

Section 5
Policy and Other Influences on the Supply of Tobacco Products

Chapter 11
Policies Limiting Youth
Access to Tobacco Products

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Policies Limiting Youth Access to Tobacco Products

This chapter examines policy interventions designed to limit youth access to tobacco products and reviews issues related to the global implementation, enforcement, and impact of these policies. Key areas of discussion include:

- Sources of tobacco products among youth and measures of levels of youth access to tobacco and their variation by world region and World Bank country income group
- Types of youth access policies and their intended impacts
- Research on the implementation and enforcement of youth access policies and the impact of these policies on youth access to tobacco and youth smoking
- Limitations of youth access policies—in particular, how the necessary infrastructure and resources for implementing and enforcing such policies may pose challenges, particularly for low- and middle-income countries, and how the tobacco industry's involvement with these interventions can undermine broader tobacco control efforts.

In high-income countries, youth access policies, when consistently enforced, can reduce commercial access to tobacco products among youth. Evidence from high-income countries suggests that strongly enforced youth access policies that successfully disrupt the commercial supply of tobacco products to minors can reduce youth tobacco use, although the magnitude of this effect is relatively small. The limited evidence on the impact of youth access policies implemented in low- and middle-income countries suggests that they can be effective in reducing youth tobacco use in these settings, although the amount of reduction is unclear.

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Introduction

This chapter discusses policies put in place around the world to limit the ability of youth to access tobacco products. Topics covered include the types of youth access policies, the economic rationale for these policies, the sources from which youth obtain tobacco products, the prevalence and comprehensiveness of youth access policies adopted around the world, and the empirical evidence on the impact of these policies in both high-income countries (HICs) and low- and middle-income countries (LMICs). The chapter concludes with a discussion of the costs of implementing youth access policies and the role these interventions can play in broader tobacco control efforts.

Types of Youth Access Policies and Their Intended Impact

Access to tobacco products is an important environmental risk factor for tobacco use among youth. Youth access policies are intended to reduce opportunities for minors to obtain tobacco products from commercial sources, with the goals of preventing youth from beginning to smoke, decreasing cigarette consumption, changing social norms with respect to smoking, and decreasing young people's overall smoking prevalence. To limit youth access to tobacco, governments attempt to regulate the sale and distribution of tobacco products to youth by establishing a minimum age of legal access to tobacco products, banning self-service displays and sale of single cigarettes, prohibiting the distribution of free tobacco samples to youth, and by other means. Jurisdictions may also attempt to reduce young people's demand for tobacco products by penalizing youth consumers who purchase, use, or possess tobacco products (PUP laws). Penalties for youth who violate PUP laws may include civil fines, loss of driver's license, and/or diversion to tobacco prevention/educational programs.

Article 16 of the World Health Organization (WHO) Framework Convention on Tobacco Control (WHO FCTC) obligates Parties to adopt and implement effective measures to prohibit the sale of tobacco products to and by minors.¹ Article 16 also obligates Parties to adopt and implement effective measures, including penalties, to ensure that sellers and distributors comply with these laws. The WHO FCTC youth access provisions are summarized in Box 11.1, along with a number of other policy measures not specified in Article 16 of the WHO FCTC.

The definition of a *minor* varies by country and can also vary within a country. By the end of 2007, most countries defined a minor as a person under the age of 18; age limits ranged from a high of 21 to a low of 14.² The term *minor* is defined as younger than 18 years of age in most U.S. states, and younger than 19 years of age in most Canadian provinces.

In 2013, the Institute of Medicine (IOM) (U.S.), at the request of the Food and Drug Administration (FDA), an agency of the U.S. Department of Health and Human Services, convened an expert committee for the purpose of determining the public health impact of raising the minimum age of legal access to tobacco products in the United States. The committee concluded that increasing the minimum age of legal access to tobacco products to age 21 would likely prevent or delay initiation of tobacco use by adolescents and young adults, particularly those between the ages of 15 and 17 years old. It further concluded that if the minimum age of legal access to tobacco products was raised to 21 nationwide, the result would be a substantial reduction in smoking prevalence—a projected 12% decrease—and avert 223,000 premature deaths and 4.2 million years of potential life lost for those born between 2000 and 2019.³

As a result of the IOM report, momentum has grown in the United States for raising the minimum age of legal access to tobacco products to 21 years, primarily because it is recognized that almost all tobacco product initiation occurs before age 26, and raising the minimum age of legal access would limit the ability of youth (<18) to obtain tobacco products from their older friends and siblings ages 18–21, who are frequent social sources of tobacco.^{3,4} On January 1, 2016, Hawaii became the first U.S. state to raise the minimum age of legal access to 21, followed by California on June 9, 2016.⁵

Box 11.1: Policy Measures to Prevent Youth Access to Tobacco Products

WHO FCTC Article 16 requires that all Parties implement policy measures to prohibit sales of tobacco products to minors. These measures may include:

- Requiring all tobacco retailers to post signs prohibiting access by minors at the point of sale and request age identification from purchasers if age is in doubt
- Banning direct access to tobacco products (e.g., self-service displays)
- Ensuring that tobacco vending machines are not accessible to minors
- Prohibiting the manufacture and sale of tobacco products in the form of sweets, snacks, toys, or other objects that may appeal to youth
- Prohibiting the distribution of free tobacco products to youth and the general public
- Banning the sale of single cigarettes or small cigarette packs, which are more affordable for youth.¹

Other policy measures, not specified in Article 16 of the WHO FCTC, include:

- Requiring face-to-face sales of tobacco products and preventing sales via mail, telephone, and Internet
- Requiring tobacco retailers to hold licenses to sell tobacco products*
- Limiting the number, density, or location of tobacco retail outlets within a community
- Banning the sale of tobacco products in educational facilities
- Banning cigarette vending machines
- Requiring locking devices on vending machines
- Penalizing youth who purchase, use, or possess tobacco products.

*WHO FCTC also suggests the licensing of tobacco product distributors, but this is intended to address illicit trade.

