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**SMOKELESS TOBACCO USE, KNOWLEDGE
ON HEALTH HARMS OF SMOKELESS
TOBACCO USE AND FAMILY
SOCIOECONOMIC STATUS AMONG YOUTH
FINDINGS FROM THE INTERNATIONAL TOBACCO
CONTROL INDIA SURVEY**

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ABSTRACT

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There are only a few studies indicating that youth with low socioeconomic status (SES) use smokeless tobacco (SLT) more than youth with high SES. Furthermore, low SES seems to be negatively associated with knowledge on the health harms of SLT use. However, the association is not known among Indian youth. Youth who have knowledge on the health harms of SLT use seem to use less SLT, but the evidence is insufficient and weak. This study examines differences in SLT use and knowledge on the health harms of SLT use among youth (aged 15-24 years) with different SES (a composite of the monthly household income and the level of education of youth).

The data for this cross-sectional study was retrieved from International Tobacco Control Project (TCP) India, Wave 2 follow-up survey (2012-2013). The survey was conducted among tobacco users and non-users aged 15 years and older from four urban cities and their surrounding rural districts. However, the present analysis was restricted to SLT-, mixed (both smokeless and smoked tobacco products)- and never SLT users aged 15–24 years in Bihar (N=580), West Bengal (N=295), Madhya Pradesh (N=371) and Maharashtra (N=281). The association between SES and SLT use (I), SES and the knowledge (II) and the knowledge and SLT use among all youth, youth with low SES and youth with high SES separately (III) were assessed by Pearson chi-square test. Logistic regression analyses were used to assess the bi- and multivariable associations for the same.

Youth with low SES used more SLT compared to youth with high SES in Bihar, West Bengal, Madhya Pradesh and Maharashtra. Youth with low SES also knew less on the health harms of SLT use compared to youth with high SES. In all four states, youth who knew on the health harms used less SLT. Stratified analysis indicated that among youth with high SES, those who knew on the health harms used less SLT, but among youth with low SES, no association was found between the knowledge and SLT use.

SLT use is a problem especially among youth with low SES in Bihar, West Bengal, Madhya Pradesh and Maharashtra. This study also demonstrated that inequalities in knowledge on the health harms of SLT use exist between youth from families of low SES and high SES. There is a need to address the disparities as these are unfair and preventable. These findings emphasize the need for providing early education on SLT use prevention focusing on the youth from low SES to reduce the burden of disability and mortality caused by SLT use in all four states.

Keywords: Health knowledge, Health literacy, Smokeless tobacco, Socioeconomic status, Youth, Young people

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1.INTRODUCTION

Smokeless tobacco (SLT) is used in 140 countries. Since 2008, nearly 303 million people, aged 15 years and older, were currently using SLT worldwide. The SLT burden among adult is highest in low resource countries (LMICs) and especially in the South-East Asia, accounting about 85 percent of the overall adult SLT users of the world. The prevalence of current SLT use is third highest (25.9%) in India among the overall adult SLT users of the South-East Asia (Siddiqi et al., 2015; Sinha, Agarwal & Gupta 2015; WHO, 2007, 25.) In addition, 12.2 million adolescent (13-15 years) use SLT worldwide. Nearly 60 percent of youth SLT users live in South-East Asia and it is the only region in the world where SLT use is more prevalent than smoking. (Sinha et al., 2018.) The prevalence of current SLT use is fifth highest (9%) in India among the overall youth SLT users of the South-East Asia (Sinha et al., 2014).

As per Global Adult Tobacco Survey (GATS) reports, the overall SLT consumption in India among 15 years and older has reduced from 25.9 to 21.4 percent from 2009-2010 to 2016-2017. There has been reduction in all socioeconomic groups. Still, SLT use is about 2.5 times higher among those who have no formal education (28.9%) than among those who have the secondary and above education (11.4%). (Tata Institute of Social Sciences (TISS) & Ministry of Health and Family Welfare (MoHFW), 2017, 66.) In recent years, multiple national cross-sectional studies from India have reported that the SLT use is higher among adults from low socioeconomic groups than high socioeconomic groups (Bhan et al., 2012; Prabhakar, Narake & Pednekar, 2012; Singh & Ladusingh, 2014; Singh et al., 2015a; Sharma et al., 2015). Daily SLT use usually starts during young adulthood (mean age in India is 19 years) continuing in adult life (Viner et al., 2012; TISS & MoHFW, 2017,66), but there is still limited research on socioeconomic disparities in the SLT use among Indian young adult, aged 15-24 years (Sharma et al., 2015; Grover et al., 2020).

SLT use in young adult causes immediate and long-term health harms. Nicotine addiction which can build already at early age and extend the duration of SLT use, increases the risk of non-communicable diseases (NCDs) (Viner et al., 2012; U.S. Department of Health and Human Services (HHS), 2012, 23). In India, SLT use in adult has been estimated to cause 0.02 million annual deaths and leaving more than 6 million in disability due to cancers of mouth, throat, lung and pancreas and cardiovascular diseases, such as ischemic heart disease and stroke which has been estimated to account alone for 74 percent of the global burden of SLT use. Estimates on the burden of SLT use in different

socioeconomic groups have not been reported. However, it is likely that the SLT use imposes a biggest burden on the lower socioeconomic groups than the higher through to higher consumption of SLT among individuals from low socioeconomic groups. (Siddiqi et al., 2015.)

The high prevalence of SLT use and its harmful effects have been well recognized in the Indian public health agenda. India has signed and ratified the Treaty of WHO Framework Convention of Tobacco Control (FCTC) and has attempted to meet the obligations of the Framework to develop evident-based interventions (ITC Project, 2013; MoHFW, n.d.; WHO FCTC, 2005). These actions are critical to ensuring public health. In an effort to strengthen the FCTC initiatives in India, Government has made number of policy decisions. In 2009, pictorial warnings on all types of tobacco products were implemented. Furthermore, the National Tobacco Control Programme (NTCP) was introduced in 2008 to create awareness on the health harms of tobacco use. The main actions of NTCP are information, education and communication activities, school programmes and training professionals like schoolteachers. However, in 2009, 50 percent of the schools have not included tobacco use prevention in the school curriculum and only 10 percent of the teachers have received training to help student avoid tobacco use. (Kaur & Jain, 2011; MoHFW, n.d.) Furthermore, health warning labels have been found to be weak and ineffective, especially among illiterate (Oswal et al., 2011).

Research from LMICs suggest that adults from low socioeconomic groups are less aware of the health harms of tobacco use compared to high socioeconomic groups (Minh An et al., 2013; Demaio et al., 2014; Driezen et al., 2016; Siahpush et al., 2006; Yang et al., 2010). But there are no studies that have examined whether unawareness of the health harms is associated with tobacco use among individuals from different socioeconomic groups. In this cross-sectional study, I report the results based on India Tobacco Control Survey, Wave 2 (2012-2013) regarding differences in SLT use and knowledge on the health harms of SLT use among youth (aged 15-24 years) from families with different socioeconomic backgrounds (I, II) and the association between the knowledge and SLT use among all youth, youth with low SES and youth with high SES (III). Clarifying whether education on the health harms of SLT use affect SLT use among youth from different socioeconomic groups is necessary to develop educational and public health awareness programmes to effectively reduce the widening inequalities in mortality and disability on the immediate and long-term health harms of SLT use. (Sawyer et al., 2012.)

2. LITERATURE REVIEW

2.1 Youth

Youth is defined through age, the stages of physical and psychological development or social roles. According to Oxford dictionary of English, “Youth is a period of life between childhood and adult age” (“Youth”, 2010). Its definitions of a specific age range vary, as it does not end to some specific event such as completion of the compulsory education (Sawyer et al, 2012; Furlong, 2012, 1-23). Youth age group is defined differently by different countries and agencies. United Nations defines “youth” as the 15-24-year age group (General Assembly Resolution 50/81, 1995). National youth policy of India, 2014, has defined youth as persons in the age group of 15 to 29 years (Ministry of Youth Affairs & Sports, n.d.).

Youth is also defined as per the stages of physical and psychological development which have been proved to occur between the age of 10 to 24 years. The biological development from child to adult usually starts at the age of 10 and ends at around 20 years. Youth go through a rapid growth and hormonal change but the central area of biological development in youth is the brain. The brain’s frontal lobe cortex matures during late childhood and young adulthood which is why youth may exercise poor judgement and be prone to risky behaviour like tobacco experiments. The neurocognitive maturation continues into early twenties but in general, the most rapid pubertal changes take place before 20’s. These changes are fairly universal. (Furlong, 2012, 1-23; Sawyer et al, 2012.)

While a biological orientation may guide the first notion of youth, it is also clear that youth are viewed within a socio-cultural context, not just a particular age range. Youth are living a period of life to gain specific knowledge and skills, learn to manage emotions and relations and same time, they are adopting adult roles and responsibilities for example household and money management, family formation and employment. The transition from childhood to adulthood differs between cultures and over time. (Lloyd, 2005.) The most important stages of youth development are gaining independence from parents, forming meaningful relationships with peers and construction one’s identity. The importance of parents declines as youth are given more power in the society (e.g. youth can legally work or purchase tobacco products). (Furlong, 2012, 1-23.) For example, the minimum legal age of purchase tobacco products in India is 18 years (Cigarettes and Other Tobacco Products Act ,2003). Thus, there are similarities within the youth age group. It is not possible to look at youth as one social

category as the life of the 15-year-old could differ from the life of the 24-year-old, for example in terms of schooling. (Furlong, 2012, 1-23.) In India, two third of women get married and the majority of men start working between the age of 20 to 24. Only, two third (63%) of youth aged 15-17 years attend school after the compulsory education ends at the age of 14. (IIPS & ICF, 2017.)

As there are many definitions of youth and its definitions of a specific age range varies as its end point can not be linked to a specific activity or a stage of development (Furlong, 2012, 1-23). It is likely that the focus on the age range of 15 to 24 years, would risk missing some important information on the youth, however, the cohort of age 15-24 years is used by United Nations, in research and guidelines for youth development (General Assembly Resolution 50/81, 1995). The literature review has been aggregated in ways that it does not distinguish the youth years specifically because the definitions of a specific age range of youth vary by different countries and agencies and no common consensus exists.

2.2 Smokeless tobacco (SLT)

2.2.1 Definition of SLT

According to Oxford dictionary of English, smokeless tobacco (SLT) is defined: “Tobacco that is chewed or snuffed rather than smoked by the user” (“smokeless tobacco”, 2010). SLT is consumed orally: chewed, sucked, dipped, held in the mouth etc. In western countries, SLT includes mainly chewing tobacco and oral snuff. Chewing tobacco is predominantly used in the U.S and snuff (snus) in Sweden. In developing countries, like India, tobacco is mostly chewed with other ingredients. The main ingredients are areca nut (betel), betel leaf, slaked lime (calcium hydroxide) and tobacco. (Critchley & Unal, 2003.) Gutka and khaini are the most commonly used SLT products among youth in India. These are presented in the picture 1. These are sold in ready-to-use tear packs in loose form which are produced in factories or in market stalls or shops (National Cancer Institute & Center for Disease Control and Prevention, 2014, 66-83). Betel quid (paan) with tobacco is used less. Apart from chewing, SLT is also applied to the teeth and gums. Among women in general, SLT is used mainly by way of oral application like mishtri/gul/gudakhu. (TISS & MoHFW, n.d, 66.)



Picture 1. Most commonly used smokeless tobacco products among youth in India (Source: NCI & CDC, 2014)

2.2.2 Health consequences of SLT use in youth

SLT use in youth causes immediate and long-term health harms. SLT use can cause white spots, sores and bleeding in the mouth already after short-term use. In addition, headache, stomach-ache and dependency occur even after few time use. The younger tobacco use starts, the more likely is the addiction to nicotine to be developed. (U.S. Department of Health and Human Services, 2012, 23; WHO, 2007, 55.) There is sufficient evidence that SLT products develop addiction similar to cigarette smoking. In case of SLT use, the mucous membranes in the mouth or nose absorb nicotine directly into the body. Furthermore, SLT users and smokers have similar blood levels of nicotine, but in case of SLT use, nicotine remains in the blood circulation for longer duration. (NCI & CDC, 2014, 375-402.)

