

Over Mortality and Labor Productivity Lose Attributable to Smoking

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Received date: January 08, 2022; **Accepted date:** January 18, 2022; **Published date:** January 31, 2022

Citation: Efraín S. González and Fé Fernández Hernández. (2022). Over Mortality and Labor Productivity Lose Attributable to Smoking. *J Clinical Research and Reports*, 10(3); DOI:[10.31579/2690-1919/227](https://doi.org/10.31579/2690-1919/227)

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Abstract

Introduction: The labor productivity lose because of smoking can be separated by final result in absolute or relative. The absolute is the one that is associated to mortality and then is irreversible because implicate the death of consumer of cigarettes or tobacco in conditions able to work according to local law. This is the labor productivity lose that focus the attention of this research.

Objective: To design a procedure to determine the social cost by absolute labor productivity lose attributable to smoking.

Materials and Methods: The procedure was made taking account empirical methods as the descriptive statistic, solution of equation system and differential calculus.

Results: The procedure designed is applicable for transversal research only. For longitudinal research, the procedure need be applied for each time period. Nevertheless, the CIT develop might contribute with an apk to standarize the calculus. The application of the procedure at Cuban context in 2011 showed the fesiability from their aplicability.

Conclusions: Was made a procedure to estimate the social cost by absolute labor productivity lose attributable to smoking. The procedure is useful in transversal research.

Keywords: smoking; labor productivity lose; over mortality; Cuba

Introduction

Smoking as risk factor it is present in several death causes in Cuba. These mortality causes represent more than the 80% of the whole mortality by the ten principal death causes [1].

WHO had appointment that one of the consequences from smoking to the national economy it is in the labor productivity lose for the time that smoker uses from work time to smoke and also in especial way, the work time lose because of a sickness related with smoking, the which may cause a vicious circle between addiction, productivity lose and poorness [2].

Also WHO had appointment that exist a very close relation between productivity force develop for the national economy and the tobacco and cigarettes consumption, where the bigger consumer around the world in absolute and relative way are the developing countries [3].

In Cuba, like characterize to producer and trader country for tobacco manufactured product, the fiscal income created by these products have an important relative burden over fiscal income structure in the government budget. Example of that it is the tax over circulation and sales especially over cigarettes and tobacco [4].

In same way, the income obtained by tax over workforce use and social security contribution may be potentially important to have the necessaries financial resources to guarantee the true assignation that may obtain all objectives previous from the state policy [5].

Related to health stay, smoking may play a significant role because of the bad effects that has over individual and collective return from the workforce like especial good that transform feedstock in the final product. Then, smoking is a health and labor productivity determinant for labor productivity across individual work result's. These bad effects are putting out in the individual labor productivity demonstrated across the morbidity and the mortality [6].

The labor productivity lose because of smoking can be separated by final result in absolute or relative. The absolute is the one that is associated to mortality and then is irreversible because implicate the death of consumer of cigarettes or tobacco in conditions able to work according to local law. This is the labor productivity lose that focus the attention of this document. The relative one it is associated with morbidity without mortality. Don't implicate the death of the consumer and the main characteristic is that is reversible [7].

The absolute labor productivity lose it is determinate by several factors like socials, economical or legal. Since the social point of view the influence is by acceptance level and the tolerance that the society in general and the work team in particular demonstrate to tobacco and cigarettes consumption and the risk perception level that have it over smoking especially by all active smokers too [8].

Since the economical point of view the influence is given by item related directly with market as supply and demand, which behavior determinate the market equilibrium for these products. Since the demand the influence is given by purchasing capacity and the consumption necessity given by addiction and by supply side the diversity of products and price [9].

Since the legal point of view, the influences are given by the measures of the labor activities in the society for searching like minimum age to work or to retire. Then, a more precise accounting for labor productivity lose cost's should include the whole people who worked during the searching period, the gross domestic product created in that period, the life expectancy for consumers and the minimum age to retire. That's why that use the total people in labor age isn't good rate because include much people who don't work because several causes. In that case is better use the total people who worked at searching period [10].