Economic Rationale for Youth Access Policies

The information failures in the market for tobacco products are particularly pronounced during the ages at which most tobacco use begins, providing an economic rationale for governments to intervene by limiting the supply of tobacco products to youth. Almost all tobacco use is initiated and established in adolescence, a developmental period characterized by high levels of impulsivity, risk-taking, and immature cognitive control mechanisms.⁶ Relative to adults, young consumers lack the capacity to make fully informed, appropriately forward-looking decisions about the risks of tobacco experimentation and use. They underestimate the future costs of smoking due to imperfect information about the health consequences of tobacco use and the potential for addiction. Data from the Global Youth Tobacco Survey (GYTS)—a school-based survey focusing on the use of, attitudes toward, and access to tobacco products among students ages 13–15 across the WHO Member States—reveal that a sizeable proportion

of youth worldwide lack basic education about the health hazards of tobacco use.⁷ Even when youth are informed about the harms of smoking, their propensity to be present- rather than future-oriented leads them to discount future smoking-related health costs.⁸ Moreover, many young people fail to appreciate the highly addictive nature of tobacco products and their own risk of becoming addicted. Emerging scientific evidence suggests that the adolescent brain has a heightened sensitivity to the addictive properties of nicotine.^{9,10} Most young people view smoking as a temporary activity that can be stopped at any time. Yet, of every three young smokers in the United States, only one will quit, and one of those remaining smokers will eventually die from tobacco-related causes.¹⁰

Restricting youth access to tobacco is intended to reduce youth smoking directly. Increasing the amount of effort and potential legal costs associated with obtaining and using tobacco products is expected to increase the full costs of smoking for youth.¹¹ Youth access policies could also impact youth smoking indirectly, by creating and reinforcing perceptions that tobacco products are difficult to obtain and consume, and fostering social norms that discourage adults from furnishing tobacco to underage youth.^{12,13}

Sources of Tobacco Products for Youth

Young people acquire tobacco products in a variety of ways and from both commercial and social (noncommercial) sources. Commercial sources include retail establishments (e.g., convenience stores, gas stations, restaurants, supermarkets); vending machines; street vendors; door-to-door sales; mail-order, Internet, and telephone sales; and via the distribution of free cigarettes to youth. Social sources involve the interpersonal exchange of tobacco, either for free, for money, or in the anticipation of future reciprocation.¹⁴ Social transactions may involve youth “bumming” or sharing cigarettes with friends or legal-age siblings, sneaking cigarettes from parents or other family members, or giving somebody else money to purchase cigarettes for them.

Both commercial and social sources play an important role in youth access to tobacco products.^{14–17} Their relative importance varies by the amount and frequency of tobacco used and the young person’s age, gender, and race/ethnicity.^{18,19} For example, based on studies conducted in the United States, youth who are more established smokers, older, male, and white are more likely than their counterparts to obtain tobacco products from commercial sources.

According to nationally representative data from the Youth Risk Behavior Surveillance System developed by the Centers for Disease Control and Prevention (CDC), an agency of the U.S. Department of Health and Human Services,²⁰ 14% of young smokers (grades 9–12) in the United States rely on commercial sources of cigarettes (i.e., buy them directly from a gas station or store). Data from the GYTS²¹ gives an indication of the extent to which young smokers around the world rely on commercial sources of cigarettes. Tables 11.1 and 11.2 show the importance of commercial sources for the six WHO Regions and the World Bank’s four country income groups, respectively. In the European Region, 56.5% of young smokers turn to commercial sources for their cigarettes, as do more than 45% of those in the Americas, Western Pacific, and South-East Asia Regions. In contrast, young smokers in the African and Eastern Mediterranean Regions rely heavily on social sources of cigarettes; only about one-third of young smokers in these regions buy cigarettes from commercial sources (stores, shops, and street vendors). Young smokers in low-income countries are the least likely to obtain cigarettes from commercial sources compared with youth in other country income groups.

Table 11.1 Percentage of Youth Smokers, Ages 13 to 15 Years, Who Buy Cigarettes From Commercial Sources, by WHO Region, 1999–2011

WHO Region	Number of countries in region	Number of countries reporting	Percentage who usually buy cigarettes in a store
African	46	36	30.0
Americas	35	32	45.1
Eastern Mediterranean	22	18	39.2
European	53	31	56.5
South-East Asia	11	11	47.2
Western Pacific	27	22	51.8
Total	194	150	46.4

Notes: The data presented here are based on nationally representative Global Youth Tobacco Survey (GYTS) data when available. When national data were not available, data from the capital or largest city were used as a proxy for the country data, based on a previously described methodology.¹²³ The regional data summations seen here are weighted based on country-level population data for youth ages 13–15 in 2007.¹²⁴

Source: Global Youth Tobacco Survey 1999–2011.²¹

Table 11.2 Percentage of Youth Smokers, Ages 13 to 15 Years, Who Buy Cigarettes From Commercial Sources, by Country Income Group, 1999–2011

World Bank country income group	Number of countries in group	Number of countries reporting	Percentage who usually buy cigarettes in a store
Low-income	36	28	36.9
Lower middle-income	52	47	45.6
Upper middle-income	56	49	51.6
High-income	50	23	37.9
Total	194	150	46.4

Notes: Four countries/administrative regions that were in previous analyses were not included here because they do not have an income category. The data presented here are based on nationally representative Global Youth Tobacco Survey data when available. When national data were not available, data from the capital or largest city were used as a proxy for the country data, based on a previously described methodology.¹²³ The income and regional data summations shown here are weighted based on country-level population data for youth ages 13–15 in 2007²³ and World Bank Analytical Classifications for 2011.

Source: Global Youth Tobacco Survey 1999–2011.²¹

Youth access policies primarily address commercial sources of tobacco; commercial and social sources are interrelated, however. When youth access restrictions are successful in reducing the commercial availability of cigarettes, young people may increasingly rely on social sources of tobacco.^{22–24} In the United States, documented reductions in illegal tobacco sales to youth have been accompanied by a shift in youth cigarette acquisition from commercial to social sources.²⁴ The opportunity to substitute social for commercial sources decreases the effectiveness of youth access interventions,^{25,26} but studies also show that youth who purchase tobacco from commercial sources are the primary suppliers of tobacco to other youth.^{27–29} Thus, interventions that effectively restrict youth access to commercial sources can also decrease the social exchange of tobacco by disrupting the supply chain and reducing the total supply of tobacco available to youth.^{10,27,30}

Country Adoption of Youth Access Legal Measures

There is considerable global variation in the prevalence and comprehensiveness of youth access policies. Table 11.3 shows the number of WHO Member States that have adopted the eight most common youth access legal measures as of 2014. The average adoption rate of the Article 16 treaty provisions ranks among the highest of all the WHO FCTC Articles.³¹

Prohibiting sales of tobacco products to minors and prohibiting the distribution of free cigarettes to minors are the youth access legal measures that have been most often adopted by WHO Member States; they are most common in the Western Pacific, South-East Asia, and European Regions. Vending machine bans and restricting direct access to tobacco products are the least commonly adopted policies. Youth access legal measures are least common in the African Region. In terms of country income group, youth access policies are generally most prevalent in HICs and upper middle-income countries (Table 11.4).