SLT products vary by their constituents. Most commonly used SLT products among youth in India, gutka and khaini, contain *N.rustica*, cultivated tobacco, which has higher levels of nicotine than *N.tabacum* which is contained in cigarettes. Although, those contain an appreciable amount of areca nut thus, the amounts of total nicotine are generally lower. Gutka and khaini also contain various other ingredients like slaked lime that booths pH level in the product and increases the percentage of nicotine. SLT may also contain toxic substances such as lead, nitrosamines, ect. The levels of tobacco specific nitrosamines (TSNAs) which are the major compounds in SLT causing cancer, also vary by SLT product. The higher the level of TSNAs, the greater the risk for cancer. In khaini, quantities of TSNAs were found large but in gutka relatively low. Also, areca nut has been shown to induce various tumours. (NCI & CDC, 2014, 91-106; WHO, 2007, 55-60.)

Adolescent brains are susceptible to the effects of nicotine as they continue developing until the age of 24. SLT use at young age causes changes in brain function. Learning, remembering and concentrating could be disturbed. (WHO, 2007, 55.) There is no evidence that nicotine in SLT alone causes any diseases such as cancer but there is strong evidence that other constituents in SLT cause various health problems like gum diseases, cancer of the oral cavity, throat and pancreas, as well as it causes harm to foetus during pregnancy. Some smokeless products are associated with increased risk of fatal ischemic heart disease, fatal stroke and type 2 diabetes, though more studies are needed to clarify the causal associations. Initiation of tobacco use at young age increases the risk of these disease in adulthood. (NCI & CDC, 2014, 115-138; Gupta & Ray, 2003; Thakur & Paika, 2018; Viner et al., 2012; U.S. Department of Health and Human Services, 2012, 23.)

2.2.3 SLT use among youth in India

SLT use is more common than smoking among Indian youth. The prevalence of current tobacco use among youth aged 15-24 years was 12.4 percent in 2017. Of those, 9.1 percent consumed SLT, 1.6 percent smoked (cigarette and bidi) and 1.8 percent were dual users. (TISS & MoHFW, n.d, 34.) In 2009, 9 percent of students aged 13-15 years used SLT and 4.4 percent cigarettes (MoHFW, n.d). Among adults from all age-groups, the prevalence of SLT use has significantly decreased between 2009-10 and 2016-17, the decrease in the prevalence has been largest among youth aged 15-24 years, 16.1% to 10.8%. Most of those who currently use tobacco have initiated in youth. Among the younger age-groups (20-34-year-old) almost two-third (63.8%) of daily users of SLT initiated regular use when they turned 18 years-old. (TISS & MoHFW, n.d, 69, 72-77.)

The prevalence of SLT use in youth in India varies by state, age, gender, residence and education. According to the International Tobacco Control Project (TCP) India, in 2010-2011, the prevalence of SLT only and mixed tobacco use among 15-17-year-old was 31 percent in Bihar while in West Bengal, Maharashtra and Madhya Pradesh, it was much slower (3-5%). Among 18-24 –year-old, the prevalence of SLT only and mixed tobacco use was 38 percent in Bihar, 15 percent in West Bengal, 11 percent in Madhya Pradesh and Maharashtra. SLT use was more common in the age group of 18-24 -year-old than in 15-17 -year-old. (ITC project, 2013, 39). In a nationally representative study, with a sample of 13 463 respondents aged 15-24 years in 2009-2010, Sharma et al (2015) showed that SLT use was higher among females, those residing in rural areas and belonging to low education groups.

2.3 Socioeconomic status (SES)

2.3.1 Definition of SES

Socioeconomic status (SES) or socioeconomic position (SEP) refers to the social and economic factors that influence what position individual or a family hold within the society in all phases of life, including youth. SES is a key to understanding inequalities in health and health behaviour. Numerous health studies have shown how socioeconomic disadvantages are related to poor health and health behaviour. (Galobarders et al, 2006; Viner et al, 2012; WHO Commission on Social Determinants of Health, 2008.)

There is no single measure of SES suitable for all study aims in health science. The common measures of SES are educational level, household income, occupation or a combination of these. These are intercorrelated as socioeconomic disadvantages tend to pile up among the same individuals, for example lower education leads to a lower position at the labour market which offers lower income. Multiple SES measures encompass the whole effect of SES on health better than a single measure of SES. (Galobardes et al, 2006.)

Assessing of the SES of youth is challenging because of the transition from childhood social status which is determined primarily by parent's education or household income to adult social status which is more self-determined. Most often the SES of father or mother is the proxy applied to youth in studies of socioeconomic inequalities in SLT use (Fisher et al, 2014; Doku et al, 2010; Pedersen & Von Soest, 2014; Welte et al, 2011). Parental educational level has been used as a proxy measure of the SES of youth as the final educational level is yet to be acquired in youth and parental education predicts the youth educational level later in adulthood. (Viner et al, 2012.) Although, youth's individual social position in relation to his peers is also taken into account while measuring the SES of youth. Youth educational level (Fisher et al, 2014; Grover et al, 2020; Sharma et al, 2015), school performance and plans after graduation (Doku et al, 2010) play a role in producing differences in SLT use among youth. As self-conceptualization of the youth matures, observations of the social status may be based on both the SES of parent and the SES of youth (Fisher et al, 2014; Doku et al, 2010; Sharma et al, 2015).

Education is a frequently used measure of SES in health science. It attempts to capture the knowledge, skills and competencies related assets of a person. These assets may be important to avoid or abandon

unhealthy behaviour. Education is strongly related to the future income and employment. Education is easy to measure through self-administrated questionnaires. It is suitable measurement to individuals regardless of age. Income attempts to measure the financial resources that may contribute to health behaviour through consumption. Better income may offer individual certain privileges such as access to education or health care. (Galobardes et al., 2006.) Richer people may have relatively better purchasing power of tobacco products. For example, youth who have more pocket money, use more tobacco (Oswal, 2015; Mohan, Sharma & Thankappan, 2005). There are few limitations of income measure. It is prone to underreporting and it does not take account of in-kind transfers and does not reflect what households can actually spend. (Galobardes et al., 2006.)

2.3.2 Socioeconomic differences in SLT use among youth

Ten cross-sectional studies from countries worldwide have examined the association between SES and SLT use among youth (Table 1). The majority found some support that low SES is associated with greater SLT use. Five studies reported negative association indicating that youth with low SES use SLT more than youth with high SES (Doku et al., 2010; Grover et al., 2020; Grotvedt et al., 2008; Sharma et al., 2015; Welte et al., 2011). Another, two studies found negative association in a subgroup of the sample (Fisher et al., 2014; Hagquist, 2006). Two studies did not find an association between SES and SLT use at all (Øverland et al., 2010; Pedersen & Von Soest, 2014) and one study reported positive association indicating that youth with high SES use SLT more than youth with low SES (Oswal, 2015). All the studies included a sample that had a *N* greater to 500 and eight of ten studies were nationally representative according to the authors.

Studies from HICs demonstrate that the evidence of association between SES and SLT use is inconsistent. In the U.S, parental low education and part-time employment were associated with greater SLT use among youth (Welte et al., 2011). Similarly, a local, school-based study from Sweden discovered that parental low education was associated with greater SLT use (Hagquist, 2006). Parental SES measures were retrieved from youth which is why the levels of parental education may be over- or underestimated. However, low education of youth (plans for higher education and current education of the youth) has been found to be associated with greater SLT use among Swiss, Swedish and Norwegian youth (Fisher et al., 2014; Grotvedt et al., 2008; Hagquist, 2006). Opposite to this finding, two Norwegian nationally representative studies did not find association between parental education or youth education and SLT use (Pedersen & Von Soest, 2014; Øverland et al., 2010). Øverland et al. (2010) argue that even though snus use has been associated with lower SES in Norway,

it could be that during the past years there has been wider range of new SLT products available which have attracted also youth with higher SES. In addition, education alone may not give an overall picture of SES, especially in Norway where there are no schooling fees. Thereby those attending academic school may be also from poor families. Two studies from HICs reporting an opposite association between SES and SLT use utilized resource-based measure (eg. family income). Grotvedt et al. (2008) reported that Norwegian youth from very well-off families use more SLT than youth from less well-off families. Fisher et al. (2014) reported that Swiss men from high income families use more SLT than men from low-income families. This suggest that a reason why SLT use is higher among youth with high SES could have to do that these youth have more money to purchase SLT.

In India, similarly, research suggest that low education is associated with greater SLT use. Two nationally representative studies have illustrated that Indian youth aged 15-24 years with no formal education used more SLT compared to youth with high education. (Grover et al., 2020; Sharma et al., 2015). The association between income and SLT use is not that clear. Sharma et al. (2015) reported a negative association indicating that youth from low-income families used more SLT compared to youth from high income families. An opposite association was found among younger age group (13-15-year-old) (Oswal, 2015). Oswal (2015) discovered that youth with pocket money were more likely to use SLT compared to youth with no pocket money after adjusting for close friend or parent being SLT user, age and gender. This finding is in line with the studies from HICs. Though, in India greater financial resources may not explain why SLT use is higher among youth from well-off families than less well-off families. This is because SLT products are relatively cheap (starting from Rs 2 (1US dollar= Rs45) in 2011) and easily available (Oswal, 2015). More valid explanation could be that those youth who have pocket money may however belong to the low SES families: their parents may be still casual labours with medium income. In addition, the sample include only youth in schools which could have led to selection bias as most probably SLT use is highest among non-school going youth. However, again negative association was observed in a school-based study from another low-middle income country, Ghana. Youth from families with poorer material resources were more likely to use SLT compared to youth from families with greater material resources. (Doku et al., 2010.) The material resource of family may be more valid measure when examine the association between resources and SLT use compared to pocket money.

In conclusion, the majority of the findings suggest that youth SLT use has negative relationship with SES, such that youth with low SES use SLT more than youth with high SES. (Fisher et al., 2014; Doku et al., 2010; Grover et al., 2020; Grotvedt et al., 2008; Sharma et al., 2015; Welte et al., 2011;

Hagquist, 2006). In terms of the effects of different SES measures, measures indicating the knowledge, skill and competence assets of a person (e.g. parental education, youth education) show negative association with SLT use compared to measures indicating financial situation (e.g. pocket money, family income) which show positive association with SLT use. Youth who have more money may be more likely to use SLT. However, In India SLT products are easily accessible and cheap thus even to those youth with low SES. A single measure of SES may not encompass the whole effect of SES on the SLT use (Galobardes et al., 2006). This is why a combination of SES measures should be used to examine the association between SES and SLT use.

Table 1. Summary of studies that examined the association between SES and SLT use

Study	country/place	Age range	N	SES measure	Results*	limitations
Sharma et al. (2015)	India, nationally rep.	15-24	13,463	self-reported, (GATS), single items: education, wealth index score	-	no information which confounders were taken into account
Grover et al. (2020)	India, nationally rep.	15-24	13,329	self-reported, (GATS), single item: education	-	confounders not taken into account
Oswal (2015)	India, nationally rep.	15-17	62,737	self-reported (GYTS), single item: pocket money	+	limited to adolescents in schools
Welte et al. (2011)	US, nationally rep.	14-21	2,253	self-reported, composite: mean of father's and mother's years of education, father's and mother's occupational prestige	-	SES not derived from parent or household indicators
Doku et al. (2010)	Ghana, nationally rep.	13-18	1,165	self-reported, single items: parental occupation and education, material affluence scale, family structure, participants school performance, plans for graduation	-	SES not derived from parent or household indicators. limited to adolescents in schools
Hagquist (2006)	Sweden, one city	17-18, only youth residing in urban	6,217	self-reported, single items: plans for higher education, parents' education	-	limited to adolescents in schools. SES not derived from parent or household indicators. Confounders not taken into account.
Grotvedt et al. (2008)	Norway, nationally rep.	15-16	15,931	self-reported, single items: plans for higher education, family economy	- =education + =family economy	SES not derived from parent or household indicators. Confounders not taken into account
Fisher et al. (2014)	Switzerland	17-31, only men	572	self-reported, single item: family income, participant's current education	- =education, + =family income	SES not derived from parent or household indicators
Pedersen & Von Soest (2014)	Norway, nationally rep.	16-17	6,217	self-reported, single items: family economy, parents' education, plan for higher education	0	SES not derived from parent or household indicators
Øverland et al. (2010)	Norway, nationally rep.	16-18	4,815	self-reported, single items: current main activity (vocational school, academic school, unemployed, working, other), plans for higher education	0	

* - =Low SES is significantly associated with greater SLT use, 0 = No significant association between SES and SLT use, + =High SES is significantly associated with greater SLT use

2.3.3 Factors associated with youth tobacco use in lower socioeconomic groups

There are various reasons why youth with low SES use SLT more than youth with high SES. It is known that least educated adult smokers are most addicted to nicotine (Jarvis & Wardle, 2006) and least likely to be able to quit (Gilman, Abrams & Buka, 2003). Youth from less educated parents have higher possibilities to take up tobacco use behaviour (Pampel, Mollborn & Lawrence, 2014). It is common that youth start experimenting with tobacco imitating parents, grandparents or siblings (Gupta & Ray, 2003; U.S. Department of Health and Human Services, 2012) as tobacco use is more prevalent and more acceptable in the social environments where youth with low SES live in (Narain et al., 2013). In addition, quitting tobacco is harder in the environment which support tobacco use (Jarvis & Wardle, 2006). Jarvis & Wardle, (2006) also argue that addition to the higher rates of tobacco use, stronger effect of satisfaction leading to higher level of dependency and fewer available coping resources, may be the reasons why tobacco use is higher in lower socioeconomic groups.

