SECONDHAND TOBACCO SMOKE EXPOSURE IN LATIN AMERICAN COUNTRIES (PROTOCOL)

BACKGROUND AND RATIONALE

Secondhand tobacco smoke refers to the mixture of sidestream smoke and exhaled mainstream smoke that pollutes air in locations where tobacco smoking is taking place[1]. Exposure to secondhand smoke is, in almost all cases, an involuntary exposure and passive smoking currently affects a large percentage of the population worldwide.

In addition to its annoying and irritant effects[2,3], secondhand smoke poses a serious health risk to both children and adult passive smokers. The annual number of lung cancer deaths due to passive smoking in the USA is estimated at around 3000[4]. Additional health effects linked to secondhand smoke exposure in adults include reduced lung function and increased rates of respiratory symptoms compared with non-exposed adults[5-8]. Regarding cardiovascular diseases, passive smoking has also been associated with an increased risk of stroke for both men and women[9,10], and with subclinical markers of atherosclerosis disease[11,12]. In children, higher pericardial cotinine levels have been measured in children with sudden infant death syndrome (SIDS) compared to children who died of infectious disease[13], and structural airway changes have been observed in SIDS children whose mothers smoked compared to children with nonsmoking mothers[14]. Table 1 summarizes meta-analyses of secondhand smoke exposure and disease, including SIDS and several respiratory diseases in children and lung cancer, chronic respiratory infections and coronary heart disease in adults[15-23]. The majority of this evidence comes from self-reports of passive smoke exposure in the home or in the workplace.

In Latin America, active smoking is increasingly becoming a major public health problem (tobacco country profile). The estimated number of tobacco related deaths in the region of the Americas is 1,100,000 of which half occur in Latin American countries (PAHO. Health in the Americas, 2002 (in press)). Past experience has shown that as active smoking increases, so does involuntary exposure to secondhand smoke. There is, however, insufficient information regarding the range of exposure, the locations where passive smoking is taking place and the determinants of exposure in Latin America. Self-reported data from persons 13-15 years of age in Latin America and the Caribbean indicate that secondhand smoke exposure is elevated for spouses and offspring in the

home and also in public places (GYTS). In the Caribbean, exposure prevalence in homes varies between 20-30%, while in Latin America it fluctuates from 40 to 70%. Exposure to secondhand smoke in public places varies between 88% in Argentina and 34% in Huancayo, Peru. In regard to secondhand smoke legislation, most Latin American countries have some smoking restrictions in closed environments, especially in airplanes, public places, health care facilities, schools, public transport, public buildings, and workplaces. For workplaces, however, regulations vary widely across countries, and few have total bans on smoking in workplaces. In addition to the presence of legislation, another factor that may influence secondhand smoke exposure is the level of compliance with existing legislation.

Secondhand smoke is a complex mixture of particles, gas-, and vapor-phase components. The concentration of the smoke is directly related to the number of smokers in a given space and inversely related to the size and ventilation of the space. Consequently, the range of exposure in different locations may vary greatly, as observed through direct measurements[24,25]. Secondhand smoke exposure in public places (health care facilities, schools, public transport, public and governmental buildings, diverse workplaces…) is highly dependent on the presence of and compliance with smoking regulations. Compliance, in turn, varies across countries depending on a number of country-specific political, economic and cultural issues. For example, in the USA, ETS exposure in the workplace has declined sharply over the last decade as control measures have been implemented, including restrictions or outright bans on smoking, however, the absolute number of exposed workers remains large[1].

The assessment of secondhand smoke exposure may rely on questionnaires that characterize exposure to secondhand tobacco smoke, direct measurement through either personal or area monitoring or by using biomarker data[1]. Secondhand smoke exposure may also be indirectly assessed using empirical distributions of exposure in specific microenvironments, output from microenvironmental models and human activity pattern data[1]. These methods estimate personal exposure using information on microenvironment concentration along with the amount of time spent in the microenvironment.