A growing number of countries have enacted laws to regulate youth access to nicotine-containing liquids and/or electronic nicotine delivery systems (ENDS), which are battery-powered devices designed to heat a liquid, typically containing nicotine, into an aerosol for inhalation by the user. Countries banning their sale to minors include Canada, Costa Rica, Ecuador, Fiji, Honduras, Italy, Malta, Republic of Korea, Spain, Togo, and Viet Nam.³² Additionally, a number of countries ban the sale and marketing of ENDS and all types of liquids to all persons, including Panama,^{33,34} Singapore,³⁵ Thailand,³⁶ and Uruguay.³⁷ Since 2009, the FDA has enforced the U.S. federal minimum age for sales to minors (age 18) for cigarettes, roll-your-own tobacco, and smokeless tobacco products. In 2016, the FDA finalized a rule extending its authority to all tobacco products; the rule has a number of provisions aimed at restricting youth access to newly deemed products such as ENDS, waterpipe tobacco, pipe tobacco, cigars, and cigarillos, including a prohibition on the sale of “covered” products to persons under the age of 18 years (either in person or online).³⁸

The Impact of Youth Access Policies on Youth Smoking Behavior

Sales-to-Minors Policies and Youth Smoking

Early community-level studies from the United States found that strongly enforced sales-to-minors policies can reduce youth smoking. For example, Jason and colleagues³⁹ reported that after two years of active enforcement of sales-to-minors laws and laws prohibiting minors’ possession of tobacco, smoking prevalence in Woodridge, Illinois, dropped by 50% among middle school students. Similarly, DiFranza and colleagues⁴⁰ found that enforcement of sales-to-minors laws as part of a comprehensive smoking cessation program in Leominster, Massachusetts, resulted in a 44% decline in smoking among middle school youth.

Table 11.3 Adoption of Youth Access Legal Measures, by WHO Region, 2014

WHO Region	Sales to minors banned (n=141)		Sales by minors banned (n=139)		Age verification for sales required (n=141)		Direct access to cigarettes banned (n=141)		Vending machines banned (n=138)		Free cigarette distribution to the public banned (n=140)		Free cigarette distribution to minors banned (n=139)		Single cigarette sales banned (n=140)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
African (24 countries)	17	(71)	18	(75)	9	(38)	6	(25)	8	(36)†	15	(63)	16	(67)	8	(33)
Americas (22 countries)	19	(86)	18	(82)	15	(68)	12	(55)	13	(59)	15	(68)	18	(82)	14	(64)
Eastern Mediterranean (16 countries)	15	(94)	12	(80)*	7	(44)	11	(69)	10	(67)*	14	(88)	14	(88)	10	(67)*
European (48 countries)	47	(98)	35	(73)	41	(85)	31	(65)	32	(67)	44	(92)	45	(96)*	42	(88)
South-East Asia (7 countries)	7	(100)	5	(83)*	3	(43)	4	(57)	7	(100)	7	(100)	7	(100)	5	(71)
Western Pacific (24 countries)	22	(92)	16	(67)	15	(63)	14	(58)	16	(37)	21	(91)*	21	(91)*	17	(71)
Total (141 countries)	127	(90)	104	(75)	90	(64)	78	(55)	86	(62)	116	(83)	121	(87)	96	(69)

*Data are missing from one country. That country was excluded from the denominator.

†Data are missing from two countries. Those countries were excluded from the denominator.

Notes: This analysis only includes WHO Member States that provided information on youth access laws. A total of 141 countries provided some data on adoption of youth access policies; the number of countries that provided data is noted under each region. Twenty-seven Member States did not provide any data on adoption of these policies, but a few countries were missing data for some policies, as indicated in the table. WHO = World Health Organization.

Source: World Health Organization 2016.³¹

Table 11.4 Adoption of Youth Access Legal Measures, by Country Income Group, 2014

World Bank country income group	Sales to minors banned (n=141)		Sales by minors banned (n=139)		Age verification for sales required (n=141)		Direct access to cigarettes banned (n=141)		Vending machines banned (n=138)		Free cigarette distribution to the public banned (n=140)		Free cigarette distribution to minors banned (n=139)		Single cigarette sales banned (n=140)	
	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)	n	(%)
Low-income (13 countries)	9	(69)	8	(67)*	4	(31)	4	(31)	5	(42)*	8	(62)	9	(69)	6	(46)
Lower middle-income (32 countries)	28	(88)	26	(81)	13	(41)	14	(44)	18	(56)	25	(78)	26	(81)	19	(59)
Upper middle-income (46 countries)	42	(91)	37	(80)	30	(65)	28	(61)	37	(80)*	38	(83)*	39	(85)*	31	(67)
High-income (50 countries)	48	(96)	33	(67)*	43	(86)	32	(64)	26	(53)*	45	(90)	47	(96)*	40	(82)*
Total (141 countries)	127	(90)	104	(75)	90	(64)	78	(55)	86	(61)	116	(82)	121	(86)	96	(68)

*Data are missing from one country. That country was excluded from the denominator.

Notes: This analysis only includes WHO Member States that provided information on youth access laws. A total of 141 countries provided some data on adoption of youth access policies; the number of countries that provided data is noted under each income group. Country income group classification based on World Bank Analytical Classifications for 2014. Twenty-seven Member States did not provide any data on adoption of youth access policies, and data were missing for additional Member States only for certain policies, as noted in the table.