Youth may be missing the support systems in everyday life for healthy behaviour. SLT products may be easily available and affordable in the areas where youth from families with low SES live in (Oswal, 2015). The sales of tobacco nearby schools increase youth susceptibility to tobacco and encourages purchasing it (Mistry et al., 2019). Youth are exposed to tobacco use through images and movies, but also via Internet. Youth are also target of tobacco industries. (Reddy et al., 2006.) Although, youth in low socioeconomic groups are exposed to anti-SLT messages through pictorial warnings on SLT products more frequently than their counter partners, but they might be less sensitive to anti-tobacco messages than youth with high SES (Welte et al., 2015).

Sharma et al. (2015) explanation is that Indian youth with low SES are less well informed about the health harms compared to youth with high SES. Youth attending tobacco knowledge-based sessions in school are less likely to use tobacco (Hussain, Zaheer & Shafique, 2017; Kabir et al., 2015; Mishu et al., 2020). Still, in India, only around two-third of students aged 13-15 years were taught in school about the dangers of tobacco use. Only 10 percent of the teachers have training to help student to avoid tobacco use and less than 40 percent had access to teaching and learning materials about tobacco use and how to prevent its use among youth. (MoHFW, n.d.) Most likely youth with low SES go more often to schools where tobacco prevention programmes do not exist compared to youth with high SES.

Additionally, knowledge on health harms of tobacco use among users have been positively associated with higher quit ratios (Chow et al., 2017). This is why cessation interventions should be a part of the school tobacco prevention programmes. It could be that young users willing to quit may not have adequate cessation services. For example, school based SLT use prevention may be not encouraged. (Nethan et al., 2018.) It is also important to notice that many of low SES youth are not school-going thus the programmes should also be implemented for example in slums and workplaces, where SLT use is more prevalent. (Reddy et al., 2006.)

2.4 Health knowledge

2.4.1 Definition of health knowledge

Health knowledge is defined as a fact, information or skill, related to health acquired through experience or education. In Nutbeam's model, health knowledge is seen as a part of a health literacy. Nutbeam's model of health literacy is not based only on knowledge on health harms but also on possibilities and abilities to use the knowledge to enable a person to promote and maintain good health and to critically analyse information. It means that one has to have access to health information, ability to read and has to have seen or heard of tobacco products to gain knowledge on tobacco related health harms. (Gellert & Tille, 2015; Nutbeam, 2008; Manganello, 2007.)

Manganello (2007) has provided a framework of youth health literacy (Figure 1). Individual characteristics such as male gender, older age, and higher education and family income predict knowledge on health risks of tobacco use which then determines tobacco use (Kong et al, 2019; Xu et al., 2016). In addition to individual characteristics, family and peers influence youth health literacy, eg. youth who are aware of the health harms of tobacco use are more likely to have parent with high education. Thus, youth could have heard about the health harms from their well-educated parent. (Kong et al, 2019.) In addition, institutions such as the media, education- and health care system contribute to the development of youth health literacy (Manganello, 2007). Although, knowledge on health harms of tobacco use alone may not lead refusing or quitting tobacco (Rosendahl et al. 2005). According to Nutbeam's theory, in addition to knowledge and understanding of health harms, it is necessary to have motivation and ability to act consistently to promote one's health (Nutbeam, 2008), for example youth should have tobacco refusal skills and positive attitude towards non-use.

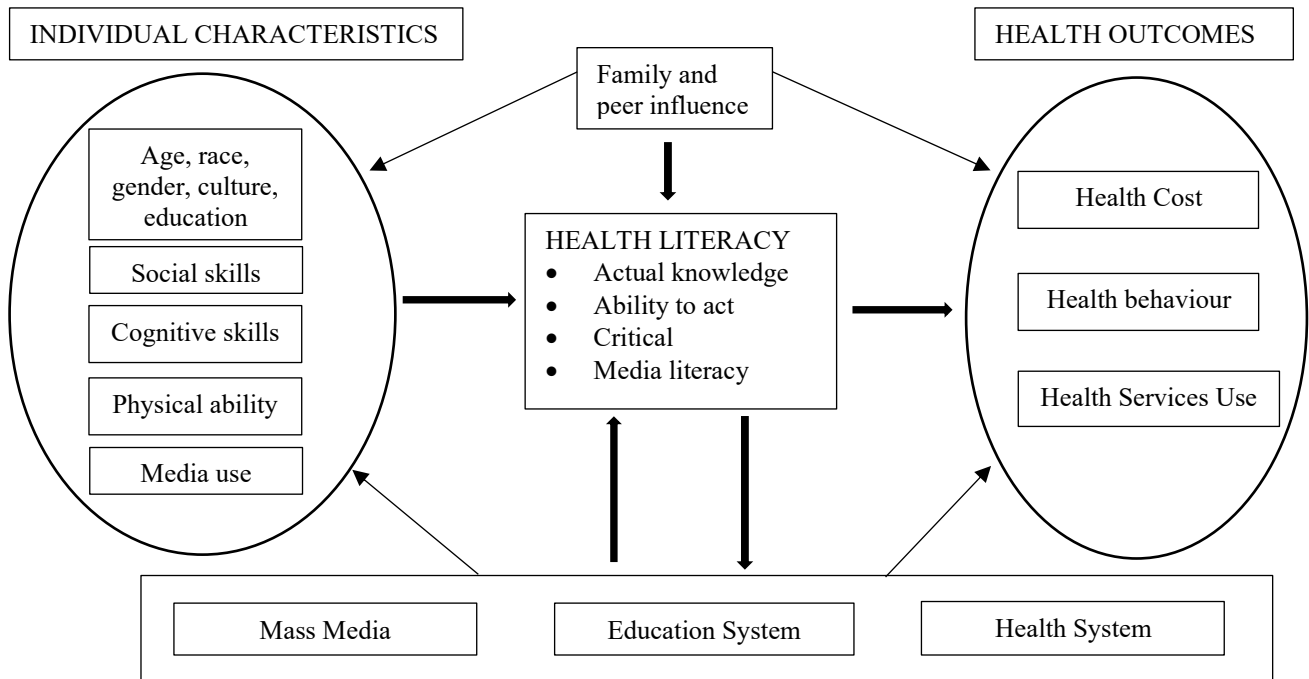


Figure 1. A framework of youth health literacy (modified from Manganello, 2007)

Measuring health literacy from all its aspects (e.g. individual capability to read, knowing context, understanding the written and oral health information) is challenging and mainly impractical (Baker, 2006). Therefore, in the reviewed articles, health knowledge alone has been used to examine the differences between the health literacy and SLT use. Health knowledge could be measured in two ways: actual and perceived knowledge. The measure of actual health knowledge tests the context- and disease -specific knowledge based on false and correct answers. Either a person knows the disease specific facts or does not know. (Gellert & Tille, 2015.) Health knowledge on health harms of tobacco use have been mostly tested by actual knowledge. Health knowledge was assessed by questions (e.g. Driezen et al., 2016; Kong et al., 2019; Siahpush et al., 2006; Yang et al., 2010). The most common question on knowledge was “Does tobacco use cause heart disease, cancer...ect?” (Driezen et al., 2016; Li et al., 2010; Minh An et al., 2013; Siahpush et al., 2006; Yang et al., 2010). In Kong et al. (2019) study images of tobacco products were shown to youth and they were asked whether they have seen or heard of these products and how much they think people harm themselves when using them.

In India, the prevalence of knowledge on health harms of SLT use among the young have been examined in nationally presentative survey (GATS) in 2016-17. In general, youth, aged 15-24 years know that SLT use causes serious illness. Youth had good knowledge on the diseases that SLT use causes: oral cancer (96.2%) and dental diseases (92%), but they did not know well that SLT use causes harm to foetus during pregnancy (87.9%). (TISS & MoHFW, n.d, 161-166.) Further, few local

cross-sectional studies have examined youth knowledge on health harms of tobacco use in India. A study from Bangalore (Singh et al., 2015b) showed that over 90% of the students knew that tobacco use is harmful. In the 48 focus group discussions, students (n=435) from Delhi cited several negative consequences of tobacco use but they were not able to cite any benefits of quitting tobacco use (Mishra et al., 2005). SLT users have poorer knowledge compared to non-users. Non-users aged 15-24 years knew slightly better on the health harms of SLT use than the current users of SLT (oral cancer 96.5% vs.93.7%, dental disease 92.7% vs.88.6% and harms to foetus during pregnancy 88.4% vs.83.6%) in 2016-17. (TISS & MoHFW, n.d, 161-166.)

2.4.2 SES and knowledge on the health harms of tobacco use

Eight cross-sectional studies from countries worldwide have examined the association between SES and knowledge on health harms of tobacco use among adults and youth (Table 2). All the studies found some support that low SES is associated with poorer knowledge. Four studies reported negative association indicating that low SES adult and youth knew less than high SES adult and youth (Minh An et al., 2013; Demaio et al., 2014; Driezen et al., 2016; Kong et al., 2019). Another, four studies found negative association in a subgroup of the sample (Li et al., 2010; Siahpush et al., 2006; Yang et al., 2010; Xu et al., 2016). All the studies included a sample that had a *N* greater to 500, and five of the eight studies were nationally representative according to the authors.

Studies from the U.S and Europe show that low SES is associated with poorer knowledge on health harms of tobacco use. In the U.S, nationally representative study showed that youth with low educated parent were less likely to know about the health harms of SLT use compared to youth with high educated parent (Kong et al., 2019). Similarly, smokers with low SES aged 18 years and older from the U.S, UK, Australia and Canada knew less about the smoking related health harms compared to smokers with high SES. (Siahpush et al., 2006.) Similar findings were found in a sample of women aged 18 and older from five European countries (France, Ireland, Italy, The Czech Republic and Sweden). Women with middle income knew less about the smoking related health harms than those women with high income. This association was also found in unskilled workers and homemakers compared to working women. (Li et al., 2010.)

Studies from Asia show strong evidence on the association between SES and knowledge. In Bangladesh, Vietnam and Mongolia, nationally representative studies showed that adults with low education knew less about the smoking related health harms compared to adults with high education (Driezen et al., 2016; Minh An et al., 2013; Demaio et al., 2014). Bangladeshi adults with low education knew also less about the SLT related health harms compared to adults with high education (Driezen et al., 2016). Again, in China, less educated smokers living in urban knew less about the smoking related health harms than more educated smokers (Yang et al., 2010). Same results were observed among Chinese Male students aged 12-19 years living in urban, those from middle school knew less about the smoking related diseases compared to those from high school. Similar findings about the association between family income and knowledge were reported. (Xu et al., 2016.) However, family income was not associated with knowledge among Bangladeshi, Vietnamese and Chinese adults (Minh An et al., 2013; Driezen et al., 2016; Yang et al., 2010).

In summary, the majority of the findings suggest that adults with low SES know less on the health harms of tobacco use compared to adults with high SES (Minh An et al., 2013; Demaio et al., 2014; Driezen et al., 2016; Li et al., 2010; Siahpush et al., 2006; Yang et al., 2010). In terms of the effects of different SES measures, measures indicating the knowledge, skill and competence assets of the person (education) show negative association with knowledge. The measures indicating financial situation (family income) show negative association in the U.S and Europe but no association in Asia. One explanation to this could be that in Asian countries one can be from a high-income family but still having low level of education and not been exposed to the tobacco prevention programmes. Among youth, the evidence on the association between SES and knowledge on health harms of tobacco use is inadequate and weak (Kong et al., 2019; Xu et al., 2016) and only one study examined the association between SES and knowledge on the health harms of SLT use among youth (Kong et al., 2019).