Abstracting, the absolute labor productivity lose attributable to smoking is determined by the smoker overmortality in first place and as main condition. Also is determined by the smoker death in age before retirement. These are the main condition for the existence of this social cost attributable to smoking.

Social cost because of absolute labor productivity loses

Overmortality as social phenomenon implicates a potential diminution for the individual life. To accounting this overmortality had been defined several concepts like life expectancy at born and also had been used several tools that may able the estimation for that life potential loses [11].

Overmortality because of smoking had been a worry reason for fiscal authorities. This situation had carried to make several searching where it appointment the importance of public policies in smoking control to reduce the overmortality because of smoking and the cost associated [12].

Overmortality attributable to smoking implicate a potential risk related with labor productivity lose because of the early death in active smoker in ages down retire age. This life time lose implicate additional cost to health system and an important opportunity cost for society for don't have that workforce for productive return [13].

The academic community had used several methods estimating the number of year potentially lose like rate to the overmortality attributable to smoking. Life expectancy at born as rate measuring the whole life potential from a person died early isn't sufficient because don't take account the number of year in overlife that have people who don't smoke over the life expectancy at born, understanding the distance that separate the life expectancy at born with the life expectancy in a no-smoker person [14].

The necessity to a better register it strength while number of person in population grow in applying public policies because it is necessary more economical resources to cover the searching. Given then the natural restriction from economical goods, it is understandable the use of other methods in population searching that with unless the same precision supports the same result: overmortality attributable to smoking like the difference between the potential life in an active smoker and the potential life in a no-active smoker [15].

These conditions show the necessity to have a procedure to determine the social cost by absolute labor productivity lose attributable to smoking. The main objective from this research is the designing of that procedure.

Materials and methods

The procedure was made taking account empirical methods as the descriptive statistic, solution of equation system and differential calculus.

Supposes

- 1) Masculinity rate is one.
- 2) In all cases, the success to have an active smoker and the success to have a passive smoker are complementary and mutually excludes.
- 3) The consumption level by active smoker is fix

Variables

To begin the analyze it is necessary to declare the variables to use:

Life expectancy at born. Middle years' life in expectancy for a person at born. For this research **EVNx** will be used for female and **EVNy** for male.

Life expectancy for an active smoker: Middle years' life for a person who active smoker. For this research **EVFAx** will be used for female and **EVFAy** for male.

Life expectancy for a passive smoker: Middle years' life for a person who active smoker. For this research **EVFPx** will be used for female and **EVFPy** for male.

Overmortality in an active smoker respect to age middle life: Middle years' life don't lived by an active smoker respect to life expectancy at born. **ASMx** will be used for female and **ASMy** will be used for male.

Overlife in a passive smoker respect to the middle: Middle years' life lived by a no-active smoker over the life expectancy at born. In this case **SVFPx** will be used for female and **SVFPy** will be used for male.

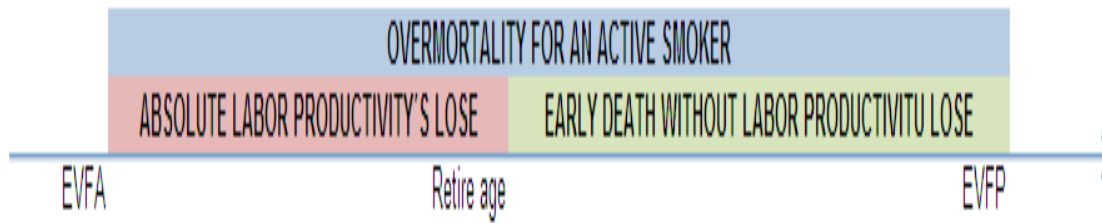
Total overmortality: Middle years' life doesn't live by an active smoker respect to a no-active smoker. For this research, **SMTx** will be used for female and **SMTy** will be used for male.

Probability to have an active smoker: relative number of active smokers inside the society for search. For this research **PFAx** will be used for female and **PFAy** for male.

Probability to have a no-active smoker: relative number of no-active smokers inside the society for search. For this research **PFPx** will be used for female and **PFPy** for male.