Source: World Health Organization 2016.³¹

Larger multi-community intervention studies, however, have reached varying conclusions about the effectiveness of these policies. For example, in a six-community controlled trial in metropolitan Boston, Rigotti and colleagues⁴¹ did not find that vendors' compliance rates had any effect on the perceived access to commercial sources of cigarettes by youth or on youth smoking, even when compliance levels were relatively high. In contrast, in an analysis of data from 12 communities in Erie County, New York, between 1992 and 1996, Cummings and colleagues⁴² found that youth smoking during the past 30 days increased by 18% in communities that were unable to achieve an 80% retailer compliance rate by 1995, but did not change in communities with rates of 80% and above. Similarly, among youth ages 12 to 17 in the Central Coast of New South Wales, Australia, Tutt and colleagues⁴³ found that self-reported monthly smoking declined 34% as the retailer compliance rate increased from 69.1% in 1993 to 100% in 1999. However, when expanded to include all of New South Wales, the data showed a marginal increase in the rate of monthly smoking among this age group from 1993 to 1996.

In one of the most scientifically rigorous studies of youth access interventions, Forster and colleagues⁴⁴ conducted a randomized controlled study of seven pairs of small communities in Minnesota. The communities used different enforcement strategies as part of a broader community intervention. Between 1993 and 1996, daily, weekly, and monthly smoking increased at a lower rate among 8th- and 10th-grade youth who lived in high-compliance communities (94.9% average compliance rate) than among their counterparts who lived in control communities (87.5% average compliance rate). A net difference of -4.9% was observed in the prevalence of daily smoking between the intervention and control communities. Due to the small difference in the compliance rate, the authors suggested that the decline in the social acceptability of youth smoking, linked to the community mobilization, might have had a greater impact on the youth smoking rate than the reduced youth access to tobacco.

More recently, Jason and colleagues⁴⁵ measured the commercial availability of cigarettes in 24 Illinois towns and found that youth living in towns with higher levels of illegal sales to youth also had a higher prevalence of current smoking than youth who lived in towns with lower illegal sales rates. In contrast, Conley Thomson and colleagues⁴⁶ tested the impact of youth access policies and enforcement practices in a prospective cohort study of youth living in 295 Massachusetts towns. They found no association between community-level youth access restrictions and adolescents' rate of smoking initiation or progression to established smoking over two years. However, the authors acknowledge that the compliance rates in their study may have been below the threshold necessary to sufficiently limit retail access to tobacco, and they conclude that shutting off the supply of tobacco to minors may require unrealistically high levels of retailer compliance.

Of the few studies that have used national data to study the impact of youth access restrictions on youth smoking behavior, results have been mixed. Most of these studies have used cross-sectional survey designs to determine if exposure to youth access laws affects the likelihood that youth will use tobacco. For example, Lewit and colleagues⁴⁷ conducted a multivariate analysis using 1990 and 1992 data on 9th-grade students from 22 U.S. communities. Controlling for other tobacco control policies, cigarette prices, and demographic factors, the authors found that youth access policies were significantly associated with a reduction in tobacco use and the intention to smoke in this age group. In contrast, Chaloupka and Grossman¹¹ conducted a multivariate analysis of data on 8th-, 10th-, and 12th-grade students from 1992 to 1994 and found little impact of sales-to-minors policies on youth smoking. These authors attributed their findings to weak enforcement of youth access policies and retailers' poor compliance with the law. Such studies highlight the critical need for retailer compliance and strong

enforcement of these laws in order to produce a reduction in youth access to tobacco and, potentially, youth smoking.

Other research suggests that youth access laws can influence youth smoking, but that their impact is small relative to other tobacco control policies—significant tax and price increases in particular. For example, a study by Ross and Chaloupka⁴⁸ found that youth access laws were associated with reduced smoking among high school students, but that other tobacco control policies have a larger impact on reducing smoking prevalence and cigarette consumption among youth. Similarly, Powell and colleagues⁴⁹ found that although youth access policies reduced the prevalence of smoking among youth both directly and indirectly (by influencing peers), higher cigarette prices had a much larger effect on youth smoking prevalence. In another study examining the effect of cigarette prices on youth smoking in 38 countries participating in the GYTS, Nikaj and Chaloupka⁵⁰ attempted to quantify the potential impact of other tobacco control variables, including local-level heterogeneity in youth access to commercial cigarettes. They found that reduced access of minors to commercial cigarettes was associated with lower smoking prevalence and consumption across all country income levels. However, the estimated impact of price on smoking prevalence and consumption was far greater.

Some evidence suggests that youth access laws may prevent smoking uptake and transitions along a smoking trajectory. Botello-Harbaum and colleagues⁵¹ examined state-level youth access and smoke-free laws, controlling for sociodemographic characteristics and cigarette price, and found that these policies decreased the odds that young people will experiment with cigarettes or become daily smokers. Ross and colleagues⁵² found that retailer compliance with youth access laws significantly reduced progression to higher uptake stages, with the greatest impact observed among those who were in the later stages of smoking uptake (i.e., more addicted). This finding suggests that social sources of cigarettes are more important in the earlier stages of smoking uptake and that adolescents who are closer to completing their smoking uptake are more affected by retailers' compliance with youth access laws. Widome and colleagues⁵³ found that a greater proportion of youth become heavy smokers in communities where more adolescent smokers relied exclusively on commercial sources. Tworek and colleagues⁵⁴ found that stronger youth access laws were associated with less continuation of smoking among high school regular smokers. DiFranza and colleagues⁵⁵ examined the association between merchant compliance with youth access laws and youth smoking, while controlling for other tobacco control policies, and found that for every 1% increase in merchant compliance, the odds of daily smoking by youth were reduced by 2%.

In 2005, a systematic review of interventions to reduce minors' access to commercial sources of tobacco products was conducted by the Cochrane Tobacco Addiction Group.⁵⁶ This review concluded that active enforcement of youth access laws could reduce illegal sales to youth, but found little evidence that these interventions reduced the prevalence of adolescent smoking or perceived ease of access to tobacco products.

Also in 2005, the Community Preventive Services Task Force (U.S.)⁵⁷ conducted a systematic review of interventions to reduce minors' access to commercial sources of tobacco products. This review concluded that such interventions can effectively reduce youth tobacco use and commercial access to tobacco products when they are coordinated with community mobilization efforts and additional policy tools, such as stronger local laws directed at retailers, active enforcement of retailer sales laws, and retailer education with reinforcement.

In the most comprehensive systematic review of the literature to date, DiFranza³⁵ evaluated over 400 academic documents as well as local, state, and federal government reports, and concluded that enforcement programs that effectively disrupt the commercial supply of tobacco to minors reduce the number of youth who use tobacco. DiFranza argued that prior systematic reviews of the effectiveness of youth access interventions to prevent the sale of tobacco to minors failed to distinguish between interventions that successfully disrupted the commercial distribution of tobacco to underage youth and those that did not, resulting in erroneous conclusions about the effectiveness of these policies.