Table 2. Summary of cross-sectional studies that examined SES and knowledge on tobacco related health harms

study	country/place	population	N	knowledge measure	SES measure	results*	strenght	limitations
Demaio et al (2014)	Mongolia	15-64 years	3,450	self-reported, (WHO STEPS), a composite scale of 8 smoking knowledge items	self-reported, single item: education	–		
Kong et al. (2019)	U.S	12 - 17 years	13,651	self-reported, (PATH-Study), single items: (1) Seen or heard of SLT, (2) think people harm themselves when use SLT?"	self-reported, single item: parental education	–	assessed SLT related health harms	
Xu et al. (2016)	China, Chongqing,	grades 7-12, urban men	1,297	self-reported, single knowledge items: (1)smoking causes lung cancer, (2)chronic bronchitis, (3)laryngeal cancer, (4)health diseae, (5) peptic ulcer, (6) cerebral stroke, (7) nicotine is a kind of addictive substance, (8) smoking has direct effect on the health, (9)smoking is harmful to fetus	self-reported, single items: household income, school status	–		limited to adolescents in schools, and male genger and urban residents, confounders not taken into account
Siahpush et al. (2006)	U.S, Canada, The United Kindom and Autralia	18 years and older, smokers	9,058	self-reported, (ITC-Survey) single knowledge items: knowledge items: smoking causes (1)heart disease, (2)stroke, (3)impotence, (4)lung cancer, (5) nicotine causes most of the cancer, And tobacco contains (1) cyanide, (2) mercury, (3) arsenic, (4) carbon monoxide	self-reported, single items: income and education	–		limited to smokers only
Li et al. (2010)	France, Ireland, Italy, The Czech Republic snd Sweden,	aged 18 and older, women	5,000	self-reposted, score of knowledge items: (1)light cigarettes are safer than regular, (2) smoking is most important cause of cancer, (3) smoking is harmful, (4) second-hand smoking is dangerous to fetus, (5) smoking causes lung cancer (6) cigarettes are addictive, (7) quitting decreases the risk of getting lung cancer	self-reported, single items: household income, occupation	–		limited to women, Instead of asking what level of education had been achieved, participants were asked how old they were when they completed their education.
Driezen et al. (2016)	Bangladesh	15 years and older	5,278	self-reported, (ITC-Survey) single knowledge items: SLT causes (1)mouth cancer, (2) throat cancer, (3) health disease, (4)gum disease, (5) SLT contains nicotine (6) nicotine is the main substance that makes people use SLT	self-reported, single items: income and education	– =education, 0 =income	assessed SLT related health harms seperately	
Minh An et al. (2013)	Vietnam	15 years and older	9,925	self-reported, (GATS) single knowledge items: smoking causes (1)serious illness, (2) stroke, (3) health attack, (4) lung cancer	self-reported, single items: income and education	– =education, 0 =income		

Yang et al. (2010)	China, 6 cities, regional	15 years and older, urban smokers	5,986	self-reported, (ITC-Survey) a score of knowledge items: smoking causes (1)heart disease, (2)stroke, (3)impotence, (4)lung cancer, (5)emphysema,(6) stained teeth, (7)premature ageing (8)lung cancer in non-smokers	self-reported, single items: income and education	- =education, 0 =income	lower proportion of young people in the sample, limited to urban smokers
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* - =Low SES is significantly associated with poorer knowledge, 0 = No significant association between SES and knowledge, + =High SES is significantly associated with poorer knowledge

2.4.3 Knowledge on the health harms of tobacco use and SLT use

Three cross-sectional studies worldwide have examined the association between knowledge on the health harms of tobacco use and SLT use among youth and adult (Table 3). One study reported negative association indicating that lower SLT use is associated with higher knowledge (Palipudi et al., 2012). Another study found negative association in a subgroup of the sample (Goebel et al., 2000;). One prospective cohort study found that future tobacco use was not associated with knowledge (Rosendahl, 2005). All the studies included a sample that had a *N* greater to 500 and two of the three studies were nationally representative according to the authors.

Research from the U.S suggests that those who have higher knowledge are less likely to use tobacco. In the U.S, West Virginia, students who knew more about the health harms of SLT use used less SLT compared to students who did not know (Goebel et al., 2000). However, a prospective cohort study from Sweden shows that knowledge on health harms of SLT use is not associated with future SLT use in youth (Rosendahl et al., 2005). In India, the prevalence of tobacco use (smoking and chewing) was lower among adults who knew about the health harms of tobacco use compared to those who did not know. Same trend was observed in China, Philippines, Poland, Russia, Thailand, Ukraine and Viet Nam. (Palipudi et al., 2012.)

In conclusion, there is evidence across cultures that the prevalence of tobacco use is lower among those who know about the health harms of tobacco use compared to those who do not know. Evidence from a high-quality study from LMICs including India show decreasing prevalence of SLT use with increasing level of knowledge on harmful effect of smoking (Palipudi et al., 2012). Only two studies till now have examined the association between knowledge on the health harms of SLT use and SLT use among youth and both from HICs (Goebel et al., 2000; Rosendahl et al., 2005).

Table 3. Summary of studies that examined SLT use and knowledge on tobacco related health harms

study	Country	population	N	knowledge measure	results*	streght	limitations
Goebel et al. (2000)	U.S, West Virginia	grades 5th, 7th, 11th, urban youth only	1,846	self-reported, single items: SLT uses (1)lung cancer (2) mouth cancer, (3) health disease, (4) tooth decay	–	assessed SLT related health harms	limited to adolescent in schools
Palipudi et al. (2012)	Bangladesh, China, Egypt, India, Mexico, Philippines, Poland, Russian Federation, Thailand, Turkey, Ukraine, Uruguay, and Viet Nam	15 years and older	209,027	self-reported, (GATS) single knowledge items: smoking causes (1)lung cancer, (2) stroke, (3) health attack, (4) are low-tar cig. less harmful	–		
Rosendahl et al. (2005)	Sweden	grade 6th	2,581	self-reported, single item: Nicotine dependence does not occur if one only uses snus	+	assessed SLT related health harms, adjusted for gender	limited to adolescent in schools

* – =lower SLT use (smoking or chewing or both) is significantly associated with greater knowledge, 0 = No significant association between knowledge and SLT use, + =higher SLT use is significantly associated with greater knowledge

2.5 Research gap in the literature

There are two studies which have examined the association between SES and tobacco use indicating that Indian youth with low SES use SLT more than youth with high SES (Grover et al., 2020; Sharma et al., 2015). But there is need to examine the association between SES and SLT use across the states. It is known that the prevalence of SLT use among youth vary by state in India (ITC project, 2013, 39). Therefore, it is likely that there are differences in SLT use between youth from different socioeconomic backgrounds across the states. Additionally, Grover et al. (2020) and Sharma et al. (2015) used single SES measures (income and education) to examine the association between SES and SLT use. There is a chance of measurement error. In India, the youth from high-income families may also have low or middle level of education. Using income and education measures separately could lead to the higher prevalence of SLT use among youth with low SES and middle SES compared to high SES youth. This is why a composite measure of multiple single SES measures should be used to examine this particular research question.

Till now, only one study has examined the association between SES and knowledge on the health harms of SLT use among youth and that also using a nationally representative sample of youth from the U.S. The results showed that youth with low SES had poorer knowledge compared to youth with high SES (Kong et al., 2019.) There are no studies that have examined the association between SES and knowledge on the health harms of SLT use in India. There are also no published studies on the association between knowledge on the health harms of SLT use and SLT use among Indian youth. Evidence from Indian adults show decreasing prevalence of SLT use with increasing level of knowledge on harmful effect of smoking (Palipudi et al., 2012) and youth from the U.S, West Virginia, that students who know more about the health harms of SLT use less SLT compared to students who do not know (Goebel et al., 2000). However, the evidence is insufficient and weak. Albeit, finding out what youth with different SES know on the health harms of SLT use and whether their poor knowledge is associated with SLT use is essential to determine the focus of the anti-SLT use actions in different states in India.

In conclusion, as presented in the figure 2, there is a research gap in the literature what comes to identifying the SES correlation with SLT use and knowledge among youth in India and determining how the SLT use is associated with knowledge on the health harms of SLT use among youth from different SES groups in India.

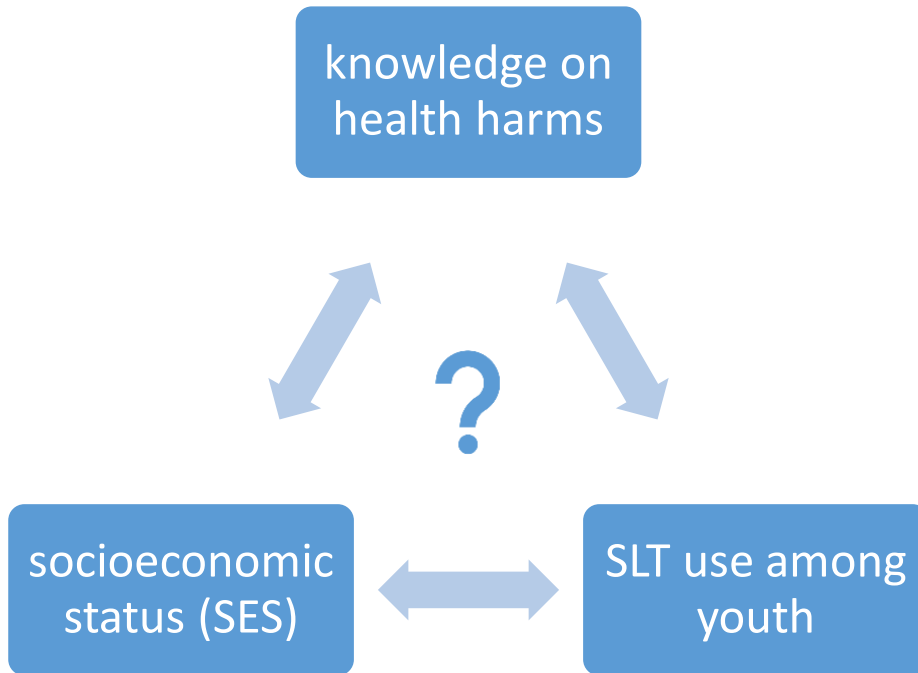


Figure 2. The knowledge gap in the literature

3. AIMS AND RESEARCH QUESTIONS

First, this research aims to study the differences in SLT use and knowledge on the health harms of SLT use among youth (aged 15-24 years) with different SES (a composite measure of the monthly household income and the level of education of youth) in 2012-2013 separately in four states of India: Bihar, West Bengal, Madhya Pradesh and Maharashtra. Secondly, the relationship between knowledge and SLT use will be examined among youth with low and high SES separately. The specific research questions and hypothesis are the following:

- 1) Are there any differences in SLT use among youth with different SES groups?

Hypothesis: SLT use will be higher in youth with low SES compared to youth with high SES in Bihar, West Bengal, Madhya Pradesh, and Maharashtra, when adjusted for age, gender and area of residence.

- 2) Are there any differences in knowledge on the health harms of SLT use among youth with different SES groups?

Hypothesis: Youth with low SES will know less on the health harms of SLT use compared to youth with high SES in Bihar, West Bengal, Madhya Pradesh and Maharashtra, when adjusted for age, gender and area of residence.

- 3) Is knowledge on the health harms of SLT use associated with SLT use among youth in low and high SES groups?

Hypothesis: Among all youth, youth with low SES and youth with high SES, who know about the health harms, will use less SLT compared to those who do not know in Bihar, West Bengal, Madhya Pradesh and Maharashtra, when adjusted for age, gender and area of residence.

4. DATA AND METHODS

4.1 Data source and sampling methods

This cross-sectional study is based on the data from International Tobacco Control Project (TCP) India, Wave 2 follow-up survey which was conducted jointly by the International Tobacco Control (ITC) Policy Evaluation Project Group at University of Waterloo, Canada and the Healis Sekhsaria Institute for Public Health in India, as part of the ITC parallel surveys in 28 other countries. It aims to evaluate and understand the impact of tobacco control policies of the World Health Organization (WHO) Framework Convention on Tobacco Control (FCTC) as they are implemented in India. TCP India survey has been conducted three times: 2010-11 (Wave 1), 2012-13 (Wave 2) and 2018-19 (Wave 3). The TCP India Wave 2 follow-up survey is the first follow-up survey of the longitudinal cohort study of tobacco users and non-users aged 15 years and older from four urban cities and their surrounding rural districts. The TCP Wave 2 Survey was conducted between October 2012 to September 2013. It includes 7988 tobacco user and 2513 non-users. (ITC project, 2016.) The data from Wave 3 was not yet available for these analysis. The study protocol and survey materials were reviewed and accepted by the Office of Research Ethics at the University of Waterloo, Canada and the Institutional Review Board at the Healis Sekhsaria Institute for Public Health, India.

