IMPACT OF CIGARETTE POLICIES ON SMOKING ECONOMICS: A SYSTEMATIC REVIEW ON THE METHODS OF ASSESSMENT

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ABSTRACT

Background: The importance of economics in reducing the global tobacco use is reflected in policy-related measures proposed by the WHO such as the WHO Framework Convention on Tobacco Control and the MPOWER package. These policies provide a set of actions that would reduce the demand and supply of tobacco products especially by using economic tools such as raising taxes and prices of cigarettes. Various studies have been done to assess the impact of policies on smoking economics and among the methods of assessment used by researchers is cigarette consumption, price elasticities and by using the direct or indirect costs of smoking to estimate the economic burden from tobacco usage.

Objective: The objective of this paper is to conduct systematic review on methods of assessment used in determining the impact of cigarette policies on smoking economics.

Methodology: Articles were retrieved using both online databases and manual searches. Online search engines used were CINAHL, PubMed, Science Direct, and Medscape. Manual searches were conducted by looking at hardbound copies of journals, articles, thesis and dissertations. Inclusion criteria are papers with available abstracts and full articles, written in English while exclusion criteria are publications that discuss smoking economics not related to cigarette smoking policies and articles that is not an original study such as a review article.

Results and Discussion: For each of the study under review, methods of assessing smoking economics as an impact from cigarette policies are not limited to only one method per study. With regards to the methods, the reviewed literatures reveal that cigarette consumption had been used 9 times, price elasticity of demand 7 times, and economic burden 3 times. Detailed analysis on these 3 methods revealed that each method has its usage, strengths and limitations.

Conclusion: Among the methods of assessment for smoking economics include cigarette consumption, price elasticity of demand and economic burden of cigarette smoking. In choosing between these methods, it all comes down to the study objectives and authors' preference keeping in view of each method's strengths and limitations. While some care

needs to be given to overcome the limitations, all are feasible tools to be used in assessing the smoking economics.

Keywords: 'smoking economics', **'**cigarette policies impact and 'assessment'

1.0   Introduction

Tobacco is known to be the leading cause of preventable premature death worldwide. Its use continues to kill more than 5 million people from all over the world every year and this number is expected to grow as the years go by (World Health Organization [WHO], 2009). If the amount of tobacco consumption continues as it is now, the death toll associated with tobacco could reach to more than 8 million by 2030 and up to a billion people by the end of the century (WHO, 2010). Not only a global public health issue, tobacco is increasingly being recognized as an issue especially in terms of economic contexts. It causes massive economic burden because it leads to a wide variety of diseases and the cost to treat them will have to be borne by individuals, family, society and its country.

Economics is defined as the science that studies human behaviour as a relationship between ends and scarce means which have alternative uses (Robbins, 1932). In other words, it is the study of the way in which mankind organizes itself to tackle the basic problems of scarcity (Mazumdar & Mitra, 2011). Worldwide, WHO had estimated that tobacco damages are on the order of hundreds of billions of ringgits each year. The importance of economics in reducing the global tobacco use is reflected in policy-related measures proposed by the WHO such as the WHO Framework Convention on Tobacco Control (FCTC). The WHO FCTC is an evidence based treaty that reaffirms the right of all people to the highest standard of health (WHO, 2003). The FCTC provides guidelines as foundation for countries to implement and manage tobacco control. In line with the FCTC, WHO produced the MPOWER package which is a package of six most effective tobacco control policies such as by raising taxes and prices, banning advertising, promotion and sponsorship, protecting people from second-hand smoke, warning everyone about the dangers of tobacco, offering help to people who wants to quit and careful monitoring of the epidemic and prevention policies (WHO, 2008). But most importantly these policies provide a set of actions that would reduce the demand and supply of tobacco products especially by raising taxes and prices of cigarettes. Though more distinct among the poor than the rich, the fact that tobacco tax and price increase leads to a significant reduction in tobacco consumption suggests that economics have become integral to understanding and addressing tobacco use.