Few studies have examined the impact of youth access policies in countries other than the United States. Nelson⁵⁸ compared the impact of sales-to-minors laws in 24 HICs and 42 LMICs and found that regulations banning sales to minors did not affect prevalence of smoking in the past 30 days or ever smoking among youth in HICs, but were associated with reduced prevalence of past 30-day smoking among boys in LMICs. A study by Kostova and colleagues⁵⁹ measured retailer compliance based on youth reports of being denied tobacco sales because of age. They analyzed data from 17 LMICs that conducted the GYTS survey multiple times between 1999 and 2006 and found that high compliance with sales-to-minors laws, defined by the proportion of youth turned away by vendors because of their age, was associated with reduced youth smoking prevalence but had little impact on the intensity of smoking. The study also compared findings for different policy interventions, concluding that although youth access policies can effectively reduce the prevalence of smoking in LMICs, tax and price increases would be more effective.

Other Policies With Potential to Decrease Youth Access and Youth Smoking

Other policies with the potential to reduce youth access include PUP (penalizing youth who purchase, use, or possess tobacco products) laws, bans on self-service displays, restrictions on vending machines and single cigarette sales, and regulation of the number, density, or location of tobacco retail outlets within a community. The available evidence for evaluating the effects of these policy tools on youth tobacco experimentation and consumption is limited, but the existing research suggests that certain approaches (e.g., retailer licensing) hold particular promise.

Supply-Side Policies

Most supply-side policy research has focused on sales-to-minors laws; few studies have evaluated the impact of other supply-side youth access policy approaches on youth smoking behavior. The display or sale of tobacco products in a manner that makes them easily accessible to the general public without the assistance of the retailer (i.e., vending machines, in-store self-service displays) can increase the ease with which youth obtain tobacco, either by theft or illegal purchase. Restricting or banning such self-service access to tobacco products can reduce commercial access to tobacco products for underage youth.⁵⁶ In the United States, the sale of tobacco products through vending machines is prohibited except in adult-only facilities; self-service displays are prohibited for cigarettes and smokeless tobacco, except in adult-only facilities.^{38,60} Studies conducted in the United States show that limiting self-service access to tobacco products can effectively reduce the commercial availability of tobacco products to youth. Wildey and colleagues⁶¹ found that illegal cigarette sales to underage youth in San Diego, California, dropped from 31% to 13% when stores eliminated self-service access to tobacco. Bidell and colleagues⁶² compared illegal sales rates for stores with and without self-service access in three California communities; the illegal sales rate in stores requiring clerk assistance to purchase tobacco products was significantly lower than the rate in stores with self-service displays (3.4% vs. 32.1%).

A few U.S. studies have examined access to cigarettes from vending machines and concluded that laws requiring lockout devices or total bans on vending machines are the only effective policies that can reduce youth access to cigarettes from this source.^{63,64} A study conducted in Germany found that the number of cigarette vending machines decreased in anticipation of a law that required electronic locking devices on the machines. However, lockout devices did not have a significant impact on cigarette acquisition by underage smokers, who increasingly obtained cigarettes through friends or purchased them from kiosks.⁶⁵ The evidence is mixed regarding the impact of self-service access on youth smoking prevalence. In a study examining the association between tobacco control policies and smoking prevalence among adolescents in 29 European countries, the legality of cigarette vending machines was associated with regular smoking (i.e., weekly or daily), among adolescent males.⁶⁶ In another study of the association between smoking onset and vending machine bans in the United States using data from the National Longitudinal Study of Adolescent Health, Kandel and colleagues⁶⁷ found that the presence of a state-level vending machine ban was protective against youth smoking uptake. On the other hand, a study examining the impact of retail marketing practices on smoking prevalence found that the presence of self-service displays in the local retail environment was not associated with increased odds of smoking uptake in a large cohort of U.S. youth.⁶⁸

The availability of tobacco retail outlets near homes and schools may influence youth tobacco use by making cigarettes easier for youth to obtain. Nearby tobacco retail outlets may also influence tobacco use in other ways—for example, by exposing youth to tobacco marketing and influencing social norms. Tobacco retailer licensing laws can be used to restrict and control the location and density of tobacco retailers. Epidemiologic studies^{69–80} have found that greater density of tobacco retail outlets near schools and homes has been associated with increased susceptibility to smoking, experimental smoking, current smoking, and smoking frequency by youth. These findings suggest that it may be possible to reduce youth access to tobacco products by restricting the number of retailers with a license to sell tobacco. Leatherdale and Strath⁸¹ also found that youth smokers who attended schools in neighborhoods with a higher density of tobacco outlets were more likely to buy their own cigarettes and less likely to get cigarettes from others. The IOM has recommended that, if feasible, U.S. states should restructure retail tobacco sales and restrict the number of tobacco retail outlets so as to discourage tobacco use, including tobacco use by youth.⁸² Despite its potential, few communities have utilized this policy tool, so the evidence base is not yet well developed.

Demand-Side Policies

A number of scientifically rigorous studies conducted in the United States have demonstrated the ability of PUP laws to impact youth smoking in the short term. In one of the earliest studies of PUP laws, Livingood and colleagues⁸³ found that the rates of tobacco use were lowest in Florida counties with high PUP law enforcement, after controlling for demographic factors. Tauras and colleagues⁸⁴ found that the presence of state-level PUP laws reduced smoking prevalence but not smoking intensity among youth and young adults. Cawley and colleagues⁸⁵ found that state-level PUP laws reduced smoking initiation among girls but not among boys.

Tworek⁸⁶ reported that although local possession ordinances could lower smoking rates among youth, state-level PUP laws did not have a similar impact. In contrast, Pokorny and colleagues⁸⁷ found an inverse association between enforcement of PUP laws and current smoking among youth; a prospective randomized trial of 24 Illinois communities demonstrated that towns with higher levels of PUP law enforcement had significantly smaller increases in rates of adolescent smoking over time, compared with

towns with weaker PUP law enforcement. In a related analysis using data from the same prospective trial, Jason and colleagues⁸⁸ also found smaller increases in the proportion of youth who were heavy smokers (>20 cigarettes per day) in communities with higher levels of PUP law enforcement. In another study, Jason and colleagues⁴⁵ examined the effect of PUP law enforcement on observed and perceived tobacco use in 24 towns. Youth living in towns with higher levels of PUP law enforcement perceived lower rates of tobacco use among their peers and observed fewer instances of underage tobacco use at school and in their community. This finding suggests that enforcement of PUP laws can strengthen nonsmoking social norms among youth.