The TCP India Survey was conducted in four major cities of four states (Patna, Bihar; Kolkata, West Bengal; Indore, Madhya Pradesh; Mumbai, Maharashtra) and near-by rural areas (within 50 km from city centres) (Figure 3). In each state, total of at least 2000 households (1500 urban and 500 rural households) were enumerated and at least 2000 tobacco users and 600 non-users aged 15 years and older were interviewed. Household enumeration was continued until the required number of tobacco users (2000 per state) and non-users (600 per state) were interviewed. To ensure adequate power to examine subsamples of tobacco users and non-users and urban and rural households for each question, tobacco users and urban households were oversampled. (ITC project, 2016.)

Samples were selected independently in each stratum through a multistage selection process. In the first stage, 10 wards were selected from each city using a probability proportional to size strategy and two to three sub-districts were selected from rural districts purposively. In second stage, within each ward of urban areas, 10 enumeration blocks (EBs) were selected at random and within rural area four villages were selected from sub-districts using probability proportional to size strategy. Complete household listing and mapping was carried out in all selected EBs and villages. A total of 150

households in each urban ward and a total of 125 households per village were randomly selected. (ITC project, 2016.)

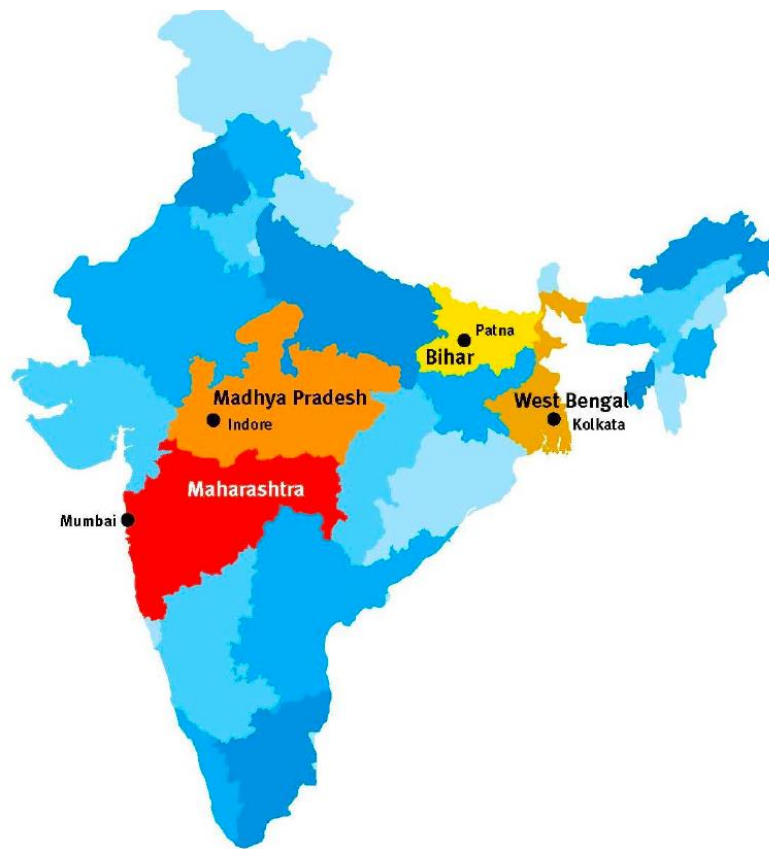


Figure 3. TCP India Wave 2 Follow-up Survey sampling areas (ITC project, 2013, 29)

Households in urban and rural areas were approached in random order. Households included in the enumeration were private houses that are considered to be the usual place of residence for at least one of the persons living there. Each household was approached up to two times in an effort to enumerate the household. In each enumerated household, the identified key informant (eligible member of the household aged 15 years and older) listed all the names of the members of the household and their tobacco use status to a household enumeration form. The enumeration form was used to randomly select up the participants of the study. (ITC project, 2016.)

The people who met the inclusion criteria of the study were:

- Up to four tobacco (smoked, smokeless or mixed) users aged 15 years and older in the household (all female tobacco users were interviewed first to total up to four and if there were more than four tobacco users in the household dice was used to select the participants)

- One non-user of tobacco (mostly never user or uses less often than monthly or has quit completely) aged 15 years and older from every third household, whether it was a tobacco use household or a household with no tobacco user (ITC project, 2016.)

Selected individuals were interviewed immediately or asked to give an appointment. Up to four attempts were made to interview an individual unless that individual refused to respond. In each state, the data collection continued until at least 2000 tobacco users and 600 nonusers were recruited. In Wave 1 (Aug .2010-Dec. 2011), a total of 11,503 tobacco users and nonusers met with the inclusion criteria of the study and interviews were completed for 10,585 respondents (8,051 tobacco users and 2,534 non-users), resulting in response rate of 92.02% (Figure 4). (ITC project, 2016.)

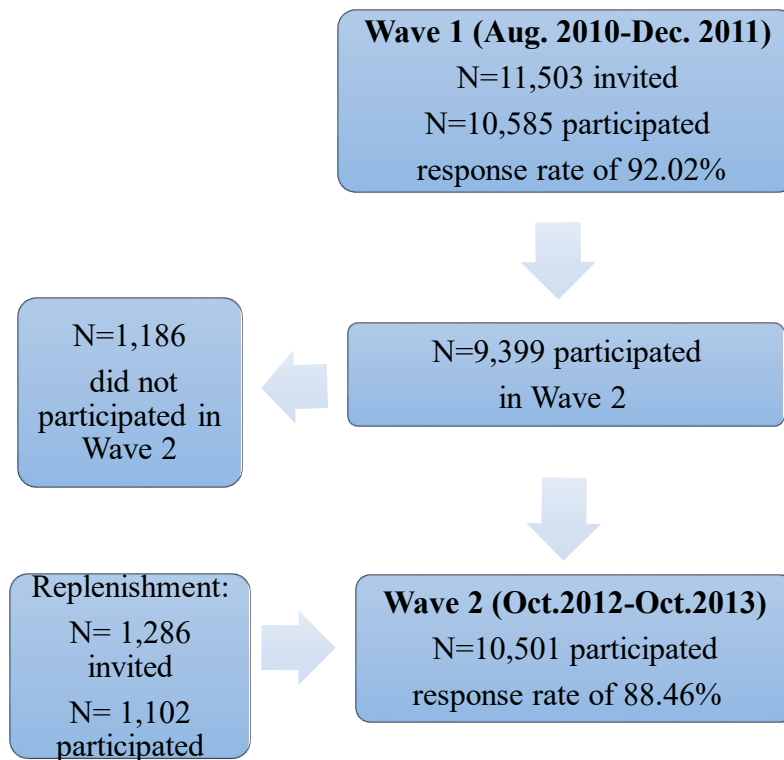


Figure 4. Flow chart of the selection of the participants of the International Tobacco Control India Survey, Wave 1 and Wave 2 and their response rates (adapted from ITC Project, 2016)

Households where members were interviewed in the Wave 1 survey were re-contacted at the Wave 2 follow-up survey. Out of 10,585 individuals who had participated in Wave 1, 9,399 participated in Wave 2 follow-up survey as well. Once all the recontact interviews of all wave 1 participants were

completed, 1,286 new individuals were recruited to replace Wave 1 respondents who did not participate in the survey at Wave 2 (N=1,186). The new samples of tobacco users and non-users were collected by enumerating the households which were not enumerated or were enumerated with no interviews in Wave 1. Households were approached and tobacco users and non-users selected as per the Wave 1 procedure. A total of 1102 out of 1,286 invited new individuals were recruited to replace Wave 1 respondents who did not participate in the survey at Wave 2. In Wave 2, total of 11,871 tobacco users and nonusers met with the inclusion criteria of the study and interviews were completed for 10,501 respondents (7988 tobacco user and 2513 non-users), resulting in response rate of 88.46% (ITC Project, 2016.)

4.2 Study population

The study population of the present study consist of youth aged 15-24 years living in the four major cities of the four states and near-by rural areas at the time of TCP Wave 2 follow-up survey (from October 2012 to September 2013).

The eligibility criteria of the study participant:

- 15-24 years old at Wave 2
- Living in one of the four major cities of four states (Patna, Bihar; Kolkata, West Bengal; Indore, Madhya Pradesh; Mumbai, Maharashtra) or one of their near-by rural areas (within 50 km from city centres)
- SLT users (uses any SLT products at least once a month) or mixed tobacco user (uses both smokeless and smoked tobacco products) or non-user of SLT (never SLT user) at the time of survey

The exclusion criteria:

- +25 years and older
- Smoked tobacco users
- Former users of any tobacco products between Wave 1 and Wave 2

4.3 Methods of data collection and measures

The data was collected using structured questionnaires in face-to-face interviews with each respondent either in Hindi, Marathi, Bengali or English by trained interviewer. Information about the household including income, expenditure and wealth index was collected by household questionnaire from the key informant. The purpose of the household questionnaire was to measure the socioeconomic status of the household. After the household questionnaire was completed, each participant was given a screener to determine their current tobacco use status and thus, determine the correct questionnaire to administer. The screener for a recontact respondent was given depending on their tobacco use status at Wave 1. Only one screener was administered for all replenishment respondents. The questionnaire was administered based on the type of tobacco use: smoked, smokeless, mixed (both smoked and smokeless) and non-use. Prior to interview, all respondents were provided with information about study and asked for written consent. No personal information such as names were collected. Token of appreciation was given for those who completed the questionnaire. (ITC project, 2016.)

Outcome variable of research question 1 and 3 was SLT use defined as current use of smokeless tobacco product that is not burned or smoked at least once a month. SLT use was measured by following question, “In the past have you used any smokeless tobacco (SLT) products?...”. Those who responded “no” were categorised as a “never SLT users” and those who responded “yes” were categorised as “ever SLT users” for the current research. All the “ever SLT users” were also asked “Do you currently use any smokeless tobacco products at least once a month”. Those who responded “yes” were categorised as “SLT users” for the current study. Mixed users were included in this category. Those who responded “no” were categorised as “former users” and excluded from the current study.

In the research question 2, four knowledge variables formed the outcome measures. Respondents were asked “Does smokeless tobacco contain... nicotine or lead” Possible responses included “yes”, “no” or “don’t know”. Those who responded “yes” were categorised as “knowledge”. Those who responded “no” and “don’t know” were categorised as “no knowledge”. Respondents were also asked to reply to two statements on nicotine, “nicotine in SLT causes most of the cancer” and “nicotine is the main substance in SLT that makes people use it”. Possible responses were “true”, “false” and “don’t know”. In the first statement, “false” response was categorised as “knowledge” and “true” and “don’t know” as “no knowledge”. In the second statement, “true” was categorised as “knowledge”

and “false” and “don’t know” as “no knowledge”. All the questions included options of “refused”. These answers were treated as missing values and excluded from the analysis.

The main exposure variable was SES in research question 1 and 2. Educational level and household income were used to define the SES of youth. Youth educational level was assessed according to self-reports and were categorized as “low” (Illiterate, literate, no formal education, up to primary school (up to class IV), or middle school class V to VII), “middle” (Secondary school (ITI course, class XII/X or intermediate)) and “high” (Graduate (BA/ BSc/ Diploma etc.), Postgraduate/ Professional Degree, Above Post Graduate degree (i.e. PhD)). The total monthly income of youth’s family was reported by the head of household and categorized as “low” (5000 INR or less), “middle” (5001-15,000 INR) and “high” (15,001 INR or higher). For households not reporting income, income was classified as “not stated”. These answers were treated as missing values and excluded from the analysis. A composite SES variable was created (Table 4) and defined as low, middle and high SES using following categories: 1) “low SES” (low income and low education or middle income and low education or low income and middle education, 2) “middle SES” (middle income and middle education) and 3) “high SES” (high income and high education or both) (Table 4). Categories for education and income were chosen because of their overlapping influences, for example 44 of respondents with low education belong to high income group.

Table 4. Construction of the composite SES variable

	Education			Total
	Low	Middle	High	
Income				
Low	111	57	23	191
Middle	407	444	144	995
High	44	133	123	300
Total	562	634	290	1486
Low SES	Middle SES	High SES		

In research question 3, the main exposure was knowledge on the health harms of SLT use. This variable was described earlier. Potential confounders of research questions were continuous age, gender (“female” or “male”) and place of residence (“urban” or “rural”). These confounders were selected because they have been used as confounders in previous studies (Doku et al, 2010; Kong et al, 2019; Minh An et al., 2013).

