Smoking Endgames in the United States
Executive Summary

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Cigarette smoking is the leading cause of preventable death in the United States. Though the health harms associated with smoking have long been established, cigarette smoking continues to pervade American society—one in five Americans smoke, and the rate of cessation has decreased over the past decade. Internationally, medical and public health experts have put forth dynamic "endgame strategies" that seek to eliminate the consumption of combustible tobacco and associated health harms. In this report, we focus on three tobacco endgames and their potential for implementation in the United States: the nicotine reduction strategy, sinking lid strategy, and reduced harm alternative strategy. Our goal is to identify a policy that may reduce the number of tobacco related deaths from over 443,000 to fewer than 10,000 per year.

To this end, we analyzed these strategies using a comparative multiple case study analysis and qualitative comparative analysis for the nicotine reduction and sinking lid strategies, and an iterative analysis and refinement model for reduced harm alternatives. We then reviewed the strengths and weaknesses of each approach and how each strategy could complement the others. Ultimately, we recommend a combination of the nicotine reduction and reduced harm alternative strategies, using both regulatory and legislative routes. We found that this strategy is the most feasible method by which to reduce tobacco related deaths from over 400,000 deaths to fewer than 10,000 per year.

Nicotine Reduction and Sinking Lid

The nicotine reduction strategy gradually reduces the amount of nicotine in combustible tobacco until the product is no longer addictive. A sinking lid strategy aims to reduce the market supply of combustible tobacco over a multi-year period. We chose a multiple case study approach to compare cases that feature similar elements as a nicotine reduction or sinking lid strategy, as neither strategy has been implemented previously. This approach provides contextual and historical precedent in policy areas with similar characteristics.

We selected cases for analysis based on eight analytical criteria. These criteria required that each case: (1) be implemented by a policy or regulation (rather than voluntary change or industry standard), (2) be industry transforming, (3) decrease the supply of a product, service, by-product, or input, (4) display relatively inelastic demand, (5) be susceptible to illicit markets, (6) impact tax revenue, (7) face political opposition, and (8) impact the market of a complementary good. Based on these criteria, we selected six case studies. Three of the case studies reduced a harmful component of a good, and were thus considered analogous to a nicotine reduction strategy. The other three cases reduced the overall supply of a good and were considered analogous to a sinking lid strategy. In all of the cases, the regulated good

emulates the market behavior associated with addictive goods because consumption does not vary proportionately with price.

Nicotine Reduction Cases	Sinking Lid Cases
Ratification of the Kyoto Protocol in the United States to gradually reduce greenhouse gas emissions	Sinking lid on slot machines in New Zealand
Reduction of trans-fats in food production	Gun control in the United States
Reduction of lead in gasoline in the United States	Legislation to limit the sale of incandescent light bulbs in the United States

Table 1. Case studies for nicotine reduction and sinking lid analyses.

Research Method. We used two methods of multiple case study analysis to identify the successes and failures of various elements of our respective strategies: qualitative case study analysis and fuzzy set qualitative comparative analysis. For the qualitative case study analysis, we compiled key literature on each case and used QSR NVivo to assess the relative presence of 39 different variables in the literature. We then analyzed the trends in each case and variable, and across analog cases, and documented these trends in a database. This method provided contextual and historical precedent in policy areas with similar characteristics. We then used this qualitative data to create a numerical data set for qualitative comparative analysis. This method helps identify complex causal relationships between variables—reconciling different outcomes among relatively similar cases. We used the fsQCA software developed by Dr. Charles Ragin to execute our qualitative comparative analysis. This software inputs a numerical data set that attributes set membership of each case to a variable, and uses Boolean minimization to output a simplified logical statement relating the variables to a specified outcome. We analyzed how three variables (scientific evidence of health harms, enforcement, and equity) and three variable indexes (public opinion, actor cohesion, and economic feasibility) contributed to the successful passage of a policy.

Public Opinion α = 0.662	Actor Cohesion α = 0.728	Scientific Evidence	Economic Feasibility α = 0.731	Enforcement	Equity
Media support	Clear authority	Scientific evidence of health harms	Cost-effectiveness	Enforcement	Equity
Stakeholder cohesion	Political feasibility		Elasticity of demand		
Acceptability	Actor cohesion		Economic feasibility		
Appropriateness	Organizational support				

Table 2. Indices and variables used for qualitative comparative analysis.