Despite demonstrated short-term effects, the total weight of the evidence thus far does not suggest a long-term impact of PUP laws on youth smoking or on subsequent rates of smoking when youth become young adults.⁸⁹ However, small sample sizes, non-randomized designs, and lack of long-term follow-up limit the conclusions that can be drawn from published studies in this area.⁹⁰

Costs of Youth Access Interventions

The infrastructure, systems, and resources required to implement and enforce youth access policies can present a challenge for LMICs and even HICs.⁹¹ Some researchers have argued that these policies divert resources from more effective tobacco control strategies and should be abandoned altogether.^{26,92} However, studies suggest that modest, earmarked increases in the tobacco tax or retailer licensing fees, coupled with fines collected from noncompliant retailers, may be sufficient to cover the costs of implementing youth access policies.^{93,94} To date, only a few studies have assessed the costs or cost-effectiveness of these policies.

DiFranza and colleagues⁹³ calculated that in the United States, a well-designed and implemented youth access program consisting of quarterly inspections of all tobacco retailers would cost an average of 50 U.S. dollars (US\$) per outlet per year if the enforcement was implemented at the community level, US\$ 150 at the state level, or US\$ 350 at the federal level. The total estimated cost for implementation at the federal level was US\$ 190 million per year. The higher costs at the state and federal levels reflect contractual requirements, greater distances from enforcement agencies, and special requirements for prosecuting violations under state and federal laws. Using relatively optimistic estimates of the impact of a well-implemented youth access program on youth smoking, the study estimated that enforcing sales-to-minors laws in the United States would save 1 year of life for a price of US\$ 44 to US\$ 3,100. Similarly, Tutt⁹⁵ found that youth access interventions were relatively cost-effective, estimating that a youth access program implemented in the Central Coast of New South Wales, Australia, prevented a young person from smoking for a price of US\$ 65 to US\$ 130, which was one-fifth to one-tenth the cost of a course of nicotine replacement therapy to help an adult quit smoking.

Implementation, Enforcement, and Compliance With Youth Access Policies

Sufficient resources are required to implement and enforce youth access policies at levels high enough to adequately constrain youth access to commercial sources of tobacco. Theoretically, governments can effectively restrict retail sales of tobacco to youth through active enforcement, whereby retailers' compliance with the law is tested and consequences for noncompliance are administered. However, evidence from countries that have adopted sales-to-minors laws suggests that retailer compliance with these laws is generally quite low, and interventions to boost compliance rates have been met with mixed success.⁵⁶

Tables 11.5 and 11.6 summarize GYTS²¹ data on minors' access to commercial sources of cigarettes worldwide and give the percentages of 13- to 15-year-old youth (i.e., minors in most jurisdictions) who reported that they usually obtained cigarettes from stores and were not refused purchase because of their age. Overall, whether based on WHO Region (Table 11.5) or World Bank country income group (Table 11.6), the data show that young smokers report being able to purchase cigarettes with little difficulty.¹

Table 11.5 Percentage of Youth Smokers, Ages 13 to 15 Years, Who Were Allowed to Buy Cigarettes Despite Being Underage, by WHO Region, 1999–2011

WHO Region	Number of countries in region	Number of countries reporting	Percentage of underage youth not refused cigarette sales
African	46	10	69.9
Americas	35	21	75.9
Eastern Mediterranean	22	9	85.6
European	53	28	75.1
South-East Asia	11	5	57.0
Western Pacific	27	14	87.0
Total	194	87	72.7

Notes: The data presented here are based on nationally representative Global Youth Tobacco Survey data when available. When national data were not available, data from the capital or largest city were used as a proxy for the country data, based on a previously described methodology.¹²³ The regional data summations seen here are weighted based on country-level population data for youth ages 13–15 in 2007.¹²⁴ WHO = World Health Organization. Source: Global Youth Tobacco Survey 1999–2011.²¹

As shown in Table 11.5, 87.0% of youth in the Western Pacific Region successfully obtained cigarettes from commercial sources. In other WHO Regions, between 57.0% and 85.6% of youth were not refused sale of cigarettes. The available data do not show a pattern based on country income group (Table 11.6).

Table 11.6 Percentage of Youth Smokers, Ages 13 to 15 Years, Who Were Allowed to Buy Cigarettes Despite Being Underage, by Country Income Group, 1999–2011

World Bank country income group	Number of countries in group	Number of countries reporting	Percentage of underage youth not refused cigarette sales
Low-income	36	15	80.8
Lower middle-income	52	6	60.2
Upper middle-income	56	31	84.8
High-income	50	34	61.5
Total	194	87	72.7

Notes: The data presented here are based on nationally representative Global Youth Tobacco Survey data when available. When national data were not available, data from the capital or largest city were used as a proxy for the country data, based on a previously described methodology.¹²³ The income and regional data summations shown here are weighted based on country-level population data for youth ages 13–15 in 2007¹²⁴ and World Bank Analytical Classifications for 2011. Source: Global Youth Tobacco Survey 1999–2011.²¹

Implementation in High-Income Countries

The majority of studies of retailer compliance with youth access policies are from HICs; evidence from these studies suggests that compliance varies greatly across countries and world regions, as shown by the discussion of implementation-related studies from HICs in North America, Europe, and Australasia.

In all 50 U.S. states, it is unlawful for tobacco retailers to sell tobacco products to minors. The Synar Amendment, named for its sponsor, Congressman Mike Synar of Oklahoma, and adopted in 1992, requires states, territories, and the District of Columbia to enact and enforce laws prohibiting the sale or distribution of tobacco products to individuals under age 18 years.⁹⁶ U.S. states must achieve at least 80% merchant compliance or face the loss of some federal funding. States measure their compliance by conducting annual, random, unannounced inspections of tobacco retail outlets. In 2012, Synar compliance checks found that 90.9% of U.S. retailers complied with youth access laws, a substantial improvement from the baseline of 59.9% in 1997.⁹⁷ Under a separate and complementary mechanism for enforcement oversight, required by the Family Smoking Prevention and Tobacco Control Act,⁶⁰ FDA contracts with states to conduct compliance check inspections of retailers and take enforcement action when appropriate.