Results

The procedure in self is simple but conclusive. Has like main objective determinate the absolute labor productivity's lose in active smokers. The procedure can be clarified by the following picture.



Such as the picture before show, the absolute labor productivity's lose it is part of the overmortality in an active smoker and it is the main reason for this procedure. Following it show the action to do to determinate the overmortality attributable to smoking.

- 1) To describe analytically the relations established by the selected variables.
- 2) Select the necessities equations to form a determined equation system.
- 3) To resolve the equation system
- 4) Calculate the years of absolute labor productivity's lose for actives smokers
- 5) Calculate the cost associated to the absolute labor productivity's lose

Analytic description for relations established between the selected variables

From supposes it obtain the following equation:

$$PFAx + PFPx = 1 \text{ (I)}$$

$$PFAy + PFPy = 1 \text{ (II)}$$

From the equation declare it obtains the following equations:

$$EVNx = EVFAx * PFAx + EVFP * PFPx \text{ (III)}$$

$$EVNy = EVFAy * PFAy + EVFPy * PFPy \text{ (IV)}$$

$$EVFPx = EVNx + SVFPx \text{ (V)}$$

$$EVFPy = EVNy + SVFPy \text{ (VI)}$$

$$EVNx = EVFAx + ASMx \text{ (VII)}$$

$$EVNy = EVFAy + ASMy \text{ (VIII)}$$

Isolating PFAx from (I) and replace in (III) and, isolating PFAy from (II) and replace in (IV) it obtain:

$$EVNx = EVFAx * (1 - PFPx) + EVFPx * PFPx$$

$$EVNy = EVFAy * (1 - PFPy) + EVFPy * PFPy$$

Reordering the equation for each gender finally it obtains that:

$$EVNx = EVFAx + SMTx * PFPx \text{ (IX)}$$

$$EVNy = EVFAy + SMTy * PFPy \text{ (X)}$$

Then, making (VII) – (IX) and (VIII) – (X) it obtains that:

$$ASMx = SMTx * PFPx \text{ (XI)}$$

$$ASMy = SMTy * PFPy \text{ (XII)}$$

By other way, isolating PFPx from (I) and replace in (III) and, isolating PFPy form (II) and replace in (IV) it obtains that:

$$EVNx = EVFAx * PFAx + EVFPx * (1 - PFAx)$$

$$EVNy = EVFAy * PFAy + EVFPy * (1 - PFAy)$$

Reordering the equation for each gender finally it obtains that:

$$EVNx = EVFPx - SMTx * PFAx \text{ (XIII)}$$

$$EVNy = EVFPy - SMTy * PFAy \text{ (XIV)}$$

Comparing (V) with (XIII) and (VI) with (XIV) it obtains that:

$$SVFPx = SMTx * PFAx \text{ (XV)}$$

$$SVFPy = SMTy * PFAy \text{ (XVI)}$$

Making (XV) / (XI) and (XVI) / (XII) it obtain that:

$$\frac{SVFPx}{ASMx} = \frac{PFAx}{PFPx} \text{ (XVII)}$$

$$\frac{SVFPy}{ASMy} = \frac{PFAy}{PFPy} \text{ (XVIII)}$$

Overmortality attributable to smoking is determined by the personal consumption of cigarettes or tobacco in active smokers and the relative number of active smokers. ¹⁶ Then, the proportion of overmortality attributable to smoking between genders it is equivalent to the proportion between the relative numbers of actives smokers, like show the following equation.

$$\frac{SMTx}{SMTy} = \frac{PFAx}{PFAy} \text{ (XIX)}$$

Then, multiplying both members by PFAx/PFAy and in the numerator for right member replaces by (XV) and in the denominator for the same member it replaces by (XVI) it obtains:

$$\frac{SVFPx}{SVFPy} = \frac{PFAx^2}{PFAy^2} \text{ (XX)}$$

By other way and taking account the equations (XIII) and (XIV), the life expectancy at born it is a decreasing function for the probability to have an active smoker and the whole overmortality too. Then, smaller variations in the probability to have an active smoker or in the whole overmortality will move the life expectancy at born in opposed way. But for more precise result it is necessary apply other rate: elasticity and the equation like result are the following:

$$\text{Elasticity}(EVNx, PFAx) = \frac{\partial EVNx}{\partial PFAx} * \frac{PFAx}{EVNx}$$

$$\text{Elasticity}(EVNy, PFAy) = \frac{\partial EVNy}{\partial PFAy} * \frac{PFAy}{EVNy}$$