Analysis of smoking economics dates back to mid twentieth century but back then it was motivated by factors that prompted market analysis of any other products such as price elasticity of demand for the product (Tennant, 1950). However, in this modern day it is now motivated by the desire to determine how economic forces could influence tobacco consumption with the objective of using economic tools to reduce smoking and ultimately to reduce the effect of tobacco on society (Chaloupka & Warner, 2000). Now economic methods and concepts play an important role across a wide variety of domains in tobacco control research, from understanding the structure of the tobacco product market, to evaluating the effectiveness and cost-effectiveness of tobacco control policies, to estimating the economic

and disease burdens from tobacco-related disease and mortality. In these studies, various methods were used by researchers to assess smoking economics such as by using cigarette consumption, price elasticities or by using the direct or indirect costs of smoking to estimate the economic burden from tobacco usage. Thus is the objective of this manuscript which is to systematically review the methods of assessment used in these literatures in determining the impact of cigarette policies on smoking economics.

2.0   Methodology

In this review of literatures, a number of studies on the impact of cigarette-related policies on smoking economics had been analysed to look at their methods of assessment. These articles were retrieved using both online databases and manual searches. Online search engines used were CINAHL, PubMed, Science Direct, and Medscape but the search was limited to papers with available abstracts and full articles that is written in English. The keywords used were: smoking economics, cigarette policies impact and assessment. Manual searches were conducted by looking at hardbound copies of journals, articles, thesis and dissertations. The exclusion criteria for the search are articles not written in English, full articles or abstracts were not available, publications that discuss smoking economics not related to cigarette smoking policies, and articles that is not an original study such as a review article.

3.0   Results

The result section will cover a section on document analyses to look at the steps on how the documents are chosen and the type of information that was extracted from each publication. Next is a section on article analyses where the publications were laid out in table form. Each study was analysed to look at the methods used by the authors to assess the smoking economics and subsequently categorized according to its theme.

3.1   Document analyses

A total of 785 publications were identified but only 360 with available abstracts and full articles. After removing duplicates, 307 abstracts were reviewed. 20 abstracts were shortlisted and its full article screened. Of these articles, 15 publications were accepted as its contents are deemed relevant (See Figure 1). Upon analysing the articles, several conclusions can be made with regards to the studies. These articles that were published from 2005 until 2016 described regarding the impact of cigarette policies such as a cigarette tax increase to smoking economics. Data used were from various sources such as from pooled data, surveys, cross sectional study and interventional study. Most of these articles also collectively show that the enforcement of cigarette policies would be of advantage to all parties especially in terms of health and financial benefits. Several characteristics were then extracted from each study namely the authors, year of publication, study methodology and the final results. Of these facts, the main information singled out and later categorized was the methods that the authors used to assess smoking economics.

Available articles identified through databases (CINAHL, PubMed, Science Direct, Medscape and Google Scholar): 360

Figure 1 Study flow diagram showing results of the search for literatures on smoking economics in relation to cigarette policies impact

3.2   *Article analyses*

Each of these articles was reviewed focusing on the impact of cigarette policies on smoking economics. These articles were analysed in detail and divided according to their methods in assessing smoking economics as shown in Table 1- 4.

Table 1: Review of literatures on the impact of cigarette policies on smoking economics using cigarette consumption as its method of assessment

	Author (Year)	Methods	Results and discussion	Remarks
1	Warner, Sexton, Gillespie, Levy & Chaloupka, 2014	The author used logit regression to model diffusion of smoking from 1900 to 2011. They also projected the hypothetical cigarette consumption after 1963 in the absence of tobacco control. Model predictors included historical events such as wars, specific tobacco control interventions, and other influences	The result of the study showed that per capita consumption increased rapidly through 1963, consistent with sigmoid diffusion. The course reversed beginning in 1964; the year of publication of the first surgeon general's report on smoking and health. Subsequent tobacco control policy interventions significantly reduced consumption. Had the tobacco control movement never occurred, per capita consumption would have been nearly 5 times higher than it actually was in 2011. The study had shown that tobacco control had been one of the most successful public health endeavours of the past half century.	Smoking economics in this study was assessed by way of per capita consumption
2	Sassi & Belloni, 2014	The author divided the article into three parts. First it reviews the effectiveness of taxes in generating health improvements by changing consumption behaviours. Secondly it provides a discussion of the more typical rationale for the use of commodity taxes, including the dimensions of fiscal revenues and external costs associated with consumption. Thirdly it reviews the main concerns that governments have in the use of taxes on health-related commodities	The author had found that commodity taxes are generally regressive, and this is especially the case for taxes on tobacco, foods and non-alcoholic beverages, although the actual size of the tax burden involved is relatively modest.	In this article, cigarette consumption is discussed to assess the effectiveness and use of taxes
3	Maslennikova, Oganov, Boytsov, Ross,	The *Sim Smoke* tobacco control model was used which inputs population size, birth, death and smoking rates specific	Increasing cigarette taxes to 70% of retail price, stronger smoke-free air laws, a high-intensity media campaign and comprehensive treatment policies are each potent policy to	Economics of smoking was assessed using

