenges, and patches. Some types require a prescription (ibid).

Perspective

Perspective is important in economic valuation, as it assesses costs to a certain party. Accordingly, economic analysis can be conducted from a program, societal, pay, or participant perspective (Sanders et al., 2016)

Quality-Adjusted Life Years (QALYs)

A modified measure of health improvement that takes into account both mortality and morbidity to assess overall quality of life, where 1 is optimal health and 0 reflects a health state equivalent to death (Robberstad, 2005).

Quit Attempt

An attempt to stop smoking that lasted at least 24 hours (Babb, 2017).

Quit Rate

Also called abstinence rates. Quit rates are calculated using the number of quitline enrollees who used tobacco products within the previous 30 days prior to enrollment. Depending on the timing of follow-up, a quit rate may be seven days, 30 days, 6 months, or 12 months. The standard NAQC quit rates are 30-day point prevalence rate asked at 7-month follow-up (NAQC, 2015).

Return on Investment (ROI)

A financial metric used to calculate the probability of gaining a return after spending an investment cost, expressed as a ratio (Nonnemaker et al., 2020). For cost benefit analyes, ROI is expressed as \$1 cost : \$ saved because of averted medical costs. For cost utility analyses, ROI is expressed as \$1 cost : \$ cost of discounted QALYs/LYs saved (ibid).

Social Determinants of Health

The social, economic, and environmental conditions in which people are born, live, work, play, worship, and age that influence health and quality of life risks and outcomes (US CDC, 2021).

Smoking Attributable Expenditure (SAE)

Healthcare costs attributed to tobacco use or tobacco-related illness (US CDC, 2020).

Smoking Attributable Mortality, Morbidity, and Economic Costs (SAMMEC)

The combined annual expenditure of ambulatory services, prescription drugs, hospital and nursing home fees, and other costs attributable to diseases where tobacco use is a primary risk factor (US CDC, 2020).

Smoking Attributable Mortality (SAM)

The number of deaths in a population caused by tobacco use (US CDC, 2020).

State Tobacco Activities Tracking and Evaluation System (STATE)

An interactive application that presents current and historical state-level data on tobacco use prevention and control (US CDC, 2018).

Tobacco Cessation

Otherwise known as sustained abstinence, cessation is defined as not using tobacco products for a period of time. Different data collection methods use different time periods: some define cessation as sustained abstinence after 24 hours, while others require a longer period of time (up to 12 months) (Babb, 2017; NAQC, 2015). Also see <u>quit rate</u>.

Tobacco-related Health Disparities

This refers to the idea that certain populations are disproportionately impacted by tobacco use and adverse tobacco-related health outcomes due to structural inequities.

Treatment Reach

The number of people who receive evidence-based tobacco treatment services (e.g., phone counseling and/or cessation medications) through a quitline as a proportion of adults who use tobacco in the state.

Years of Potential Life Lost (YPLL)

The number of years an individual would have lived had they not died prematurely of a smokingattributable disease. It is calculated as the number of years of life expectancy remaining at death (WHO, 2011).

SUPPLEMENTAL TABLES

QuitLink Utilization

Table 7. Cumulative Direct Calls and Referrals to the Maine QuitLink (July 2015 – June 2020)

	Total Number of Direct Calls	Total Number of Referrals		
FY16	14,604	5,273		
FY17	10,669	4,442		
FY18	10,332	6,673		
FY19	10,402	6,260		
FY20	8,743	5,779		
Annual Average	10,950	5,685		
Cumulative	54,750	28,427		
Data source: Maine NAOC Annual Surveys FY16 – FY20				

Table 8. Maine QuitLink Utilization (July 2015 – June 2020)

Fiscal Year	Number of Unique People Registered for Treatment Services	Number of Unique People Receiving Treatment Services	Estimated Number of People Who Quit Conventional Products (25.8%)	Estimated Number of People Who Quit Conventional and ENDS Products (24.1%)
FY16	5,637	4,567	1,181	1,101
FY17	4,768	3,743	968	902
FY18	4,706	3,651	944	880
FY19	4,741	3,783	978	912
FY20	3,781	3,167	819	763
Total	23,633	18,911	4,889	4,558
Data sour	rce: Maine NAQC Annua	ıl Surveys FY16 — FY20		

Quit Rates

Table 9. Estimated Quit Rate for Maine QuitLink (July 2015 – June 2020)

Maine NAQC Survey	Conventional Products Quit Rates	Conventional and ENDS Products Quit Rates			
FY17	25.6%	23.8%			
FY18	26.1%	24.4%			
Average 25.8% 24.1%					
Data source: Maine NAQC Annual Surveys FY17 and FY18					

Characteristics of Adults in Maine Who Use Cigarettes

Table 10. Annual and Average Demographic Characteristics of Individuals Enrolled in the Maine QuitLink for Tobacco Cessation Treatment (2015 - 2020)