The three variable indices we used—public opinion, actor cohesion, and economic feasibility—allowed us to reduce the number of inputs as the software required. We combined variables relating to public opinion (media support, stakeholder cohesion, acceptability, and

appropriateness) and tested internal validity using a Cronbach-alpha test, using $\alpha=0.600$ as a baseline for acceptance. We repeated this process for the actor cohesion index (consisting of clear authority, political feasibility, actor cohesion, and organizational support variables) and the economic feasibility index (consisting of cost-effectiveness, elasticity of demand, and economic feasibility variables). Table 2 gives a description of each index and its Cronbach-alpha value.

Nicotine Reduction Findings. For a nicotine reduction strategy, the qualitative comparative analysis found that equity, enforcement, scientific evidence of health harms, actor cohesion, and public opinion contributed to the successful implementation of a policy. The success of such a strategy depends upon all of these factors acting together. Additionally, the findings from the comparative multiple case study analysis suggest a regulatory venue would aid in successful implementation of a nicotine reduction policy, as they have been found to be friendlier to the use of scientific evidence.

Sinking Lid Findings. For a sinking lid strategy, the analysis found that enforcement and public opinion contributed to the successful passage of a policy. Within the public opinion index, the variables for a successful sinking lid strategy include media support, stakeholder cohesion, acceptability, and appropriateness. These variables are important for a sinking lid strategy on combustible tobacco, as the strategy involves a substantial reduction of the most popular products in the tobacco industry. Historically, sinking lid analogous cases have suffered from inappropriateness related to perceived infringements on rights or consumer choice. The comparative multiple case study analysis suggests this barrier to strong public opinion may be overcome by taking a more gradual approach to reducing market supply, encouraging industry innovation for substitute goods, and convincing consumers of the advantages of such substitute goods.

Lastly, the sinking lid findings from the fuzzy set qualitative comparative analysis—enforcement and public opinion—were the same as the findings from the analysis of all six cases. This indicates that sinking lid is a subset of nicotine reduction, which also included enforcement and public opinion, and that these two variables are necessary conditions for success.

Reduced Harm Alternatives

The RHA strategy is unique in its approach because it focuses solely on the act of smoking, separating the issues of addiction and health harms from dirty delivery. The objective of this strategy is to eliminate combustible tobacco use in the United States by providing smokers safer delivery methods of nicotine, the addictive component of tobacco. Cleaner delivery systems may either replace cigarettes or enable the nicotine-dependent consumer to quit. Although the reduced harm alternative strategy does not combat addiction, it recognizes

that addiction is a problem that must be addressed and has been included in various reduced harm alternative strategies.

Research Method. These three alternative strategies are the result of a multi-stage research design. The foundation for this method is a goals-alternative matrix, wherein each different policy mechanism was analyzed for its suitability as a reduced harm nicotine strategy. These mechanisms included subsidizing RHNAs, decreasing subsidies on tobacco, increasing taxes on combustible tobacco products, regulating combustible tobacco use, regulating combustible tobacco advertising, regulating combustible advertising content, deregulating RHNA product use, regulations of RHNA manufacturing, government sponsoring of research and development, and varying public awareness campaigns. These mechanisms were all identified as potential components of strategies and were then combined together to create five complete strategies.

Strategy A	Strategy B	Strategy C	Strategy D	Strategy E
Revenue Neutral	*Revenue Positive*	*Revenue Negative*	*Revenue Negative*	*Revenue Positive*
• Tax increase on combustible tobacco ($0.75/pack) • Subsidize reduced harm alternatives • Subsidy decrease on combustible tobacco • Government sponsored research and development of reduced harm alternatives	• Tax increase on combustible tobacco ($0.25/pack) • Regulation of combustible tobacco advertising • Regulation of combustible tobacco content • Deregulation of reduced harm alternatives use • Public awareness campaign	• Regulation of reduced harm alternatives manufacturing • Public awareness campaign	• Regulation of combustible tobacco use • Government medical program incentives to quit smoking • Public awareness campaign	• Tax increase on combustible tobacco ($0.50/pack) • Subsidize reduced harm alternatives

Table 3. Strategies considered in reduced harm alternatives iterative analysis and refinement method.

The next stage of the research design analyzed each strategy under specific criteria in five main categories—outcomes, losses, gains, equity, and feasibility—and twenty-nine impact categories within these broad criteria. The evaluative methods determining the extent to which the different strategies met the impact categories included both quantitative and qualitative measures. These evaluations were compared within the goals-alternatives matrix for a side-by-side comparison. Then, in the next and final stage of the research design, the findings from the goals-alternative matrix were used to develop a final recommendation.