	Author (Year)	Methods	Results and discussion	Remarks
	Huang, Near, Kotov, Berezhnova & Levy, 2014	to Russia and assesses the effect of seven types of policies consistent with the WHO FCTC: taxes, smoke-free air, mass media campaign, advertising bans, warning labels, cessation treatment and youth access policies. Outcomes are smoking prevalence and the number of smoking-attributable deaths by age and gender from 2009 to 2055.	reduce smoking prevalence and smoking-attributable premature deaths in Russia. With the stronger set of policies, the model estimates that, relative to the status quo trend, smoking prevalence can be reduced by as much as 30% by 2020, with a 50% reduction projected by 2055. This translates into 2 684 994 males and 1 011 985 female premature deaths averted from 2015–2055.	cigarette consumption
4	Norashidah, Nik Mustapha, Lekhraj Rampal & Zaleha, 2013	The estimation of optimal cigarette tax done using the Laffer curve model	The author had stated that the determination of an optimal cigarette excise tax is essential for the government to ensure that price of cigarette after tax is high enough to reduce consumption of cigarette and generate maximum tax revenue to the government. The article had estimated that the optimal real excise tax rate is 0.216 sen or 0.262 nominal excise tax rates per stick, which is 16.5% higher than the excise tax rate in 2009. The expected reduction in consumption per capita for cigarette is 6.4% in the short run and 11.6% in the long run.	Smoking economics in this article is assessed using cigarette consumption
5	Wakefield, Durbin, Spittal, Mohammad Siahpush, Scollo, Simpson, Chapman, White & Hill, 2008	A population survey was used in which smoking prevalence was measured each month from 1995 to 2006. Time-series analysis assessed the effect on smoking prevalence of televised antismoking advertising (with gross audience rating points per month), cigarette costliness, monthly sales of nicotine replacement therapy (NRT) and bupropion, and smoke-free	There is 0.3%-point reduction in smoking prevalence by either exposing the population to televised antismoking ads an average of almost 4 times per month or by increasing the costliness of a pack of cigarettes by 0.03% of gross average weekly earnings. Monthly sales of NRT and bupropion, exposure to NRT advertising, and smoke-free restaurant laws had no detectable impact on smoking prevalence. Increases in the real price of cigarettes and tobacco control mass media campaigns broadcast at sufficient exposure levels and at regular intervals are	Smoking economics is assessed using cigarette consumption

	Author (Year)	Methods	Results and discussion	Remarks
		restaurant laws	critical for reducing population smoking prevalence.	

Table 2: Review of literatures on the impact of cigarette policies on smoking economics using price elasticity of demand as its method of assessment