Indicator	FY16	FY17	FY18	FY19	FY20	Annual	Annual
						Average	Average %
Total unique users:	4,567	3,743	3,651	3,783	3,167	3,782	100%
Female	2,430	1,908	2,002	1,978	1,694	2,002.4	52.9%
Median age	51	52	52	51	54	52 years	
Uninsured or enrolled							
in Medicaid/Medicare	2,964	2,498	2,415	2,265	2,032	2,434.8	64.4%
Education:							
GED or lower						1,996	
education level	2,395	2,056	2,010	1,882	1,641		52.8%
Sexual Orientation:							
Identified as LGBTQ+	109	182	225	183	213	182.4	4.8%
Race:							
White	4,073	3,425	3,523	3,443	2,766	3,446	91.1%
Non-white	202	228	212	219	199	212	5.6%
Ethnicity:							
Hispanic / Latino	59	51	57	65	64	59.2	1.6%
Data source: Maine NAQC	Annual Sur	veys FY16 –	FY20				

Table 11. Calculation of Total Number of Adults who Used Cigarettes in Maine (2019)

	Source	Data point
Total population in Maine	www.census.gov	1,344,212
Total individuals <18 years (18.5%)	www.census.gov	- 248,679
Total number of adults in Maine		1,095,533
Smoking prevalence of adults in Maine	Maine BRFSS, 2019	17.6%
Total number of adults who use cigarette	192,813	

Demographic Characteristic ^s	Number of Maine Adults who currently use cigarettes	Number of Maine Adults who currently use cigarettes	Percentage of Adults Who Use Cigarettes	Maine QuitLink Enrollee Data (2015 – 2020) ^c
Overall Adults who use	(2010)	(2011 – 2010)		
cigarettes	206 960	212 192	100%	100%
Education:	200,500	212,192	100/0	10070
Less than High School				
Diploma, High School	124.447		60.1%	52.8%
Diploma, or GED	,			
Some college	63,966		31.0%	23.8%
Bachelor's degree or				
higher	18,432		9.0%	17.3%
Health Insurance ^d :				
Private Coverage	96,406		46.6%	31.3%
Medicare/Medicaid or				
MaineCare/Other	68,597		33.1%	33.4%
Uninsured	41,680		20.1%	19.9%
Race:				
White		197,442	93.0%	91.1%
American Indian or				
Alaska native		5,224	2.5%	1.9%
Asian [†]		662	0.3%	0.4%
Black or African				
American		1,942	0.9%	1.5%
Multiracial		4,359	2.1%	NA
Native Hawaiian or				
Pacific Islander		DSU ^e	DSU	DSU
Other race		DSU	DSU	DSU
Ethnicity:				
Non-Hispanic		207,328	97.7%	95.2%
Hispanic		3,200	1.5%	1.6%
Sexual Orientation: ^g				
Heterosexual or Other		192,607	90.8%	76.4%
Homosexual or Bisexual		10,421	4.9%	4.8%

Table 12. Troportion of Mante Maato Mile officite officites by Demographic characteristic	Table 12. Pro	portion of Maine	Adults who Smoke	Cigarettes by	/ Demographic	Characteristics
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Notes:

^a Data source: Maine BRFSS, 2016 Data Tables compiled by USM Epi Team

^b Data source: Maine BRFSS, 2011 – 2016 Data Tables compiled by USM Epi Team

^c Maine NAQC Annual Surveys FY16 – FY20

^{*d*} Healthcare coverage only asked in Part A of BRFSS survey in 2016

^e Demographic characteristics counts may not sum to Maine total due to missing data

^f Interpret with caution as data point based on an unweighted numerator of less than 50

^g Sexual orientation was not available in 2016

Sub-Population	CUMUL	CUMULATIVE TREATMENT REACH				
	QuitLink	Adults Who	Cumulative	Annual Reach		
	Enrollees ^a	Use	Reach			
		Cigarettes				
		(2011 - 2016) ^b				
Uninsured	4,546	41,680	10.9%	2.2%		
Medicare/Medicare or						
MaineCare/Other	7,628	68,597	11.1%	2.2%		
Less than High School Diploma,						
High School Diploma, or GED	9,984	124,447	8.0%	1.6%		
Identified as bisexual, lesbian,						
or gay	912	10,421	8.8%	1.8%		
White ^a	17,230	197,442	8.7%	1.8%		
Hispanic ^a	296	3,200	9.3%	1.9%		
Notes:	Notes:					
^a Data source: Maine NAQC Annual S	urveys FY16 - FY20					

Table 13. Cumulative Treatment Reach of the Maine QuitLink (2015 – 2020)

Cost Elements

^b See Table 12

Table 14. Cost Elements for the Total Cost of Maine QuitLink (July 2015 – June 2020)

