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EDITORIAL VIEWPOINT

Noncigarette Smoking Patterns, Their Health Effects and Policy Options

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Cigarette smoking is the biggest killer of people worldwide. Half of the 1 billion projected smokers will die prematurely by the turn of this century if they do not give up smoking [1]. Of those premature deaths, 70–80% could occur in low- and middle-income countries [1]. At the same time, noncigarette smoking habits, including both the use of bidis and electronic cigarettes, are growing “social norms” in the West and in the low- and middle-income countries.

Bidis are small hand-rolled cigarettes made of a small amount of sun-dried, flaked tobacco wrapped in dried *temburni* or *tendu* leaf and tied with a string; they are primarily produced and popular in India and other South Asian countries [2]. “E-cigarettes” or electronic nicotine delivery system (ENDS) look like cigarettes but do not contain or burn tobacco. Instead, they refer to battery-powered atomizers producing a vapor for inhalation from disposable cartridges containing humectants such as propylene glycol, flavors, and nicotine [3].

EPIDEMIOLOGICAL PATTERNS

Even though understanding about the epidemiology of bidi use is improving, knowledge about the use of e-cigarettes is grossly inadequate and inconclusive. The Global Adult Tobacco Survey India—one of the largest tobacco-use surveys cosponsored by the Government of India—indicated that more than one-third (35%) of adults in India use tobacco [4]. Of all the prevalent smoking forms of tobacco, bidi is the most popular product in India. About 9% of Indian adults smoke bidis, with use relatively more common in the rural areas

both in India and Bangladesh [4,5]. It is interesting to note that e-cigarettes were first patented in China in 2007, and a recent survey in the United States shows that almost 1 million Americans have ever used e-cigarettes and the rate has quadrupled in recent years [6]. Such a growing popularity of products that are of unknown safety claims is a wake-up call for the tobacco-control community worldwide.

A very small fraction of bidis is produced for U.S. markets. During the late 1990s, a growing appeal of the bidi was observed among young people to whom it was promoted as herbal bidi available in exciting flavors [7]. The user profile, reasons for use, and marketing strategies are very different in the United States compared with South Asia. An earliest convenience sample of 642 adolescents in Massachusetts during 1999 found that 40% had smoked bidis at least once during their lifetimes and 16% were current users. Highest use was noted among Hispanic students [7]. A significant increase in bidi use was reported among Hispanic students between 2002 and 2004 [8]. More recent survey data collected in 2009 has indicated current use by 1.6% and 2.4% of middle-school and high-school students, respectively (with any tobacco product use by 8.2% and 23.9%, respectively). Gender difference is less marked in the United States (where 2.1% of female and 2.7% of male high-school students report current use) than in South Asia, where use among women is very low [9]. Urban students are more likely to smoke bidis than suburban and rural students are [10]. In the United States, two-thirds of adult bidi users are under 25 years old. This reflects experimentation among adolescents and has raised questions on the possible role of bidis as “gateway” products to regular

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cigarette use [11]. Higher nicotine delivery makes bidis more addictive and, being cheaper, also augments the initiation of tobacco addiction.

Another area of increasing concern is the gradual takeoff of bidi smoking among adolescents. A bicentric study in Delhi and Chennai has shown that Indian children in sixth grade may be using tobacco at higher rates than those in eighth grade—thus strongly signaling that more and more young youths are taking to this addictive behavior [12]. Current bidi-smoking prevalence among Indian youths in grades 8–10 in the Global Youth Tobacco Survey (2000–2004) was 2.3% in 26 states of India and increased to 3.5% in 2006 (2006) in 30 states. Bidi smoking was nearly 4× higher among boys (5.1%) than girls (1.3%) nationwide [2,13].

HEALTH EFFECTS

Adverse effects of tobacco use on human health are well established [14]. Compared with cigarettes, bidis have much less tobacco but content can vary from 0.15 g to 0.25 g [2]. Bidis sold in India and other South Asian markets are mostly unflavored and without a filter. In the United States and other Western markets, they tend to be flavored in varieties such as vanilla, strawberry, orange, and lime and can be provided with a filter. Such marketing strategies remind us of “candy” flavored cigarettes, which were banned not so long in the United States, and a similar legislation for menthol cigarettes is certainly looming large. Bidis have been found to produce approximately 3× the amount of carbon monoxide and contain approximately 3× the amount of nicotine and approximately 5× the amount of tar than cigarettes [15].

Similar to cigarette use, bidi use has been shown to cause cardiovascular diseases, oral cancers, lung cancers, and other health problems [2]. The large case-control INTERHEART (A Study of Risk Factors for First Myocardial Infarction in 52 Countries and Over 27,000 Subjects) study [16] assessed the risk of acute myocardial infarction in 52 countries and reported that bidi use was significantly associated with acute myocardial infarction (odds ratios [OR]: 2.89, 95% confidence interval [CI]: 2.11–3.96) compared with nonusers of any tobacco products and also clearly showing a dose-response relationship. Rastogi *et al.* [17] showed a dose-response relationship of similar magnitude for acute myocardial infarction among both bidi and cigarette smokers compared with never smokers. In a large cohort study from Mumbai, India,

incident oral cancer in bidi smokers (relative risk [RR]: 3.55; 95% CI: 2.40–5.24) was 42% higher than in cigarette smokers (RR: 2.50; 95% CI: 1.65–3.78) [18]. A meta-analysis by Rahman *et al.* [19] found statistically significant OR of 3.1 for risk of oral cancer for bidi smokers as compared with never smokers. Bidi use has contributed to India having the dubious distinction of being the oral cancer “capital” of the world. Bidi use has also shown to be associated with a greater risk of developing tuberculosis [20].

E-cigarettes have no documented evidence of the quantity of “free nicotine” delivered from such devices. Limited evidence regarding adverse health effects of electronic cigarettes is available to date [21,22]. Testing of such products is also not quality-controlled or well reported. Varying levels of nicotine are reported, even in products sold under the same label [23]. A recent study demonstrated that cotinine levels in ENDS users were similar to the levels observed in cigarette smokers but higher than those usually observed in nicotine replacement therapy users [24].

PUBLIC HEALTH POLICY OPTIONS

Over the past 20 years, tobacco control has seen successful developments mainly driven by robust science coupled with strong public health advocacy, such as indoor smoking restriction, advertising bans, taxation, and education. Such developments should provide opportunities to exert considerable influence on controlling noncigarette smoking products in ways that benefit public health. The most successful of such developments, however, is the introduction of the first international public health treaty—the WHO Framework Convention on Tobacco Control (FCTC)—in 2003. The FCTC, although aiming for reducing health effects of all forms of tobacco products through policy interventions, has largely focused on the effects and regulation of cigarette smoking. This is particularly problematic in populations where manufactured cigarettes do not dominate, such as India.

Article 8 of the FCTC recommends 100% bans in worksites, restaurants, and bars. Bidis are mainly consumed in open market places or inside homes or small roadside coffee shops. Enforcement of a 100% smoke-free policy under such circumstances must be a herculean task. The next best alternative should be strong health warnings, preferably pictorial health warnings, as recommended in Article 11 of the FCTC. Evidence has consistently shown that picto-

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