	Author (Year)	Methods	Results and discussion	Remarks
1	Seng, 2014	Pooled data is used from Korea National Health and Nutrition Examination Survey for the 1998–2011 periods to estimate the price elasticity of cigarette for four income groups.	Result of the study shows that lower income Korean smokers are more responsive to changes in the price of cigarettes. The overall price elasticity of cigarettes was estimated to be−0.425, the price elasticity of the lowest income quartile is estimated to be −0.812, whereas that of the highest income quartile is estimated to be −0.325. Thus cigarette tax and price increase in Korea would reduce smoking more in those with lower incomes	The smoking economics was assessed using price elasticity of demand for cigarettes.
2	John, 2008	This paper examines the price elasticity of demand for bidis, cigarettes and leaf tobacco at the national level using a representative cross-section of households.	This study found that price elasticity estimates of different tobacco products in India ranged between −0.4 to −0.9, with bidis (an indigenous hand-rolled smoked tobacco preparation in India) and leaf tobacco having elasticities close to unity. Cigarettes were the least price elastic of all.	Smoking economics is conveyed using price elasticity of demand
3	Franks, Jerant, Leigh, Lee, Chlem, Lewis & Lee, 2007	Data from 1984–2004 Behavioral Risk Factor Surveillance System surveys linked to information on cigarette prices was used to examine the relationship between smoking participation and cigarette pack price elasticity by income group and time period (before vs after the Master Settlement Agreement [MSA]) to determine role of cigarette prices in income-related disparities in smoking	Increased real cigarette-pack price over time was associated with a marked decline in smoking among higher-income but not among lower-income persons. Although the pre–MSA association between cigarette pack price and smoking revealed a larger elasticity in the lower-versus higher-income persons (–0.45 vs –0.22), the post–MSA association was not statistically significant (*P*>0.2) for either income group. Despite cigarette price increases after the MSA, income-related smoking disparities have increased. Increasing cigarette prices may no longer be an effective policy tool and may impose a disproportionate	Smoking economics presented in terms of cigarette price elasticity of demand.

	Author (Year)	Methods	Results and discussion	Remarks
		in the United States.	burden on poor smokers	

Table 3: Review of literatures on the impact of cigarette policies on smoking economics using economic burden as its method of assessment

	Author (Year)	Methods	Results and discussion	Remarks
1	Verguet, Gauvreau, Mishra, MacLennan, Murphy, Brouwer, Nugent, Kun Zhao, Jha & Jamison, 2015	Cost-effectiveness analysis methods were used to estimate the health benefits, the additional tax revenues raised, the net financial consequences for households, and the financial risk protection provided to households that would be caused by a 50% increase in tobacco price through excise tax fully passed onto tobacco consumers. Respondents include only the male population	The author conducted a modelling analysis which showed that a 50% increase in tobacco price through excise tax would lead to 231 million years of life gained over 50 years. The excise tax would increase overall household expenditures on tobacco by \$376 billion, but decrease these expenditures by \$21 billion in the lowest income quintile, and would reduce expenditures on tobacco-related disease by \$24·0 billion. It would also provide financial risk protection worth \$1·8 billion, mainly concentrated (74%) in the lowest income quintile. The increased tobacco taxation can be a pro-poor policy instrument that brings substantial health and financial benefits to households in China	The smoking economics in this article was assessed using economic burden from tobacco household expenditure and tobacco related disease
2	Mackillop, Few, Murphy, Wier, Acker, Murphy, Stojek, Carrigan & Chaloupka, 2012	In-person descriptive survey assessment in academic departments at three universities. Measurements estimated are cigarette demand, demographics and expired carbon monoxide	The cigarette demand curve exhibited highly variable levels of price sensitivity, especially in the form of 'left-digit effects' (i.e., very high price sensitivity as pack prices transitioned from one whole number to the next; e.g., USD5.80-USD6/pack). A USD1 tax increase in the ten states was projected to reduce the economic burden of smoking by an average of USD531M (range: USD93.6M-USD976.5M). Tax increases in U.S. states with similar price and tax rates to the sample are projected to result in substantial decrease in smoking-related costs	Smoking economics in this study is presented in terms of economic burden
3	Popova, Patra & Rehm, 2009	The impact of four effective population-based interventions,	An implementation of a combination of four tobacco policy interventions would result in a savings of 33,307	Smoking economics

	Author (Year)	Methods	Results and discussion	Remarks
		focusing on individual behavioural change and aimed at reducing tobacco-attributable morbidity, was assessed by modelling with respect to effects on reducing prevalence rates of cigarette smoking, population-attributable fractions, reductions of disease-specific morbidity and its cost for Canada	acute care hospital days, which translates to a cost savings of about $37 million per year in Canada. Assuming 40% coverage rate for all individually based interventions, the two most effective interventions, in terms of avoidable burden due to morbidity, would be nicotine replacement therapy and physicians' advice, followed by individual behavioural counselling and increasing taxes by 10%. Although a sizable reduction in the number of hospital days and accumulated costs could be achieved, overall these interventions would reduce less than 3% of all tobacco-attributable costs in Canada	assessed using economic burden or tobacco attributable costs such as costs of disease-specific morbidity and costs of acute care hospital days