Fiscal	Services	Medication	Evaluation	Media and	Annual	Inflation	Annual
Year				Promotions	Costs	Adjustment	Adjusted Total
							Costs
FY16	2,274,601	600,000	0	850,000	3,724,601	1.07	3,985,323
FY17	2,274,601	600,000	0	850,000	3,724,601	1.05	3,910,831
FY18	1,532,877	402,307	58 <i>,</i> 650	682,855	2,676,689	1.02	2,730,223
FY19	1,532,877	402,307	58,650	682,855	2,676,689	1.01	2,703,456
FY20	1,532,877	402,307	58 <i>,</i> 650	682,855	2,676,689	1.00	2,676,689
Total costs in 2020 USD \$16,006,522							
Data so	ource: Maine I	VAQC Annual Su	urveys FY16 - F	Y20			

Table 15. Cost Elements for the Total Treatment-only Costs of the Maine QuitLink (July 2015 – June 2020)

			/		/
Fiscal	Services	Medication	Treatment	Inflation	Annual Adjusted
Tear			Annual Costs	Aujustment	Treatment costs
FY16	2,274,601	600,000	2,874,601	1.07	\$3,075,823
FY17	2,274,601	600,000	2,874,601	1.05	\$3,018,331
FY18	1,532,877	402,307	1,935,184	1.02	\$1,973,888
FY19	1,532,877	402,307	1,935,184	1.01	\$1,954,536
FY20	1,532,877	402,307	1,935,184	1.00	\$1,935,184
	\$11,957,762				
Data sourc	e: Maine NAOC Ann	ual Surveys FY16-FY20			

Adverted Expenses

Table 16. Smoking-Attributable Expenses Estimates per Adult who Uses Cigarettes (2009 adjusted to 2020)

Cost Type	2009 Costs Averted (All Cigarette Users)	2009 Costs Averted per Person	2020 Costs Averted per Person		
Health consequences and	\$811,100,000	\$4,236.66	\$5,191.99		
COSIS					
Loss of productivity	\$647,000,000	\$3,451.30	\$4,141.56		
Total adverted expenses	\$1,458,100,000	\$7,777.96	\$9,333.56		
Data source: US CDC SAMMEC database					

Table 17. Smoking-Attributable Expenses Estimated by Quit Rate (2020 USD)

Cost	Conventional Quit Rate (25.8%)	Conventional and ENDS Quit Rate (24.1%)			
Number of Quitters	4,889	4,558			
Adverted expenses per quitter	\$9 <i>,</i> 333.56	\$9,333.56			
Total costs adverted \$45,631,751.77 \$42,542,344.97					
Data source: US CDC SAMMEC database					

QALYs

Table 18. Life Tables for 50 – 54 years old

	Male	Female	Average		
Life years saved	2.35	4.96	3.65		
Discounted life years saved (calculated)	1.31	2.22	1.77		
Quality of life years saved	3.08	4.08	3.58		
Discounted quality of life years saved	1.67	1.81	1.74		
Data source: Fiscella & Franks, 1996					

Table 19. Costs per Life Years Saved (2015 – 2020)

	Conventional Quit Rate	Conventional and ENDs
	(25.8%)	Quit Rate (24.1%)
Number of Quitters	4,889	4,558
Discounted LYs	1.77	1.77
Total discounted LYs saved	8,654	8,068
Cost per LY	\$50,000	\$50,000
Total Program Costs	\$16,006,522	\$16,006,522
Total Program Cost of one LYs saved	\$1,850	\$1,984
Return on Investment: Total Program Costs	\$1:\$27.03	\$1:\$25.20
Total Treatment Costs	\$11,957,762	\$11,957,762
Total Treatment Costs per LY saved	\$1,382	\$1,482
Return on Investment: Total Treatment Costs	\$1:\$36.18	\$1:\$33.73
Data source: Partnerships For Health analysis	•	

	Conventional Quit Rate (25.8%)	Conventional and ENDs Quit Rate (24.1%)	
Number of Quitters	4,889	4,558	
Discounted QALYs	1.74	1.74	
Total discounted QALYs saved	8,507	7,931	
Cost per QALY	\$50,000	\$50,000	
Total Program Costs	\$16,006,522	\$16,006,522	
Total Program Cost per QALY saved	\$1,882	\$2,018	
Return on Investment: Total Program Costs	\$1:\$26.57	\$1:\$24.77	
Total Treatment Costs	\$11,957,762	\$11,957,762	
Total Treatment Costs per QALY saved	\$1,406	\$1,508	
Return on Investment: Total Treatment Costs	\$1:\$35.57	\$1:\$33.16	
Data source: Partnerships For Health analysis	·	·	

Table 20. Costs per Quality-of-Life Years Saved (2015 – 2020)

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