In both cases, $\frac{\partial EVNx}{\partial PFAx}$ is -SMT according to the gender. Then, rewriting the equations it obtains:

$$\text{Elasticity}(EVNx, PFAx) = - \frac{SVFPx}{EVNx} \text{ (XXI)}$$

$$\text{Elasticity}(EVNy, PFAy) = - \frac{SVFPy}{EVNy} \text{ (XXII)}$$

Selection of the necessities equations to form a determined equation system

The previous numbered equations are forming a no-linear determined equation system. This system is solve by substitution way. Including the certain variables thus like the appropriated equations it guarantee the unique solution for this system.

All variation of life expectancy at born in this analyze depend from the variation in the number of active smoker because the consumption level by active smoker is fix by suppose. This makes able the calculus for elasticity front of smaller variation in explicative variable [17].

It must appointment that this procedure implicates to calculate the overmortality in the active smoker over the life expectancy at born. Also it must take account that down the previous supposes the life expectancy at born is equivalent to the middle value between life expectancy in active and no-active smokers. That's why if it determines the overmortality for the active smoker like the difference between life expectancy at born and the life expectancy in an active smoker, would be a leasing part didn't

account given by the overlife from the no-active smoker over life expectancy at born. This is one of the stronger from this procedure.

This procedure it is superior to the previous consulted because may a closer and precise estimation for overmortality in an active smoker. The others steps described it show in the applying of this procedure to Cuba in the 2011.

The Cuba example in 2011

From the solution of the equation system it obtains that like middle distance between male active smoker and male no-active smoker was 18.4 years. Then, the middle life expectative for active smoker in that year was 61-62 years.

For female gender, the whole overmortality was only 5.2 years. By which in this gender the life expectancy for active smoker was 75.9 years, 15.9 years over retire age. All before it shows in the following table.

Gen / var	PFA	PFP	EVN (a)	SMFA	SVFP	SMT	EVFP	EVFA
Male	0,2229	0,7771	76	14,3	4,1	18,4	80,1	61,78
Female	0,1145	0,8855	80	4,1	1,1	5,2	81,1	74,8

Fountain: a: Cuban Yearbook
 All number calculate by author except EVN based on Cuban Statistic Yearbook and III National Asking about Risk Factors [18,19].

Table 1: Over mortality from Cuban smokers in 2011 by gender

Excepted appointed value, all information is from calculus of authors

This labor productivity lose had a cost associated very important for the national economy. It main that like middle each male active smoker didn't lived 3.22 years before arrive to retire age.

Making a regressive accounting for men down this condition it could determinate that 36211 men active smoker would have living until 2011 only if his life expectancy should be equal to retire age.

5010.2 Thousand employed had Cuban society in the year 2011. If this early death people should be living and working until arrive to retire age, the Cuban labor productivity should increase until 0.7%. Then, this rate indicates the high social cost associated to over mortality because of smoking [18].

The gross national save from 2011 in Cuba was 781 million of pesos and the workers payment were 22826 million of pesos. Had account with that productivity lose should means a potential increase of 52.6 million of pesos for the gross national save and 165 millions of pesos because of salaries. Both together are 217.6 millions of pesos done obtained in 2011 because of the early death of active smokers [18].

This procedure has the limitation that may be applied only for transversal research. For logitudinal research, the procedure need be applied for each time period. Nevethless, the CIT develop might contribute with an apk to standarizate the calculus. The application of the procedure at Cuban context in 2011 showed the fesiability from their aplicability.

Conclusion

Was made a procedure to estimate the social cost by absolute labor productivity lose attributable to smoking. The procedure is useful in transversal research.

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