Table 4: Review of literatures on the impact of cigarette policies on smoking economics using cigarette consumption and price elasticity of demand as its method of assessment

	Author (Year)	Methods	Results and discussion	Remarks
1	Ministry of Health Malaysia (2016)	This study investigates the relationships between cigarette prices, cigarette taxes and cigarette consumption in Malaysia by estimating a cigarette demand model. It also determines the impact of future tobacco taxes and other tobacco control policies on smoking prevalence, the number of smokers and smoking attributable deaths using the "Abridged SimSmoke" model.	The results of this study show that price is an important determinant of cigarette consumption in the long run. The price elasticity of demand for cigarette is -0.594. Income is found to have a negative relationship with cigarette consumption indicating that cigarettes are inferior goods. The Malaysia Abridged SimSmoke simulation model used in this study predicts that based on the existing policies already implemented prior to November 2015, an increase in the excise tax from 42.03% to 49.5% would be able to reduce smoking prevalence by 4.5% in 2020 and by 8.9% in 2055 from the existing prevalence rate of 22.8%. The model predicts that many additional lives can be saved by a large increase in excise taxes.	Smoking economics in this study is assessed using cigarette consumption or smoking prevalence and price elasticities.
2	Huang, Rong	General estimating equations method	This study estimates the conditional cigarette consumption	Smoking

	Author (Year)	Methods	Results and discussion	Remarks
	Zheng, Chaloupka, Fong & Jiang, 2015	were conducted to estimate the conditional cigarette demand price elasticity using data from the International Tobacco Control (ITC) China Survey, a longitudinal survey of adult smokers in seven cities in China. The first three waves of the ITC China Survey data were used in this analysis. Analyses based on subsample by education and income were conducted	price elasticity among adult urban smokers in China using individual level longitudinal survey data. A 10% increase in cigarette price would result in a reduction in cigarette consumption among adult urban Chinese smokers by 1.2% to 1.4% shown by an overall conditional cigarette demand price elasticity that ranges from −0.12 to −0.14. No differential responses to cigarette price increase were found across education levels, among low income smokers and between high income and medium income smokers.	economics were assessed using cigarette consumption and price elasticity of demand for cigarette
3	Ross & Al-Sadat, 2007	The data on cigarette consumption, cigarette prices, and public policies between 1990 and 2004 were subjected to a time-series regression analysis applying the error-correction model.	The preferred cigarette demand model specification resulted in long-run and short-run price elasticities estimates of 20.57 and 20.08, respectively. Income was positively related to cigarette consumption: A 1% increase in real income increased cigarette consumption by 1.46%. The model predicted that an increase in cigarette excise tax from Malaysian ringgit (RM) 1.60 to RM2.00 per pack would reduce cigarette consumption in Malaysia by 3.37%, or by 806,468,873 cigarettes. This reduction would translate to almost 165 fewer tobacco-related lung cancer deaths per year and a 20.8% increase in the government excise tax revenue. Taxation is an effective method of reducing cigarette consumption and tobacco-related deaths while increasing revenue for the government of Malaysia.	Smoking economics in this study is assessed using cigarette consumption followed by the price elasticity of demand for cigarettes
4	Al-Sadat, Ross, Zain, Haniza, Al-Junid & Mohamed	Using published time-series data on cigarette excise tax, cigarette prices, per capita income and tobacco control measures from 1990 through 2004, the authors estimated the impact of price	The long-run and short-run price elasticities of cigarette demand were calculated to be -0.38 and -0.13, respectively. This means a 10% increase in price will result in a 3.8 % reduction in consumption of cigarettes in Malaysia in the long-run if tobacco tax increase is	Smoking economics assessed using cigarette consumption and

	Author (Year)	Methods	Results and discussion	Remarks
	Ibrahim, 2005	and income on cigarette demand in Malaysia. The time series error-correction model (ECM) was used and the regression model was subjected to a battery of tests to assure that the model specification is correct.	constantly made annually. Income is positively related to cigarette consumption: 10% increase in real income increases cigarette consumption by 10%. A simulation model reveals that an increase in cigarette excise tax from the current level of RM 1.60 (US$ 0.42) per pack to RM 2.00 (US$ 0.53) per pack in 2006 would increase the average cigarette price by 5.9% and reduce the consumption in that year by 2.25%, or by 445,737,729 sticks of cigarettes. This reduced consumption would translate to between 174 and 179 fewer tobacco related deaths per year among the adult population.	price elasticity of demand for cigarette in this study.