The approach employed to ascertain secondhand tobacco smoke exposure depends on the objectives of the study. For determining typical exposure to secondhand smoke over time, questionnaires are considered the preferred approach[26]. However, for the purposes of tracking the impact of clean indoor air and policies (or the lack of there

of), measurements in the environments of interest are critical. As it is not possible to quantify all the constituents of secondhand smoke, exposure measurements are generally based on the quantification of one or more tracers of secondhand smoke. Vapor-phase nicotine has generally been the most widely used tracer for secondhand smoke particulate matter and secondhand smoke as a whole[27]. Field measurements over long time periods indicate that nicotine is well correlated with the number of cigarettes smoked and with respirable particulate matter[28] and may provide reasonable estimates of exposure to the rest of components[27]. Nicotine is a particularly attractive tracer because tobacco smoke is its only source in most environments and the methods used to measure it are relatively simple, accurate and inexpensive[29].

Although the adverse effects of passive smoking remain a focus of investigation, there are now sufficient data to undertake actions directed at protecting populations from the health risks of secondhand smoke exposure. In Latin American countries it is necessary to ascertain current levels of secondhand smoke exposure in public environments, and this estimation may be easily obtained using airborne nicotine. This information would serve to strengthen and orient interventions to protect the population from the health risks of secondhand smoke, and may be especially useful as a surveillance tool for evaluating trends in ETS exposure as they relate to clean indoor air policies in the region.

PURPOSE

To assess secondhand smoke exposure in Latin American Countries

OBJECTIVES

- To measure levels of secondhand smoke in public places: health care facilities, educational settings, governmental institutions, transportation and food establishments in eight different countries from Latin American and the Caribbean.
- To identify factors related to differences in levels of secondhand smoke exposure (presence of regulations and policies, compliance with regulations, attitudes and behaviors of smokers, attitudes and behaviors of non-smokers)
- To disseminate the results in order to support more progressive smoke-free policies and programs to reduce exposure to secondhand smoke.

- To identify base-line levels for monitoring progress in tobacco control policies in Latin America and the Caribbean.

METHODS

- **Study design**: cross-sectional exposure survey using area monitoring
- **Countries**: Chile, Argentina, Paraguay, Uruguay, Peru, Honduras, Costa Rica, Brazil and Jamaica. The study will be initiated in one of the above countries. The results of the pilot study will serve to detect problems and improve the application of the protocol in the remaining countries.
- **Locations**: the following public places will be selected in each country:
    - Hospitals: a tertiary hospital will be selected in each country. Within the hospital, nurses and doctors' stations, administration offices, cafeterias, patient rooms/bathrooms and the stairwells will be sampled. Hospitals are critical places for the introduction of smoking-free workplaces and environments in a country. The selection of an important hospital within each country may serve to increase public awareness of the contradiction between smoking in health care settings and the health goals of medical institutions. In addition, health care workers represent an important proportion of the workforce; they belong to a range of socioeconomic status and play a special exemplary role in society. Finally, smoke free hospitals are a sign of respect towards the patient and offer a good opportunity for smoking patients to consider quitting.
    - Secondary schools: one or two secondary schools will be selected in each country. They will be public schools located in low-middle class neighborhoods. The following locations will be sampled: teachers' room, students' bathroom, cafeteria and the stairwells. The relevance of studying secondhand smoke exposure in schools derives from the importance of protecting children from the effects of passive smoking, responding to parental concerns, and, in the case of adolescents, helping to prevent the initiation of tobacco consumption. Finally, as for health care workers, educational workers represent a large group of the workforce in any country and they also play a special role in the society as educators and role models. Consequently, they must be one of the first occupational groups to implement smoke free workplaces.

- City government offices (as an example of governmental and public institutions): Samplers will be located in different offices (preferably offices shared by 3 or more workers), the cafeteria, one room opened to the public and the stairwells. The smoke-free environment in public institutions is a prerequisite to expand this policy to other workplaces. The public administration must lead the initiative of protecting the individuals from the long-term effects of passive smoking at work.
- Airports (as an example of public transportation): An international airport will be selected and the samplers will be located in different areas of the airport, including one cafeteria. Airports are highly comparable among countries and the estimation of secondhand smoke exposure in airports may serve as a surrogate estimation of the situation of secondhand smoke exposure in the country.
- Cafeterias/restaurants: places were secondhand smoke exposure is generally very high, and may thus suppose a considerable health risk for workers in these occupations. It may also serve as a point of relative comparison of the rest of locations in the study with respect to this one.