The Outcomes category of this measured the effectiveness of the stratgies, including projections for the number of people that quit smoking, the number of lives saved, the number of illnesses prevented, and the decrease in the number of cigarettes sold, all as a result for implementing each of the strategies. The Losses category encompasses the costs that accompany each strategy. These costs are implementation costs, medical expenses, and

industry revenue losses, and reduced employment. Implementation costs vary to include subsidies, public awareness campaigns, as well as the expenses associated with government regulation. The next category, Gains, represents the positive economic returns that are associated with each strategy - tax revenue, medical savings, productivity gains, industry revenues, and employment.

The fourth major category, Equity, includes the following impact categories: Gender, Age, Race, Socioeconomic status, Education, Smoking history, Marketing exposure, Familiarity with reduced harm alternatives, and Special populations which include those with psychiatric and substance abuse disorders, LGBT, those who are incarcerated or institutionalized, or those who are veterans or military personnel. The fifth broad category, Feasibility, illustrates the strategies' realistic chances for implementation. A few types of feasibility were explored: political, regulatory, administrative, economic, and public opinion.

Reduced Harms Alternatives Findings. Based on the evaluations of each strategy in regard to the differing criteria in the goals-alternatives matrix, we developed a reduced harm recommendation based on the strategy that most embodied efficiency, equity, and feasibility. This policy includes five different components spanning a ten year time frame: a 50 cent federal excise tax per pack on cigarettes, a $30 million subsidy of reduced harm alternatives manufacturing per year ($300 million total), a $100 million federal subsidy for the research and development of new reduced harm alternatives and improvements of existing reduced harm alternatives ($1 billion total), increasing regulation of the manufacture of reduced harm alternative products, and deregulating the use of reduced harm alternative products in public areas. With respect to both the major and impact categories, this combination is revenue positive. This means the $0.50 excise tax would cover the cost of the reduced harm alternatives manufacturing subsidies for the already existing tobacco companies. This subsidy should influence the tobacco companies to comply with the new manufacturing regulations in exchange for a subsidy. This impacts both the consumer and manufacturing stakeholders. It specifically addresses any information asymmetries between the manufacturers and consumers in regard to the products; and it ensures that safer products are on the market for consumer use.

Policy Recommendation

In the construction of our final policy recommendation, we first analyzed the strengths and weakness of the three endgame strategies in isolation. We concluded none of these strategies could individually meet the goal of the client, and that a combination of strategies would be necessary. We paired each strategy, and considered the strengths and weaknesses of each combination. We recommend a combination of the nicotine reduction and reduced harm

alternatives strategies via legislative and regulatory routes. We recognize that these strategies can be implemented individually, but believe they contain mechanisms that work well in junction with each other.

Regulatory Route

The regulatory component of the final strategy is a gradual reduction of the nicotine concentration in cigarettes from its current level to a non-addictive level within seven years. This reduction will be made in intervals imperceptible to 90% of the smoking population, reducing the prevalence of the compensatory behavior typically associated with a nicotine reduction strategy. The expected outcomes of this component will be a significant reduction in the smoking population once the nicotine concentration falls below the addictive threshold, and a large number of smokers seeking alternative nicotine delivery methods. This component will be accomplished through regulations of the Food and Drug Administration (FDA) under the authority of the Family Smoking Prevention and Tobacco Control Act of 2009.

Legislative Route

The legislative component of the final strategy proposes a new system of excise taxes on combustible tobacco products, subsidies to incentivize the development and deployment of reduced harm alternative products, and repurposing of the current revenue from tobacco taxes to subsidize future tobacco endgame research and to fund an enforcement agency to monitor the nicotine concentration levels.

Expected Outcome

We expect the combination of the nicotine reduction and reduced harm alternatives strategies will encourage a transformation in the tobacco industry, increase the number of successful cessation attempts by individuals who smoke, facilitate consumer transition to a safer tobacco delivery market, and work quickly enough to minimize the number of new smoking addictions that develop. The recommended policy aims to transition smokers from the combustible tobacco market to safer delivery markets by reducing the addictiveness of cigarettes, thereby making the reduced harm products more attractive and mitigating the potential for black markets. We also believe this strategy will reduce the number of smoking-related deaths to fewer than 10,000 per year by removing the addictiveness from dirty delivery.