4.0 Discussion

From the review of literatures listed in Table 1 to Table 4, the methods of assessing smoking economics in relation to cigarette-related policies had been analysed. Taking note that each study is not limited to only one method, it can be summarized that cigarette consumption had been used 9 times, price elasticity of demand 7 times, and economic burden 3 times. Each of these methods were then discussed in detail and its advantages and disadvantages summarized in table form.

4.1 Methods of assessment

4.11 Cigarette consumption

As evidenced by the high number of studies utilizing this method in this review, this is perhaps one of the most widely used method of choice by researchers and economist. It is relatively simple and straightforward and usually used by researchers either as the main evaluation in a study or as a basis before proceeding to other much elaborates analysis. Nevertheless, it is subject to several limitations depending on the type of data that are used to obtain the cigarette consumption. Time series data which are pooled data from several sources such as from a group of cross-sectional observations or market surveys may suffer due to inaccurate data especially due to the purchase of smuggled or illicit tobacco products. Cross-sectional studies can be used to obtain individual data from household surveys; however its reliability is very much dependent on adequate sampling, and recall and honesty by respondents about their consumption (Scollo & Winstanley, 2016). Thus, both types of data collection methods have the potential to lead to the problem of under-reporting of cigarette consumption data. Apart from that, in economics, the tobacco market is characterized by three market failures that leads to economic inefficiencies which is the informative failure about health risks of smoking, information failure about the addictive nature of tobacco consumption, and that smoking imposes external costs on non-smokers (World Bank, 2001). As a method taken to assess smoking economics, these market failures will not provide a straightforward relationship between cigarette consumption and taxes and prices, demand and supply, and its health impacts. Conventional models of demand assume that consumers are fully rational and that government has no reason to interfere with their preferences (United States National Cancer Institute [USNCI] & WHO, 2016). This model of demand perhaps ignores the addictive nature of goods like cigarettes when estimating demand. In contrast, the rational addiction model is more widely used when modelling the consumption of addictive goods such as cigarettes (USNCI & WHO, 2016). It formulates decision about current consumption by accounting for both current and future costs of their behaviour. In fact, according to this model, taxes will reduce current consumption by raising expectations about future prices which leads us to the conclusion that price based policies on cigarettes will be an effective tool in this war against smoking.

4.12 Price elasticity of demand

In today's world, tobacco products are easily and widely available to be bought for a price. The question that arises is to what extent are the consumers' willingness to buy, whether it is influenced by any characteristics such as their sense of value, income level, social, cultural or any other demographic variables (World Bank, 2001). The fundamental principle in tobacco

demand analysis is not only that these factors influence an individual's tendency to consume a particular tobacco product, but that they influence them to consume at a particular price (World Bank, 2001). A major role in tobacco demand analysis is to investigate and explain how and to what extent this price-responsiveness is influenced and by which demand factors (World Bank, 2001). Tobacco demand analysis would qualitatively explain the relationship between certain demand factors and the price-responsiveness of consumers and their demand for tobacco products, and next quantifies it using econometric techniques (World Bank, 2001). For a researcher to choose this method of analysis, their fundamental reason would be to achieve a sufficient understanding of the ways in which demand is determined (World Bank, 2001). Because by knowing the answer to this, hence the demand for tobacco can then be influenced and ultimately to be reduced.