4.4 Statistical methods

Statistical analyses were done using the Statistical Package for Social Sciences (SPSS), version 26. P-value <0.05 was considered significant in all the analyses. Frequencies and percentages were used to describe the distribution of study variables. Cross tabulation with Pearson chi-square test was utilized to test the association between SES and SLT use (Q I), the association between SES and the different knowledge variables (QII) and the association between the different knowledge variables and SLT use among youth with low SES and (middle)high SES (Q III). A cross-sectional weighing factor was used for descriptive analysis due to the oversampling of urban households and tobacco users, to ensure the representativeness of the sample of tobacco users and non-users from the cities and nearby rural areas. (ITC project, 2016.)

Logistic regression analyses were performed to estimate the crude odds ratios (ORs) and their 95% confidence intervals (CIs) for the association between SES and SLT use (Q I), the association between SES and different knowledge variables (QII) and the association between the different knowledge variables and SLT use among youth with low SES and (middle)high SES (Q III). Additionally, multiple logistic regression analyses were conducted to control potential confounders. Multiple logistic regression models were adjusted for continuous age, gender and place of residence (Q I, QII, Q III). Adjusted odds ratios with 95% confidence intervals were calculated. A re-scaled version of sampling weight was used for simple and multiple logistic regression analysis.

5. RESULTS

5.1 Characteristics of the sample

A total of 1527 respondents aged 15-24 years were analysed from Bihar (N=580), West Bengal (N=295), Madhya Pradesh (N=371) and Maharashtra (N=281). Table 5 describes the characteristics of study participants for each state. Respondents from all the states were mainly above 18-year-old. There was almost the same number of men and women from all the states, except Madhya Pradesh where men were more. The respondents from West Bengal were the most vulnerable, 43.1% having low educational level and 24.5% having low income, followed by Bihar (34.4% and 13.4%), Madhya Pradesh (16.3% and 15.3%) and Maharashtra (7.8% and 3.3%). After combining youth educational level and household income, the percentage of youth living in low SES families was highest in West Bengal (43.8 %), followed by Bihar (35.4%), Madhya Pradesh (22%) and Maharashtra (7%).

The SLT use was highest among youth in Bihar (34.4%), followed by West Bengal (11.3%), Madhya Pradesh (8.7%) and Maharashtra (5.7%). Knowledge on the health harms of SLT use varied by state. Overall knowledge on the health harms of SLT use was low in all the states. It was particularly low in Bihar. For example, only 36.8 percent of the youth in Bihar knew that nicotine makes people use SLT, followed by West Bengal (42.4%), Maharashtra (50.2%) and Madhya Pradesh (59.7%). Very few respondents from all the states knew that nicotine in SLT does not cause cancer.

Table 5. The distribution of socio-demographics, smokeless tobacco (SLT*) use and knowledge variables of the sample of respondents aged 15-24 surveyed in Wave 2, in the four states in 2012-2013 (numbers actual and percentages weighted)

	Bihar (N=580)		West Bengal (N=295)		Madhya Pradesh (N=371)		Maharashtra (N=281)	
	n	%	n	%	n	%	n	%
Age group								
15-17	166	31.5%	49	26.9%	73	27.2%	56	20.7%
18-24	414	68.5%	246	73.1%	298	72.8%	225	79.3%
Gender								
female	276	44.2%	145	49.0%	92	39.5%	144	48.1%
male	304	55.8%	150	51.0%	279	60.5%	137	51.9%
Residence								
urban	417	39.8%	202	54.8%	288	66.0%	203	81.7%
rural	163	60.2%	93	45.2%	83	34.0%	78	18.3%
Educational level ^a								
low	211	34.4%	185	43.1%	131	16.3%	49	7.8%
middle	249	45.2%	61	28.5%	164	45.2%	173	63.2%

high	120	20.3%	48	28.3%	76	38.5%	59	29.0%
Household income^b								
low	44	13.4%	74	24.5%	59	15.3%	14	3.3%
middle	425	66.7%	170	52.5%	237	59.8%	164	53.0%
high	106	18.6%	35	17.1%	59	17.1%	100	41.8%
not stated	5	1.2%	16	5.6%	16	7.9%	1	1.1%
Socioeconomic status^c								
low	213	35.4%	175	43.8%	140	22.0%	47	7.0%
middle	190	33.8%	39	15.1%	108	29.3%	107	39.0%
high	172	29.6%	64	35.4%	107	40.8%	124	52.2%
SLT use								
SLT user	394	34.4%	147	11.3%	204	8.7%	79	5.7%
never SLT user	186	65.6%	148	88.7%	167	91.3%	202	94.3%
Knows that SLT contains nicotine^d	236	40.4%	119	51.9%	212	63.2%	138	64.0%
Knows that nicotine in SLT does not cause cancer^e	18	6.2%	73	17.2%	17	2.3%	4	1 %
Knows that nicotine makes people use SLT^f	201	36.8%	88	42.4%	197	59.7%	110	50.2%
Knows that SLT contains lead^g	63	16.9%	77	34.3%	77	29.5%	84	40.6%

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

a. missing: West Bengal n=1

b. missing: Maharashtra n=2

c. missing: Bihar n=5; West Bengal n=17; Madhya Pradesh n=16; Maharashtra n=3

d. missing: Bihar n=2; West Bengal n=6; Madhya Pradesh n=1

e. missing: Bihar n=1; West Bengal n=11

f. missing: Bihar n=1; West Bengal n=13

g. missing: Bihar n=1; West Bengal n=9; Madhya Pradesh n=2

5.2 Association of SES with SLT use among youth

SLT use of the youth is presented by SES in table 6. The percentage of SLT use was higher among youth with low SES than youth with high SES in Bihar (36.1% vs. 24.4%), West Bengal (18.2% vs. 4.0%), Madhya Pradesh (19.9% vs. 3.5%) and Maharashtra (27.7% vs. 3.7%). Table 7 shows the crude and adjusted ORs for SLT use by SES. Youth with low SES had higher odds of SLT use compared to youth with high SES in all the states. When simultaneously adjusted for age, gender and area of residence, the results showed that there is a social gradient association of SES with SLT use in Bihar, West Bengal and Madhya Pradesh, indicating that the prevalence of SLT use among youth increases with decreasing SES in all these states.

Table 6. Smokeless tobacco (SLT*) use by socioeconomic status among youth aged 15-24 in the four states, 2012-2013 (numbers actual and percentages weighted)

	Bihar (N=580)			West Bengal (N=295)			Madhya Pradesh (N=371)			Maharashtra (N=281)		
	SLT user (n=394)	never SLT user (n=186)	p-value	SLT user (n=147)	never SLT user (n=148)	p-value	SLT user (n=204)	never SLT user (n=167)	p-value	SLT user (n=79)	never SLT user (n=202)	p-value
	n (%)	n (%)		n (%)	n (%)		n (%)	n (%)		n (%)	n (%)	
Socioeconomic status^a			<0.001			<0.001			<0.001			<0.001
low	155 (36.1%)	58 (63.9%)		109 (18.2%)	66 (81.8%)		103 (19.9%)	37 (80.1%)		28 (27.7%)	19 (72.3%)	
middle	135 (40.8%)	55 (59.2%)		17 (7.4%)	22 (92.6%)		60 (8.8%)	48 (91.2%)		25 (4.8%)	82 (95.2%)	
high	101 (24.4%)	71 (75.6%)		14 (4.0%)	50 (96.0%)		36 (3.5%)	71 (96.5%)		26 (3.7%)	98 (96.3%)	

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^amissing: Bihar n=5; West Bengal n=17; Madhya Pradesh n=16; Maharashtra n=3

Table 7. Crude and adjusted odds ratios (OR) and 95% confidence intervals (CI) for smokeless tobacco (SLT*) use by socioeconomic status (SES) among youth in the four states in 2012-2013

	Bihar (N=580)			West Bengal (N=295)			Madhya Pradesh (N=371)			Maharashtra (N=281)		
	n	OR (95% CI)	AOR ^o (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)
SES^a												
low	213	2.60 (1.68–4.03)***	2.80 (1.79–4.39)***	175	5.30 (3–9.39)***	8.35 (4.34–16.07)***	140	7.15 (4.09–12.51)***	15.75 (7.53–32.93)***	47	11.25 (5.19–24.4)***	19.90 (7.94–49.84)***
middle	190	2.00 (1.3–3.05)**	2.32 (1.49–3.63)***	39	2.02 (0.97–4.24)	2.32 (1.05–5.15)*	108	2.68 (1.55–4.63)***	4.01 (2.08–7.73)***	107	1.36 (0.76–2.46)	1.61 (0.84–3.09)
high	172	reference	reference	64	reference	reference	107	reference	reference	124	reference	reference

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^oAdjusted for age, gender and area of residence

^amissing: Bihar n=5; West Bengal n=17; Madhya Pradesh n=16; Maharashtra n=3

* p < 0.05; ** p < 0.01; *** p < 0.001

5.3 Association of SES with knowledge on the health harms of SLT use

Differences in knowledge by SES are presented in Table 8. In three out of four knowledge variables, youth with low SES knew less on the health harms of SLT use compared to youth with high SES in all the states. For example, a significantly smaller percentage of youth with low SES knew that SLT contains nicotine compared to youth with high SES in Bihar (11.0% vs. 77.2%), West Bengal (24.2% vs. 79.1%), Madhya Pradesh (33.1% vs. 81.9%) and Maharashtra (16.6% vs. 75.7%).

Table 9 shows the crude and adjusted ORs for knowledge variables by SES. Findings from the unadjusted model shows that SES is positively associated with knowledge for three out of four knowledge variables, indicating that SES was increasing with increasing percentage of knowledge in all the states. In West Bengal, youth with high SES had lower odds of knowledge on the fact that nicotine in SLT does not cause cancer compared to youth with low SES. The association was weak in other states or categories were not applicable. When simultaneously adjusted for age, gender and area of residence, no changes in the crude ORs were observed.

Table 8. Knowledge variables by socioeconomic status (SES) among youth in the four states in 2012-2013 (numbers actual and percentages weighted)

	Bihar (N=580)			West Bengal (N=295)			Madhya Pradesh (N=371)			Maharashtra (N=281)		
	knowledge n (%)	no knowledge n (%)	p-value	knowledge n (%)	no knowledge n (%)	p-value	knowledge n (%)	no knowledge n (%)	p-value	knowledge n (%)	no knowledge n (%)	p-value
SLT* contains nicotine												
SES ^a			<0.001			<0.001			<0.001			<0.001
high	132 (77.2%)	39 (22.8%)		45 (79.1%)	19 (20.9%)		86 (81.9%)	21 (18.1%)		81 (75.7%)	43 (24.3%)	
middle	72 (39.2%)	117 (60.2%)		23 (72.4%)	15 (27.6%)		67 (60.3%)	41 (39.7%)		48 (55.5%)	59 (44.5%)	
low	30 (11.0%)	183 (89.0%)		47 (24.2%)	124 (75.8%)		50 (33.1%)	89 (66.9%)		7 (16.6%)	40 (83.4%)	
Nicotine in SLT does not cause cancer												
SES ^b			<0.001			<0.001			<0.001			<0.001
high	2 (0.3%)	170 (99.7%)		11 (10.3%)	52 (89.7%)		2 (0.8%)	105 (99.2%)		1 (0.3%)	123 (99.7%)	
middle	6 (4.8%)	183 (95.2%)		5 (3.1%)	34 (96.9%)		6 (5.8%)	102 (94.2%)		3 (2.3%)	104 (97.7%)	
low	10 (12.9%)	203 (87.1%)		53 (29.8%)	113 (70.2%)		9 (1.4%)	131 (98.6%)		0 (0.0%)	47 (100.0%)	
Nicotine makes people use SLT												
SES ^c			<0.001			<0.001			<0.001			<0.001
high	114 (65.5%)	58 (34.5%)		35 (62.1%)	28 (37.9%)		78 (78.6%)	29 (21.4%)		70 (63.2%)	54 (36.8%)	
middle	65 (41.7%)	124 (58.3%)		17 (60.8%)	21 (39.2%)		62 (55.3%)	46 (44.7%)		33 (37.3%)	74 (62.7%)	
low	21 (8.8%)	192 (91.2%)		32 (21.5%)	133 (78.5%)		49 (35.2%)	91 (64.8%)		5 (13.5%)	42 (86.5%)	
SLT contains lead												
SES ^d			<0.001			<0.001			<0.001			<0.001
high	42 (37.5%)	130 (62.5%)		27 (51.3%)	37 (48.7%)		40 (44.0%)	67 (56.0%)		52 (51.1%)	72 (48.9%)	
middle	17 (14.2%)	172 (85.8%)		16 (53.9%)	22 (46.1%)		27 (30.2%)	80 (69.8%)		26 (30.7%)	81 (69.5%)	
low	3 (1.9%)	210 (98.1%)		31 (13.8%)	137 (86.2%)		6 (7.9%)	133 (92.1%)		5 (13.5%)	42 (86.5%)	