- **Secondhand smoke exposure assessment:** Vapor-phase nicotine measured with "nicotine monitors" as a surrogate estimator of secondhand smoke exposure. Area sampling will be the type of measurement employed, using passive sampling. Sample locations will be selected to represent areas where people frequently work or occupy. In these cases, area sampling can be used as a surrogate of personal exposure.

- **Sampling places**: The number of samples, the location of the monitors and the sampling time for each of the places selected in each city of the study are specified in the following table:

Places (number)	Location of monitors	Number of samples[1]	Time of sampling
Hospital (1)	Doctors' areas	6	1 week
	Nurses' stations	6	
	Administration offices	3	
	Cafeteria	3	
	Stairwells	3	
	Patients' bathroom	6	
		subtotal: 28 (+6)	
Secondary schools (2)	Teachers' room	1 in each school	1 week
	Students bathroom	2 in each school (boys/girls)	(Mon-Fri)
	Cafeteria	3 in each school	
	Stairwells	3 in each school	
		subtotal: 18(+4)	
City government (1)	Working offices	10	1 week (Mon-Fri)
	Public waiting room	5	
	Cafeteria	3	
	Stairwells	3	
		subtotal: 21(+4)	
Airport (1)	Baggage area	5	1 week
	Passenger area	5	
	Cafeteria	3	
		subtotal: 13(+2)	
Food establishments	Cafeterias	10	1 week
	Restaurants	10	
		subtotal: 20(+4)	
Total		**100(+20 quality control)**	

[1] 10% of blank samples and 5-10% of duplicate samples for quality control purposes (in these cases the two monitors are placed side by side). They will be randomly selected within each type of location, and the exact number of quality control samples is shown between brackets.

Thus, the total number of samples in each city of the study will be 120, including around 10% of blank samples and 10% of duplicate samples. The duplicate and blank samples will be selected randomly among each type of locations.

- **Placement of the samplers**:
    - Before placing the monitors, a letter containing basic information about the project must be sent to the main responsible of the establishment. This letter will discuss indoor air quality in general in order to reduce possible observer bias. Permission to participate will be required at all locations. A model of the letter will be provided to the investigators in each country.
    - Placement guidelines:
        - The samplers will be placed early in the morning before the arrival of the workers and/or students.
        - The location selected for the monitor must be representative of the exposure area that is to be measured. A good location is one where the sample hangs in the air, somewhere between 1-2 meters of distance from the floor (for example from a TV antenna, or from a lampshade). It is important not to place it within 1 meter of an area where someone regularly smokes or in an area where air does not circulate, such a corner, or under a shelf and not to bury it in curtains. However, it should not be too visible or accessible to avoid people touching it or even taking it out. The placement of the samplers within a location will be identified using a simple “schema” diagramming where the windows and doors are located, and the direction of airflow. Also it is important to indicate if the doors and/or windows were usually open or closed.
        - The monitors should be clearly labeled with a permanent marking. The location, date and time of each monitor should be recorded on the sampling sheet. When placing the monitor, it must be recorded with a code on the sampling sheet, along with the date, time and location. The front of the monitor should face into the room being sampled.
        - Sample time will be one week. Every sample place must be visited once a day in order to verify that the samplers are in place. When sampling is complete, the monitor must be returned to the plastic cup, be closed securely into place and the date and time of removal recorded.