More specifically, the elasticity of a good is a measure of how much consumers and the producers responds to the changes in market conditions which enables economists to anticipate how people will respond to these changes (Karlan & Morduch, 2014). The concept of elasticities can be used to measure responses to a change in the price of goods such as to demand or supply or a change in income. Price elasticity of demand (PED) is a measure of sensitivity of the consumer to a change in price (Karlan & Morduch, 2014). An elastic demand curve indicates that the consumers' buying decisions are influenced by the price of the goods, while the demand curve is less elastic when consumers buy approximately the same quantity of the goods regardless of its price (Karlan & Morduch, 2014). It is the percentage of change in the quantity of a good that is demanded in response to a given percentage of change in price and is calculated by dividing percentage of change in quantity demanded by the percentage of change in price (PED = percentage change in quantity demanded / percentage of change in price) (Karlan & Morduch, 2014). Demand is elastic when the PED is greater than 1, inelastic when PED is less than 1, while if the PED is exactly 1 then the demand is unit-elastic meaning that a percentage change in price causes the same percentage change in the quantity demanded (Karlan & Morduch, 2014). PED is influenced by several factors such as availability of substitutes, degree of necessity, cost relative to income and the time needed to adjust to price changes (Karlan & Morduch, 2014). With regards to tobacco products, the demand is usually inelastic (PED less than 1) which means that when price increases, demand decreases by a lesser percentage compared to the price increase (WHO, 2016). For example, a PED of -0.4 indicates that a price increase of 10% would reduce demand by 4% (WHO, 2016). Using PED, the amount of reduction in consumption can also be predicted in response to price increases (WHO, 2016). If PED is -0.4 and price increases by 20%, consumption would go down by 0.4 x 20% = 8% (WHO, 2016). If initially the total consumption was 100 units, then the 20% increase in price would reduce consumption to 92 units (WHO, 2016).

PED had been widely used as a measure of smoking economics as evidenced from some studies which had estimated the PED for several countries around the world as follows; -0.8 for Bulgaria (Sayginsoy, Yurekli & de Beyer, 2002), -0.66 for Taiwan (Lee, 2007), and -0.61 for Indonesia (Adioetomo, Djutaharta, & Hendratno, 2005). As consumption is included in the calculation of price elasticities of demand for cigarettes, its limitations are about similar to the limitations of cigarette consumption. However, there is the addition that it is rather difficult to determine exactly the average price increase, it does not take into account any consumer shift to possibly other tobacco products and that the impact of policies may not be represented accurately through the price elasticities as manufacturers may use various

methods to cushion customers from the effect of cigarette tax increase (Scollo & Winstanley, 2016).

4.13   *Economic burden*

Cigarette smoking causes significant negative impact and a burden to individuals and society in terms of disease and to the economics of a country. Worldwide, direct tobacco smoking is responsible for 5 million deaths globally each year while effect of second hand smoke was seen in the death of 600,000 people annually (WHO, 2012). In 2004, tobacco use causes one deaths every six seconds (WHO, 2012). Consequently, annual deaths related to tobacco are expected to reach 8 million people in the next two decades (WHO, 2012). Disease-wise, 5% of deaths from communicable diseases and 14% of deaths from non-communicable diseases among adults aged 30 years and above were caused by tobacco (WHO, 2012). Among the non-communicable diseases, 22% of deaths were due to cancer while 36% of deaths were from diseases of the respiratory system (WHO, 2012). Within communicable diseases, 7% of deaths due to tuberculosis and 12% of deaths due to lower respiratory infections were related to tobacco use (WHO, 2012).

From there, the estimated global direct health care cost of smoking in 2012 was USD 422 billion or 5.7% of global health expenditures while estimated indirect cost was USD 1014 billion, thus the total economic cost of smoking is estimated at USD 1436 billion, equivalent in magnitude to 1.8% of the global annual gross domestic product (Goodchild, Nargis & d'Espaignet, 2017). Economic burden of cigarette smoking measured in terms of costs of smoking is obtained by determining the difference between healthcare or other costs that actually occur due to smoking and the costs that would have occurred had there been no smoking (WHO, 2011). The economic consequences of illness are divided into direct costs (the expenses incurred because of the illness) and indirect costs (the value of lost production because of reduced working time) (WHO, 2011). Among the direct costs of cigarette smoking are the individual expenditures to pay for tobacco products or to get treatment for illnesses induced by tobacco, and the public health costs of the government who spent a large amount of resources to treat those illnesses. The first step in estimating the costs of smoking is to determine the smoking attributable fraction (SAF) whereby it is calculated for each smoking-related disease of interest (WHO, 2011). The direct costs of smoking or also called smoking-attributable healthcare expenditures (SAE) need to be estimated for each particular smoking-related disease of interest and by type of healthcare services (such as inpatient or outpatient visits) and population groups (such as by gender, age, race or socioeconomic status) (WHO, 2011). On the other hand, indirect costs represent the foregone opportunity to buy other goods since resources had been used to treat smoking related illnesses, the value of time lost due to illness and disability, the loss of productivity when smokers are absent, low productivity making the country less attractive to foreign investors which can affect the economy, employers paying more for employee health care insurance to cover the smokers, productivity losses for early death or illnesses due to smoking, value of lives lost due to smoking-induced premature death, fire damage from cigarette butt thrown carelessly, and even the government expenditure for litter cleanup of cigarette butts and costs of manpower to pick up the litter. Indirect costs would also include emotional costs due to dependence or addiction, pressure to quit smoking and tendency of children to follow the habit. The indirect morbidity cost of smoking or also known as smoking attributable indirect morbidity costs (SAI) is measured by work-loss days and /or disability days (WHO, 2011). SAI may include those resulting from