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^a missing: Bihar n=7; West Bengal n=22; Madhya Pradesh n=17; Maharashtra n=3

^b missing: Bihar n=6; West Bengal n=27; Madhya Pradesh n=16; Maharashtra n=3

^c missing: Bihar n=6; West Bengal n=29; Madhya Pradesh n=16; Maharashtra n=3

^d missing: Bihar n=6; West Bengal n=25; Madhya Pradesh n=18; Maharashtra n=3

Table 9. Crude and adjusted odds ratios and 95% confidence intervals (CI) for having knowledge on each of the knowledge variables by socioeconomic status (SES) among youth in the four states in 2012-2013

	Bihar (N=580)			West Bengal (N=295)			Madhya Pradesh (N=371)			Maharashtra (N=281)		
	n	OR (95% CI)	AOR ^o (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)
SLT* contains nicotine												
SES ^a												
high	171	21.15 (12.43–35.97)***	27.34 (15.31–48.83)***	64	9.93 (5.45–18.11)***	9.24 (5.01–17.03)***	107	8.51 (4.7–15.41)***	10.86 (5.68–20.74)***	124	15.61 (5.87–41.56)***	14.52 (5.43–38.88)***
middle	189	3.19 (1.93–5.27)***	4.13 (2.42–7.06)***	38	6.15 (3.07–12.36)***	5.15 (2.52–10.54)***	108	3.14 (1.85–5.33)***	3.35 (1.93–5.8)***	107	6.49 (2.42–17.34)***	5.43 (1.9–14.21)**
low	213	reference	reference	171	reference	reference	139	reference	reference	47	reference	reference
Nicotine in SLT does not cause cancer												
SES ^b												
high	172	0.19 (0.04–0.89)*	0.27 (0.06–1.3)	63	0.36 (0.19–0.69)**	0.34 (0.17–0.66)**	107	0.21 (0.04–1.21)	0.16 (0.03–0.94)*	124	.	.
middle	189	0.67 (0.26–1.74)	0.58 (0.22–1.59)	39	0.21 (0.08–0.57)**	0.19 (0.07–0.52)**	108	0.72 (0.22–2.34)	0.75 (0.23–2.45)	107	.	.
low	213	reference	reference	166	reference	reference	140	reference	reference	47	reference	reference
Nicotine makes people use SLT												
SES ^c												
high	172	22.43 (12.32–40.86)***	27.39 (14.56–51.51)***	63	5.37 (3.04–9.46)***	5.14 (2.85–9.29)***	107	6.11 (3.51–10.66)***	7.21 (3.99–13.01)***	124	13.91 (4.62–41.89)***	13.723 (4.35–40.18)***
middle	189	4.94 (2.71–9.01)***	5.77 (3.1–10.74)***	38	4.77 (2.41–9.44)***	4.10 (2.01–8.37)***	108	2.67 (1.58–4.51)**	2.71 (1.59–4.63)***	107	4.64 (1.5–14.34)**	3.87 (1.23–12.19)*
low	213	reference	reference	165	reference	reference	140	reference	reference	47	reference	reference
SLT contains lead												
SES ^d												
high	172	51.16 (11.27–232.24)***	54.10 (11.79–248.26)***	64	4.71 (2.61–8.5)***	4.65 (2.53–8.54)***	107	13.74 (5.78–32.66)**	12.55 (5.25–30)***	124	8.83 (2.93–26.59)***	8.34 (2.75–25.28)***
middle	189	8.71 (1.8–42.16)**	8.64 (1.78–42.05)**	38	5.78 (2.85–11.69)***	5.43 (2.61–11.27)***	107	6.65 (2.71–16.27)**	6.75 (2.75–16.61)***	107	3.50 (1.12–10.92)**	2.99 (0.94–9.51)
low	213	reference	reference	168	reference	reference	139	reference	reference	47	reference	reference

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^o Adjusted for age, gender and area of residence^a missing: Bihar n=7; West Bengal n=22; Madhya Pradesh n=17; Maharashtra n=3^b missing: Bihar n=6; West Bengal n=27; Madhya Pradesh n=16; Maharashtra n=3^c missing: Bihar n=6; West Bengal n=29; Madhya Pradesh n=16; Maharashtra n=3^d missing: Bihar n=6; West Bengal n=25; Madhya Pradesh n=18; Maharashtra n=3

* p < 0.05; ** p < 0.01; *** p < 0.001

. category not applicable

5.4 Association of knowledge and SLT use among youth stratified by SES

Table 10 presents the differences in SLT use by the knowledge variables among all youth and separately for, youth with low SES and youth with (middle)high SES. Youth with middle SES were combined with the group of youth with high SES. Among all youth, those who knew on the health harms used less SLT compared to youth who did not know. For example, a smaller percentage of youth who knew that SLT contains nicotine used SLT compared to youth who did not know in Bihar (33.1% vs. 35.7%), West Bengal (7.0% vs. 15.8%), Madhya Pradesh (7.3% vs.11.2%) and Maharashtra (1.7% vs. 12.9%). This was applicable for all the knowledge variables, expect for the fact that nicotine in SLT does not cause cancer. Among youth with low SES, in Maharashtra, the percentage of SLT use was lower among those who knew compared to those who did not know for three of the four knowledge variables. In Madhya Pradesh, same pattern repeated for two of the four knowledge variables and in Bihar and West Bengal for one of the four knowledge variables. Among youth with (middle)high SES, the percentage of SLT use was lower among those who knew compared to those who did not know in all the states, for all the knowledge variables, expect for the fact that nicotine in SLT does not cause cancer.

Table 11 shows the crude and adjusted ORs for SLT use by the knowledge variables among all youth and separately for youth with low SES and (middle)high SES. Among all the youth, those who knew on health harms had lower odds of SLT use compared to those who did not know for all the knowledge variables, expect for the fact that nicotine in SLT does not cause cancer. When simultaneously adjusted for age, gender and area of residence, some changes in the association in terms of crude ORs were observed. After adjustment, SLT use was less among youth who knew that nicotine in SLT does not cause cancer and the relationship was significant in West Bengal and Madhya Pradesh. Among youth with low SES, SLT use was not significantly associated with knowledge in any of the states even after adjustment. However, among youth with (middle)high SES, SLT use was lower among those who knew on the health harms compared to those who did not know, and the relationship was significant in Maharashtra and Bihar for all the knowledge variables, expect for the fact that nicotine in SLT does not cause cancer.

low ^h			<0.001		<0.001			<0.001			<0.001
knowledge	17 (55.6%)	4 (44.4%)		18 (13.9%)	14 (86.1%)		36 (18.7%)	13 (81.3%)		2 (10.9%)	3 (89.1%)
no knowledge	138 (34.2%)	54 (65.8%)		84 (19.1%)	49 (80.9%)		67 (20.6%)	24 (79.4%)		26 (30.3%)	16 (69.7%)
middle and high ⁱ			<0.001			<0.001			<0.001		<0.001
knowledge	109 (29.4%)	70 (70.6%)		12 (3.0%)	40 (97.0%)		60 (5.4%)	80 (94.6%)		11 (1.4%)	92 (98.6%)
no knowledge	127 (37.6%)	55 (62.4%)		18 (8.0%)	31 (92.0%)		36 (6.4%)	39 (93.6%)		40 (7.2%)	88 (92.8%)
SLT contains lead											
all ^j			<0.001			<0.001			<0.001		<0.001
knowledge	27 (14.0%)	36 (86.0%)		32 (6.5%)	45 (93.5%)		26 (4.1%)	51 (95.9%)		10 (1.3%)	74 (98.7%)
no knowledge	367 (38.6%)	149 (61.4%)		110 (13.7%)	99 (86.3%)		178 (10.8%)	114 (89.2%)		69 (8.8%)	128 (91.2%)
SES											
low ^k			<0.001			<0.001			<0.001		<0.001
knowledge	1 (4.9%)	2 (95.1%)		20 (22.0%)	11 (78.0%)		4 (7.6%)	2 (92.4%)		2 (10.9%)	3 (89.1%)
no knowledge	154 (36.7%)	56 (63.3%)		85 (17.8%)	52 (82.2%)		99 (21.5%)	34 (78.5%)		26 (30.3%)	16 (69.7%)
middle and high ^l			<0.001			<0.001			<0.001		<0.001
knowledge	26 (14.6%)	23 (85.4%)		11 (2.8%)	32 (97.2%)		21 (3.8%)	46 (96.2%)		8 (1.1%)	70 (98.9%)
no knowledge	210 (39.6%)	92 (60.4%)		19 (7.1%)	40 (92.9%)		75 (7.1%)	72 (92.9%)		43 (6.4%)	110 (93.6%)

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^a missing: Bihar n=2; West Bengal n=6; Madhya Pradesh n=1

^b missing: West Bengal n=4; Madhya Pradesh n=1

^c missing: Bihar n=2; West Bengal n=1

^d missing: Bihar n=1; West Bengal n=1

^e missing: West Bengal n=9

^f missing: Bihar n=1; West Bengal n=1

^g missing: Bihar n=1; West Bengal n=2

^h missing: West Bengal n=10

ⁱ missing: Bihar n=1; West Bengal n=2

^j missing: Bihar n=1; West Bengal n=9; Madhya Pradesh n=2

^k missing: West Bengal n=7; Madhya Pradesh n=1

^l missing: Bihar n=1; West Bengal n=1; Madhya Pradesh n=1

. category not applicable

Table 11. Crude and adjusted odds ratios (OR) and 95% confidence intervals (CI) for smokeless tobacco (SLT*) use by the knowledge variables among youth with different socioeconomic backgrounds in the four states in 2012-2013

	Bihar (N=580)			West Bengal (N=295)			Madhya Pradesh (N=371)			Maharashtra (N=281)		
	n	OR (95% CI)	AOR ^o (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)	n	OR (95% CI)	AOR (95% CI)
SLT contains nicotine												
all ^a												
knowledge	236	0.61 (0.43–0.87)**	0.55 (0.38–0.8)**	119	0.38 (0.24–0.59)***	0.36 (0.22–0.58)***	212	0.62 (0.41–0.94)*	0.33 (0.2–0.56)***	138	0.12 (0.07–0.23)***	0.08 (0.04–0.16)***
no knowledge	342	reference	reference	170	reference	reference	158	reference	reference	143	reference	reference
SES												
low ^b												
knowledge	30	3.80 (0.93–15.45)	3.00 (0.66–13.32)	47	0.74 (0.36–1.51)	0.80 (0.37–1.76)	50	1.25 (0.54–2.96)	0.70 (0.24–2.05)	..	..	..
no knowledge	183	reference	reference	124	reference	reference	89	reference	reference	40	reference	reference
middle and high ^c												
knowledge	204	0.59 (0.39–0.91)*	0.57 (0.36–0.91)*	68	0.61 (0.27–1.37)	0.51 (0.21–1.25)	153	0.93 (0.51–1.68)	0.57 (0.27–1.2)	129	0.16 (0.08–0.31)***	0.09 (0.04–0.21)***
no knowledge	156	reference	reference	34	reference	reference	62	reference	reference	102	reference	reference
Nicotine in SLT does not cause cancer												
all ^d												
knowledge	18	0.93 (0.36–2.37)	1.02 (0.39–2.69)	73	2.59 (1.51–4.45)**	2.59 (1.45–4.62)**	17	2.41 (0.74–7.9)	4.99 (1.21–20.59)*	..	..	..
no knowledge	561	reference	reference	211	reference	reference	354	reference	reference	277	reference	reference
SES												
low ^e												
knowledge	..	..	..	53	1.34 (0.67–2.69)	1.66 (0.76–3.64)	..	..	..	..	..	..
no knowledge	203	reference	reference	113	reference	reference	131	reference	reference	..	reference	reference
middle and high ^f												
knowledge	..	..	..	16	3.99 (1.47–10.81)**	2.67 (0.88–8.16)	..	..	..	..	..	..
no knowledge	353	reference	reference	86	reference	reference	207	reference	reference	227	reference	reference
Nicotine makes people use SLT												
all ^g												
knowledge	201	0.50 (0.35–0.72)***	0.46 (0.32–0.68)***	88	0.32 (0.2–0.52)***	0.35 (0.2–0.52)***	197	0.58 (0.39–0.88)**	0.32 (0.19–0.54)***	110	0.15 (0.08–0.29)***	0.11 (0.06–0.23)***
no knowledge	378	reference	reference	194	reference	reference	174	reference	reference	171	reference	reference
SES												
low ^h												
knowledge	21	1.87 (0.44–7.98)	1.89 (0.38–9.24)	32	0.54 (0.25–1.19)	0.49 (0.21–1.18)	49	0.85 (0.37–1.93)	0.51 (0.18–1.43)	..	..	..
no knowledge	192	reference	reference	133	reference	reference	91	reference	reference	42	reference	reference
middle and high ⁱ												
knowledge	179	0.51 (0.33–0.79)**	0.48 (0.3–0.76)**	52	0.42 (0.21–0.91)*	0.57 (0.26–1.28)	140	0.83 (0.47–1.46)	0.57 (0.28–1.14)	103	0.20 (0.09–0.41)***	0.14 (0.06–0.32)***
no knowledge	182	reference	reference	49	reference	reference	75	reference	reference	128	reference	reference