- **Quality Assurance and Control Issues:**
  - Collection of at least one blank sample for each 10 samples. The blank samples must be handled exactly the same as the rest of the samples but without opening them, and they will be sent with the others to analyze.
  - Collection of duplicate samples: 5-10% of total samples.
  - Field personnel are responsible that samples are consistently collected according to the protocol and are not tempered.
  - A training workshop will be held for the people responsible for doing the measurements in each country and a written manual will be provided.
  - Spike samples will also be analyzed by the laboratory (tests with known amounts of nicotine).
- **Calculations**: the airborne concentration of nicotine is calculated by dividing the number of μg of nicotine found by the volume of air sampled, which is the number of minutes of sampling times * the flow rate (the flow rate depends of the filter used and it remains unaltered unless there are big changes in temperature).

$$\text{Concentration of nicotine} = \frac{nicotine, micrograms}{Volume \cdots air \cdots sampled} = \frac{nicotine, micrograms}{Flowrate * minutes}$$

We will develop easy-to-understand indicators with the objective to help to disseminate the results in a meaningful way for the policy makers and the general public. The translation into number of cigarettes or some other more appropriate indicator will be considered.

- **Additional data**:
  - Information regarding the location where the monitors are placed will be recorded on the sampling sheet. This information will include: room volume (m^3), number of people that occupy the place in average, number of smokers, distance of the badge from a typical smoker, regulations (presence of any smoking restriction, including panels, written regulations, and evaluation of its compliance). Regarding smoking restriction, especially for cafeterias and restaurants smoking and smoke-free areas will be compared, looking carefully if there is a complete separation between both or not. The average number of smokers will be estimated counting

daily the number of smokers during a 15 minute-period. A sampling sheet to identify each sampler and to collect the previous information will be provided

- A self-administered survey of perceptions and attitudes of smokers and non-smokers (specifically of the persons that are occupying the places where the measurements were taken will be conducted). The survey will contain no more than 10-15 items and will be done on the day the samplers are removed. This survey could identify factors and possible solutions to convincing current smokers to respect non-smokers and smokers to breath smoke-free air. This survey could also serve as a baseline to evaluate changes in attitudes and behaviors.
- Current tobacco control environment in each country and city will be recorded, including policies and regulations (existence and compliance) and general data about tobacco consumption and smoking prevalence (from the tobacco country profile, the National Tobacco Information Online and additional secondary sources).

- **Collection of the data**:
  - Period of time to do all the sampling: 3 months
  - One or two persons should be responsible of the overall collection in each country. These persons should receive the training for the measurements (written protocol and a workshop). In addition, they should maintain continuous contact with one coordinator of all the field work in PAHO or in IGTC.
  - The samplers must be perfectly identified and correlated with its corresponding sampling sheet. The codes for each sampler, including the country code and the location code will be assigned centrally and double stickers will be provided, one for the sampler and one for the sampling sheet, so that they allow blind nicotine and data analysis but assure a perfect identification of each of the locations and countries afterwards.
  - The samplers and filters will be stored before and after the sampling in a place free of smoke and at room temperature.
- **At the beginning of the field work each country needs to have:**

- The list of places and permission to sample the hospital, secondary schools, and city government offices must be ready at the beginning of the field work, as well as the exact sampling places within each location. The places for blank and duplicate measurements will be identified by a random sampling procedure.
- A letter to present in each of the locations to be sampled, explaining the general objectives of the study and requesting permission to the individuals responsible of the direction of the places. A general model that each country can adjust to their own particularities will be provided.
- A written manual in Spanish (or Portuguese or English) of 2-3 pages explaining how the measurements must be realized.
- The samplers perfectly codified
- Sampling sheets to collect the information corresponding to each sampler (including identification of the placement, total amount of time, characteristics of the locations, number of usual smokers).
- Survey of perception and attitudes, to be done at the end of the measurements.

- **Schedule:**
  - April-May: finish all the document necessary for the field work. Each country must identify the places and persons responsible for the measurements.
  - June: pilot study in one of the countries
  - July-August: lab measurements, analysis of the pilot study and modification of the protocol if necessary
  - August-September: training workshop
  - September-November: field work in the rest of the countries
  - December: lab measurements
  - January: analysis of the data
  - February: dissemination of the results
- **Budget:**
  - Laboratory cost per sampling unit: 30 US $
  - Total lab cost per country: 120x30= 3,600 US $