productivity losses due to illness and those resulting from non-healthcare payments for caregivers and transportation (WHO, 2011).

The earliest well-documented estimates of costs of smoking had been produced by Rice, Hodgson, Sinsheimer, Browner and Kopstein in 1986 for the United States using the relative risks of health care utilization to derive the SAFs and since then numerous literatures had documented the estimation for smoking costs either globally (Goodchild, et al, 2017) or for individual countries such as in Indonesia (Kosen, 2009), Malaysia (Al-Junid, 2007), Australia (Collins & Lapsley, 2008) and Singapore (Quah, Tan, Saw & Yong, 2002). Using this method of analysis, readers could clearly and easily understand the weight and burden that any type of products would cost the society. Hence researchers often choose this type of study as it may be the base in designing effective tobacco control program, providing data for health policy makers in making relevant new policies and in identifying the health care needs of vulnerable populations. Nonetheless it is also subjected to several limitations such as underestimation of mortality and morbidity from cigarette smoking due to underreporting, poor quality of data, underdiagnoses (WHO, 2011), misclassification of cause of deaths, and majority not taking into consideration death due to secondhand smoke, maternal smoking and fires (Palmersheim & Prosser, 2015), all of which could lead to the collection of inaccurate data to represent the economic burden from cigarette smoking of a country.

4.2 *Strengths and limitations*

Table 5: Strengths and limitations of the methods used in assessing smoking economics

	Methods	Strengths	Limitations
1.	Cigarette Consumption	- Simple and straightforward - As main method of evaluation or as basis before proceeding to other analyses	Underreporting of consumption data - Time series data - inaccurate data due to purchase of illicit tobacco products. - Cross-sectional data - dependent on adequate sampling, and recall and honesty by respondents about their consumption
2.	Price elasticity of demand	- Able to explain the relationship between certain demand factors and the price-responsiveness of consumers and their demand for tobacco products. As a result, the demand for tobacco can then be influenced and ultimately be reduced	- Risk of underreporting as it uses cigarette consumption data - Difficulty in determining the exact price increase - Does not take into account any consumer shift to other tobacco products - Inaccurate result as manufacturers use various methods to cushion customers from the effect of cigarette tax increase
3.	Economic burden	- Could easily understand the weight and burden that tobacco had costs the society - Often used by researchers as a base in designing effective tobacco control program, providing data for health policy makers in making relevant new	Inaccurate data due to: - underestimation of mortality and morbidity from cigarette smoking due to underreporting - poor quality of data - underdiagnoses - misclassification of cause of deaths - majority not taking into consideration

		policies and in identifying the health care needs of vulnerable populations	death due to secondhand smoke, maternal smoking and fires

5.0   Conclusion

This systematic review has revealed that among the method of assessment for the smoking economics include cigarette consumption, price elasticity of demand and economic burden of cigarette smoking. It can be used on its own or in combination with each other, and despite seeing more publications using cigarette consumption and price elasticities, it all comes down to the study objectives and authors' preference keeping in view of each method's strengths and limitations. While some care needs to be given to overcome the limitations, all are feasible tools to be used in assessing the economics of smoking as seen from the available literatures.

Author's contribution

Author 1   : information gathering, preparation and editing of manuscript
Author 2   : initiation of idea, supervise and final review of manuscript

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