**Knows that SLT
contains lead**all^j

knowledge	63	0.21 (0.12–0.35)***	0.2 (0.12–0.34)***	77	0.42 (0.25–0.69)**	0.41 (0.24–0.69)**	77	0.34 (0.21–0.56)**	0.25 (0.14–0.45)***	84	0.15 (0.07–0.32)***	0.13 (0.06–0.29)***
no knowledge	516	reference	reference	209	reference	reference	292	reference	reference	197	reference	reference
SES												
low ^k												
knowledge	..	..	..	31	1.24 (0.5–3.1)	1.44 (0.53–3.93)	..	..	..	..	..	..
no knowledge	211	reference	reference	137	reference	reference	133	reference	reference	42	reference	reference
middle and high ^l												
knowledge	59	0.24 (0.14–0.42)***	0.23 (0.13–0.41)***	43	0.44 (0.21–0.94)*	0.47 (0.21–1.06)	67	0.51 (0.29–0.92)*	0.41 (0.21–0.81)*	78	0.17 (0.07–0.41)***	0.14 (0.06–0.35)***
no knowledge	302	reference	reference	67	reference	reference	147	reference	reference	153	reference	reference

*SLT use refers to a youth who currently uses smokeless tobacco products or smoked and smokeless tobacco products (mixed user)

^oAdjusted for age, gender and area of residence^a missing: Bihar n=2; West Bengal n=6; Madhya Pradesh n=1^b missing: West Bengal n=4; Madhya Pradesh n=1^c missing: Bihar n=2; West Bengal n=1^d missing: Bihar n=1; West Bengal n=1^e missing: West Bengal n=9^f missing: Bihar n=1; West Bengal n=1^g missing: Bihar n=1; West Bengal n=2^h missing: West Bengal n=10ⁱ missing: Bihar n=1; West Bengal n=2^j missing: Bihar n=1; West Bengal n=9; Madhya Pradesh n=2^k missing: West Bengal n=7; Madhya Pradesh n=1^l missing: Bihar n=1; West Bengal n=1; Madhya Pradesh n=1

* p < 0.05; ** p < 0.01; *** p < 0.001

.. data not available

6. DISCUSSION

6.1 Summary of the findings and comparison of the findings with previous studies

The present study focuses on assessing the socioeconomic inequalities in SLT use and knowledge on SLT use related health harms and whether the knowledge on the health harms of SLT use is associated with SLT use among youth (aged 15-24 years) with different SES in Bihar, West Bengal, Madhya Pradesh and Maharashtra. The findings from the study indicate that youth with low SES use more SLT than youth with high SES in all four states. Furthermore, youth with low SES know less on the health harms of SLT use compared to youth with high SES. Among all youth, youth who know on the health harms use SLT less compared to youth who do not know in all four states. The same association was found among youth with (middle)high SES, but no association was found among youth with low SES.

The finding that youth with low SES use more SLT than youth with high SES is consistent with previous cross-sectional studies from India (Grover et al., 2020; Sharma et al., 2015). A reason for higher SLT use among youth with low SES could be the social and cultural context where a youth adapts other's behaviour (Viner et al., 2012). In India, SLT use is more prevalent and acceptable in the social environments where youth with low SES live in (Narain et al., 2013). SLT use behaviour in the low SES families and neighbourhoods serve a model for youth's SLT use behaviour and its common that youth start experimenting with SLT use imitating the family and peers (Gupta & Ray, 2003; U.S. Department of Health and Human Services, 2012). In addition, one reason for higher SLT use among youth with low SES could be that their parents have poor knowledge on the health harms of tobacco use (Driezen et al., 2016; Demaio et al., 2014; Siahpush et al., 2006; Li et al., 2010; Minh An et al., 2013; Yang et al., 2010; Xu et al., 2016). Parent who is not aware of the health harms of SLT use may not also educate their youth about its harms (Kong et al, 2019) and youth from less educated parents have higher possibilities to take up tobacco use behaviour (Pampel, Mollborn & Lawrence, 2014).

The current study is the first study to my knowledge that has reported association between SES and knowledge on the health harms of SLT use in India. The results show that youth with low SES know less about the health harms of SLT use compared to their counter partners. Youth with low SES have been found to have less knowledge on the health harms of SLT use than youth with high SES also in a previous study from the U.S. American youth with low educated parent know less about the health

harms of SLT use compared to youth with high educated parent (Kong et al., 2019). These findings suggest that low SES might be a factor in lacking knowledge on health harms of SLT use, although there are no previous studies on this. According to Manganello's theory on youth health literacy, knowledge on the health harms is acquired at school and health facilities or obtained from the mass media, as well as family and peers have an influence (Manganello, 2007). Sharma et al. (2015) also argues that youth with low SES are less informed about the health harms of SLT use compared to youth with high SES. Schools have important role in contributing to the health education of youth. Still, only two-third of students aged 13-15 are taught in school about the health harms of tobacco use (MoHFW, n.d.). It is also important to notice that many of the youth with low SES are not school-going (Reddy et al., 2006). This suggest that the information on health harms of SLT use is lacking in the social environments where youth with low SES live in and it is necessary to target tobacco prevention programs to youth with low SES in order to increase their knowledge on the health harms of SLT use. The knowledge on the health harms of tobacco use seems to determine SLT use (Manganello, 2007).

The results of this study show that youth who know about the health harms use less SLT compared to youth who do not know. These differences persisted even after adjusting for age, gender and area of residence. These results are in line with previous research among Indian adult population (Palipuli et al., 2012). These findings suggest that knowledge on the health harms decreases the probability of SLT use. One reason for lower SLT use among youth who know about the health harms is that they have been exposed to anti-tobacco programmes and the health warning labels in the packages of tobacco products. Furthermore, they may not have been targeted by the tobacco industry's advertising and promotion or they may be more sensitive to anti-tobacco messages compared to their counter partners. (Reddy et al., 2006; Welte et al., 2015.) However, a prospective cohort study from Sweden found that knowledge did not predict the future SLT use (Rosendahl, 2005). According to Nutbeam's theory, in addition to knowledge and understanding of health harms, it is necessary to have motivation and ability to act consistently to promote one's health (Nutbeam, 2008), for example youth should have tobacco refusal skills and positive attitude towards non-use.

To my knowledge, there are no previous studies that have examined whether the knowledge is associated with SLT use among youth with low and high SES. The current study indicates that among youth with (middle)high SES, youth who know about the health harms use less SLT compared to youth who do not know, but no association was found among youth with low SES. This might have been due to small numbers of participants in the subgroups with knowledge and low SES ($n \leq 50$). The

result suggests that knowledge on the health harms of SLT use decreases the probability of SLT use especially among youth with (middle)high SES. This reinforces the idea that youth with (middle)high SES might be living in good social environments where they are well educated on the health harms of SLT use and it could be one reason why they use less SLT.

6.2 Strengths and limitations of the study and further research ideas

The study results are based on the data from International Tobacco Control Project (TCP) India, Wave 2 follow-up survey which was conducted as part of the ITC parallel surveys in 28 other countries. Therefore, the results are comparable to data from these countries (Siahpush et al., 2006). The questionnaire used in the survey focused on evaluation and understanding the impact of the FCTC as it is implemented in the four states of India and has specific question on knowledge. The questionnaire used in the survey was pre-tested (Raute et al., 2011). Field investigators were trained to administer the questionnaire. Ethical aspects were taken account during the whole research process. The questionnaire was anonymous. Participants provided a written consent. Participation to the survey was voluntary. Data was analyzed with confidentiality and no personal information was disclosed. (Alderson & Morrow, 2011). The findings are applicable to the youth living in major cities of Bihar, West Bengal, Madhya Pradesh and Maharashtra and their near-by rural areas because the sample sizes were large enough. Sample weights were used in the statistical analyses, which makes the sample representative of the population in the area. Youth who only used smoked tobacco products were excluded from this study and the finding are not applicable to them. There was very few missing information. The main potential confounding factors were taken into account at analysis.

This study used a combination of the educational level of the youth and household income as proxy measures of SES. A composite measure is more accurate to the particular research question compared to individual SES measures. This is because in India, the youth from high-income families may have low or middle level of education. Using income and education separately could lead to the higher prevalence of SLT use among low SES and middle SES youth compared to high SES youth. This is why this study had smaller chance of measure error than the previous studies which have used single SES measures (either income or education) separately. Although the combination may not capture the full picture of the youth SES in these four states, they identify groups within youth that live in poorer circumstances and are less skilled or knowledgeable. For example, a youth from high-income family with low or middle education may have difficulty to access and understand health information.

In addition, household income was reported by the key informant instead of the youth him-/herself which could have increased accuracy of the income information. Also, in India income is mostly under reported in most field surveys but since this underreporting might be applicable to all income categories, hence may not create any reporting bias.

This study has several limitations. First, it is not able to assess temporal associations between SES and SLT use or SES and the knowledge or the knowledge and SLT use due to the cross-sectional design (Grimes & Schulz, 2002). Second, there could be a risk of selection bias because the age-specific estimates were not considered in the calculations of sample size. In addition, it was not possible to have the information on the response rate of this particular age group studied. However, the overall response rate of the survey was good (88.5%). Third, some subgroups of youth with low SES had very small numbers of participants therefore it was not possible to interpret all the relationships. Fourth, the amount and duration of SLT used were not taken into account in the analysis, which may lead to misclassification. For example, using SLT one time during the past 30 days may have different effect than using it many times a day. In addition, self-reported SLT use might be subject to recall or response bias. However, the validity of self-reported tobacco products use among youth is consistently high in studies that examine its prevalence (Sharma et al., 2015; Grover et al., 2020). And fifth, it should be also noted that the health knowledge questions based on false and correct answers could be easy to guess without actual knowledge. For example, the use of self-imposed questions might result into lower levels of knowledge. (Skizo & Nieto, 2014,134–139.)

Future research needs to focus on understanding the causal structure of the association between SES and SLT use and SES and knowledge on the health harms of SLT use among youth. This study could be repeated to measure change in the population as it is a part of a cohort study. There is also need to find out which actions would improve the knowledge of youth with low SES and protect their future health by cutting down their SLT use. Furthermore, more studies are required to examine the lack of association between knowledge and SLT use among youth with low SES in India. It should be clarified whether this result was due to the small numbers of youth in the subgroup of participants with knowledge and low SES. The results of the association between SLT use and knowledge among youth with middle or high SES would also require more prospective studies.

7. CONCLUSIONS

This study enlightened the picture of the association between SES and SLT use and knowledge among youth and the association between knowledge and SLT use among youth from families with different socioeconomic backgrounds in Bihar, West Bengal, Madhya Pradesh and Maharashtra. SLT use is a problem especially among youth from low socioeconomic groups in these states. This study also demonstrated that inequalities in knowledge on the health harms of SLT use exist between youth with low SES and high SES. There is need to address the disparities as these are unfair and preventable.

Education of youth about the health harms of SLT use could be one mean to speed up the reduction of SLT use. Youth who know about the health harms of SLT use are less likely to use SLT compared to youth who do not know. This finding emphasizes the need for providing early education on SLT use prevention among youth from low socioeconomic groups to reduce the burden of disability and mortality caused by SLT use in these states.

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