- Total lab cost: 3,600x8= 28,800 US $

LIMITATIONS

- There is a possibility of an *observer bias*: alteration in the smoking pattern if people know that measurements of secondhand smoke are been taken. However, this bias will be minimized as measurements will be taken over a period of one to two weeks and it is difficult for smokers to change their behavior. Also, the letter introducing the study will ask for permission to the responsible of the direction of each of the institutions and will talk about "indoor air quality" in general, and about secondhand smoke as part of it.
- Risk of lose/removals of the samplers. To avoid this problem, the samplers will be located preferably when the workers are not yet at their positions and they must not be too visible. The correct placement of the samplers will be daily verified.
- Variability in the sampling procedures. In order to obtain comparable data across countries and locations quality assurance and control procedures are critical.
- Nicotine may have a different decay rate than other components of tobacco smoke. However, it is the best we can get and fieldwork has demonstrated an excellent correlation with particle concentrations. A similar good correlation has been proven in chamber experiments when certain criteria are met. (Daisey JM, environ health perspect, 1999).

LIST OF PENDING THINGS:

	Responsible
Chronogram of the project	PAHO+IGTC
Budget	PAHO+IGTC (manpower requirement)
Decide the concrete locations	PAHO+IGTC+Each country
Route sheet	Ana
Written manual of the sampling procedure (in Spanish)	Ana+help! (Patrick Breysse)
Training workshop for the persons in each country that are going to do the sampling	PAHO+Patrick Breysse
General Information of the country	Ana (+help)

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Table 1. Meta-analysis of the effect of ETS exposure and different health outcomes

Health effects	Reference	Exposure assessment	Main results[a]	
Children				
Sudden Infant Death Syndrome (SIDS)	Anderson HR and Cook DG. 1997[15]	Self-reported maternal and paternal smoking	Maternal postnatal smoking controlling for prenatal smoking: OR: 1.94 Paternal smoking and mother non-smokers: two studies of three found statistically significant OR equal to 1.63 and 3.41 respectively	
Acute respiratory illnesses (at age 0-2)	Cook DG and Strachan DP. 1999[16]	Self-reported maternal and paternal smoking	Either parent: OR: 1.57 Mother: OR: 1.72 Father only: OR: 1.29	
Chronic respiratory symptoms (age 5-16)	Cook DG and Strachan DP. 1999[16]	Self-reported maternal and paternal smoking	Wheeze: Either parent: OR: 1.24 Both parents: OR: 1.47	Cough: Either parent: OR: 1.40 Both parents: OR: 1.67
Asthma	Cook DG and Strachan DP. 1999[16]	Self-reported maternal and paternal smoking	Asthma (cross-sectional, 5-16 yr): Either parent: OR: 1.21 Both parents: OR: 1.50	Incidence of asthma (<6 yr): Mother: OR: 1.31
Middle ear disease	Cook DG and Strachan DP. 1999[16]	Self-reported maternal and paternal smoking	Recurrent otitis media: OR: 1.48	
Adults				
Lung Cancer	Hackshaw AK et al. 1997[17]	Self-reported spouse smoking among non-smoking	RR: 1.23 But when corrected for “misclassification” bias: 1.42	
	Wells AJ. 1998[18]	ETS exposure at work (?)	RR: 1.39	
	Brown KG. 1999[19]	Serum cotinine and nicotine samples (personal monitors) extrapolated to ETS levels	ETS exposure at work: RR: 1.25 ETS exposure from spouse: RR: 1.39 ETS exposure at work at the 95th percentile of exposure: RR:1.85 ETS exposure from a spouse at the 95th percentile of exposure: RR: 1.91	
	Zhong L et al. 2000[20]	Self reported exposure from parents, spouses, co-workers	RR women: 1.20 and the risk increased with increasing levels of exposure RR men: 1.48	
Chronic infections of lower resp tract	Zmirou D et al. 1990[21]	Self-reported	RR: 1.3	
Cardiovascular diseases	He J et al. 1999[22]		RR of coronary heart disease: 1.25 RR of CHD for home exposure: 1.17 RR of CHD for work place: 1.11	
	Law MR et al. 1997[23]		RR of ischaemic heart disease: 1.30	

[a]All the estimations presented, unless otherwise specify, are statistically significant pooled RR or