A large body of evidence confirms that commercial sales of cigarettes to youth in the United States have decreased since implementation of the Synar Amendment. In 1995, 38.7% of middle- and high-school students under the age of 18 reported that they usually obtained their cigarettes by purchasing them from a store or gas station.⁹⁸ As of 2011, this figure had dropped to 14.0%.²⁰ The perceived availability of cigarettes has also declined considerably; the proportion of youth who report that cigarettes would be “fairly or very easy to get” has declined by 26% among 8th graders and by 16% among 10th graders over the past 15 years.⁹⁹

Despite significant progress in reducing illegal sales to youth, it appears that a substantial proportion of young people are still able to obtain tobacco products. In 2012, 51% of 8th-grade students and 73% of 10th-grade students (i.e., mostly those between ages 13 and 16) reported that cigarettes would be “fairly or very easy to get” if they tried.⁹⁹ Of the 8th- and 10th-grade students who reported trying to buy tobacco products at retail outlets, 26% and 30%, respectively, reported being asked for proof of age, and only 20% and 26%, respectively, reported being refused sale.^{2,99} The apparent discrepancy between high retailer compliance rates, as measured by Synar compliance checks, and the commercial availability of tobacco products, as self-reported by youth, suggests that reported retailer compliance rates may significantly underestimate the true rate of sales to minors. It is also possible that even under conditions of high retailer compliance, opportunities for underage youth to successfully purchase tobacco may be influenced by a small number of noncompliant retailers within a community who regularly sell to youth.¹⁰⁰

Some research from the United States suggests that retailer compliance with youth access policies may differ according to individual- and neighborhood-level demographic characteristics. Asumda and Jordan¹⁰¹ conducted a geographic information system analysis of the distribution of tobacco sales to underage youth across the state of Florida. They found that in Miami, underage tobacco sales to youth decoys were significantly more concentrated in Hispanic majority neighborhoods, implying a less restricted retail environment, in which youth living in these neighborhoods are not fully protected by existing sales-to-minors laws. Another study examined compliance checks in California between 1999 and 2003 and found that a higher percentage of illegal sales were made to black and Asian underage decoys than to whites.¹⁰²

Research from other HICs shows a similar pattern: Retailer compliance improves following the adoption of sales-to-minors laws, but youth continue to report ready availability of cigarettes from commercial or social sources. For example, Finland banned tobacco sales to youth in 1995; Rimpelä and Rainio¹⁰³ evaluated the effect of the legislation on tobacco acquisition by minors, and found that the ban resulted in large and permanent decreases in underage purchases of tobacco from commercial sources. Between 1995 and 2003, the proportion of daily smoking by youth purchasing tobacco from commercial sources dropped from 90% to 67% among 14-year-olds and from 94% to 62% among 16-year-olds. However, during the same time period, a shift in youth acquisition of tobacco from commercial sources to social sources was observed, and the percentage of Finnish youth who reported that buying tobacco products from commercial sources was very or fairly easy remained rather high (72%). Two studies in England found that communities reporting 100% retailer compliance (assessed using youth under the age of 13 for compliance inspections) did not effectively prevent youth from purchasing tobacco from commercial sources: 95% of underage smokers living in these communities purchased tobacco from stores at least once per week, and 55% reported daily purchases.^{104,105} In a study from New Zealand, self-reported purchases from commercial sources declined among 14- and 15-year-olds following the introduction of comprehensive enforcement initiatives, but these reductions were accompanied by increases in acquisitions from friends, family, and other social sources.¹⁰⁶

Implementation in Low- and Middle-Income Countries

The widespread presence of informal distribution channels, weak norms against youth tobacco use, and high rates of smoking prevalence in many LMICs make it challenging and costly to significantly limit youth access to tobacco products. The limited available data from LMICs show that young people in these countries are far more able to purchase tobacco products from commercial sources than youth in HICs. For example, 79% of retailers surveyed in Mexico City violated youth access laws by selling cigarettes to minors in 1997. Youth who were older or female were more likely to be able to purchase cigarettes than younger or male youth. Age-of-sale warning signs were displayed in only 12% of stores surveyed in Mexico City, and the presence of these signs was not associated with lower rates of sales to youth. Of the 561 retailers surveyed, only 4 (0.007%) asked young people their age, and only 1 (0.002%) asked for proof of age.¹⁰⁷ The Mexico City survey was repeated in 2002 and found very little improvement; 73% of 577 retailers surveyed sold cigarettes to youth, 15 (2.6%) asked youth their age, and 8 (1.4%) asked for proof of age.¹⁰⁸ Comparing results across the U.S.–Mexico border, the Centers for Disease Control and Prevention (U.S.)¹⁰⁹ found that illegal sales to youth were much higher in Ciudad Juarez, Mexico (98.1%) than in El Paso, Texas (18.0%) or Las Cruces, New Mexico (6.1%).

Zulkifli and Rogayah¹¹⁰ conducted a study in Malaysia in which six youths (ages 15 to 17) visited 117 stores and attempted to purchase cigarettes. This study found that 97.4% of purchase attempts were successful. None of the retail clerks asked the youth to produce identification, and only four stores displayed notices (supplied by tobacco companies) stating that selling cigarettes to youth is illegal. Jirojwong¹¹¹ found that nearly one-third of 70 tobacco retailers in two provincial cities in Thailand did not know that the minimum age to purchase tobacco products was 18, and more than half of these retailers sold cigarettes to people younger than 18 despite the existence of this legal age limit for almost 10 years prior to the study.

Youth Smoking Prevention Programs and the Tobacco Industry

Tobacco companies have been active proponents of “industry-friendly” youth access laws designed to pre-empt movement toward stricter regulatory and legislative controls.^{112,113} The tobacco industry has also supported efforts that make it more difficult for retailers to be held accountable for noncompliance with youth access laws. For example, the industry has argued for the inclusion of words such as “knowingly” or “intentionally” in laws prohibiting the sale of tobacco to minors, which could render such laws unenforceable.¹¹⁴ In addition, the industry has sought to include restrictions on how, how often, and by whom enforcement or compliance testing can be conducted. For example, the industry has opposed employing teenagers in compliance testing and has argued for a requirement that only very young teenagers (who are less likely to be sold tobacco than older teenagers) can serve as buyers in compliance testing.¹¹⁴

Tobacco companies have also developed and implemented their own programs to address young people’s access to tobacco products. In the United States these have included the “We Card” initiative, “It’s the Law,” and “Action Against Access.”^{26,115,116} In Malaysia, British American Tobacco (BAT), Philip Morris, and the former R.J. Reynolds Malaysia—in collaboration with cigarette retailers—conducted the “No Sale to Under 18” campaign in 1998¹¹⁷; similar campaigns have been conducted in Mexico, Brazil, and other countries.¹¹⁸ The limited research available on the impact of industry-sponsored youth access programs on youth smoking rates or illegal purchases does not provide evidence of an effect.^{116,119,120} In her final opinion in *United States of America v. Philip Morris USA, Inc.*, U.S. District Judge Gladys Kessler found that “youth smoking prevention programs are not designed to effectively prevent youth smoking”^{121,p.667} and noted that “there is no evidence that any Defendant [tobacco company] has evaluated whether tobacco outlets participating in the We Card Program were actually not selling tobacco to young people or whether the program reduced the overall adolescent smoking prevalence rate.”^{121,p.669}

Analyses of internal tobacco industry documents strongly suggest that the goals of these programs are to improve the tobacco company’s public image, to reduce regulation and enforcement of existing youth access laws, and to legitimize industry lobbying efforts.^{26,112,116,121} Industry programs are often accompanied by considerable public relations expenditures to enhance the industry’s public image.^{112,120} Companies track the number of “media hits,” awareness among adults, and the effect of these programs on corporate images.

In the United States, the industry has also used its youth access programs to recruit a network of retailers as an early warning system to detect and defeat local tobacco control ordinances.¹²⁰ Tobacco industry documents show that the industry’s teen smoking prevention programs have also provided an opportunity for the industry to study teenage attitudes toward smoking. The data collected as part of a “youth smoking prevention” effort contain information that tobacco marketers would need to sell their products to young people.¹²⁰

Additionally, the industry has used the investment in its youth access programs as an argument against other tobacco control efforts and to forge alliances with government and nongovernmental organizations.¹²⁰ For example, the “No Sale to Under 18” campaign in Malaysia was conducted by three tobacco companies in collaboration with cigarette retailers, with the endorsement of the country’s Minister of Domestic Trade and Consumer Affairs. This endorsement helped the industry influence the government’s tobacco control efforts.¹¹⁷ In 2000, Philip Morris and BAT responded to the Lebanese Minister of Health’s concern about smoking among youth by proposing a joint government–industry

effort to prevent youth smoking, including the encouragement of minimum-age-of-sale legislation and the launch of retail access prevention programs. At the same time, however, the tobacco companies stressed the importance of “defending brand communication and advertising freedoms” and supported an assessment of the potential economic impact of a ban on tobacco advertising that had been adopted in Lebanon the previous year.^{122,p.22}

Implementation of these programs in various countries has been selective, often driven by the strength of the market and the willingness of competitors to collaborate. For example, Philip Morris in Latin America rejected a U.S. program that discontinued the distribution of free cigarette samples because such a move was perceived as “extremely damaging unless [BAT] went along, which is highly unlikely.”^{112,p.63} Youth access programs sponsored by the tobacco industry can be particularly damaging when their endorsement by government officials legitimizes the programs as official anti-smoking messages. Philip Morris seized this opportunity in Latin America, where it developed a model for legislation on the minimum age for cigarette purchases to be promoted throughout the region.¹¹²

Summary

Youth access policies are intended to limit the commercial supply of tobacco products to youth, with the goals of preventing or delaying initiation of tobacco use by youth and reducing underage consumption, changing social norms about smoking, and decreasing overall smoking prevalence. A variety of policy measures are available to regulate the sale and distribution of tobacco products to youth. These measures are economically justified on the grounds that failures in the market for tobacco products are particularly pronounced during the ages at which most tobacco use begins. Youth access policies are most common in high-income and upper middle-income countries. When consistently enforced, these policies can effectively reduce commercial access to tobacco products among underage youth. However, sufficient resources are needed to implement and enforce these policies well enough to effectively limit the commercial supply of tobacco to youth.

Evidence from HICs about the effectiveness of youth access policies in reducing youth smoking is mixed. Strongly enforced youth access policies that successfully disrupt the commercial distribution of tobacco products to underage youth appear to reduce youth tobacco use, although the magnitude of this effect is relatively small. More research is needed to evaluate the impact of youth access policies in LMICs; emerging evidence suggests these policies can be effective in reducing youth smoking in LMICs although the amount of reduction is unclear. The evidence indicates that youth access policies are likely to have a greater marginal impact in countries with relatively weak overall tobacco control policies and programs. Moreover, the absence of youth access laws sends mixed messages about the harm posed by the use of tobacco and the importance of other youth tobacco prevention efforts. Efforts to limit youth access to tobacco products, although of limited influence as stand-alone measures, are an important component of a comprehensive strategy to reduce tobacco use.

Research Needs

Most of the evidence on the efficacy and cost-effectiveness of youth access policies reflects the experiences of HICs. More evidence is needed to evaluate the adoption, implementation, and impact of various youth access interventions in LMICs. Specific research needs in LMICs include continued monitoring of tobacco sales to minors and ongoing evaluation of enforcement and compliance measures in countries with existing youth access policies. In both HICs and LMICs, research could further inform

other policy approaches for limiting youth access to tobacco, including bans on self-service displays, and regulation of the number, density and location of tobacco retail outlets within communities. As noted previously, a growing number of U.S. states and localities are raising the minimum age of legal access to tobacco products to 21 years; research to understand their experiences will help inform the evidence base for youth access policies going forward in the United States and elsewhere.

Conclusions

1. Information failures in the market for tobacco products are particularly pronounced during the ages at which most tobacco use begins, providing an economic rationale for interventions to limit youth access to tobacco products.
2. Youth access policies, when consistently enforced, can reduce commercial access to tobacco products among underage youth. Sufficient resources are needed to implement and enforce these policies well enough to effectively limit youth access to commercial sources of tobacco.
3. Evidence from high-income countries indicates that strongly enforced youth access policies that successfully disrupt the commercial supply of tobacco products to underage youth can reduce youth tobacco use, although the magnitude of this effect is relatively small.
4. Emerging research suggests that youth access policies can also be effective in reducing youth tobacco use in low- and middle-income countries, although the amount of reduction is unclear.

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