Literature Review on Health and Productivity Factors in Kitchens

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ABSTRACT

This paper provides an overview of the current publications regarding the link between indoor air quality and productivity in working places and cooking and health issue in kitchens. First, the paper discusses more generally productivity in working places. Based on the literature review there is no relevant paper on significance of indoor air quality for productivity in kitchen. Then, the existing results dealing with cooking emissions and health are presented. There are surveys dealing with hazardous components of cooking fumes, cooking and cancer risk of women in Asia, who rarely smoke but contract lung cancer relatively often, and also one study of cancer risk of cooks has been found.

BACKGROUND AND NATIONWIDE SCALE

Poor indoor air quality (IAQ) is believed to lead an increase of acute respiratory diseases, SBS symptoms and asthma and allergic exacerbations. These in turn can lead to an increase in absenteeism or a loss of productivity. Current literature contains certain amount of evidence that indoor environmental can significantly influence worker performance through the above problems.

It is determined that for US office buildings, building energy, maintenance, annualized construction and rental costs are exceed by salaries of workers by a factor of 100 (Woods, 1989). Skåret (1992) has published the same kind of study in Norway. He estimated that increased productivity due to improved indoor climate, even at the low estimates, is 10 to 100 times greater than the operational and maintenance costs.

Therefore, a modest increase in productivity can be a reasonable basis to justify expenditure equivalent to a doubling of energy or maintenance, or large increase in construction costs or rents. Now, one of the primary design targets is to design indoor conditions that are conducive to the tasks being performed in that space so as to maximize productivity.

The measures that improve IAQ can significantly increase productivity and health on nationwide scale. Fisk (1997, 1998) has estimated that in the USA the yearly potential gain of productivity increase due to reduction of respiratory infection cases equals to 6-14 billion USD, due to reduction of allergy and asthma cases 2-4 billion USD, due to reduction of sick building syndromes 15-38 billion USD, and due to improved working efficiency 20-200 billion USD. Same kind of results has published by Seppänen (1999). He has estimated that the total annual cost of poor indoor climate in Finland is about 2.7 billion Euros. The National Office of Building Technology and Administration, Norway, estimated in 1991 that poor indoor climate results in a yearly loss of somewhere between 1 and 1.5 billion Euros (NOK 8 to 12) due to reduced productivity, absenteeism and resultant medical treatment (Pillgram 1991). At NOK 0.50 per kWh, a loss of NOK 8 to 12 billion represents 16 to 24 billion kWh of energy (16 to 24 TWh). These are sobering figures when the generally accepted economic potential for energy conservation in Norwegian homes and businesses amounts at best to 10 TWh.

While there is no doubt that effects on health, comfort and performance translate into effects on productivity, there is an urgent need to discover which of the hypothetical mechanisms of cause and effect are valid, to quantify how much each mechanism affects productivity in different work situations, and to validate predictions in the field.

In commercial kitchens, the working conditions are harder than in offices despite the fact there are limited data specially dealing with commercial kitchens. On the other hand, the emission of cooking fumes is obvious health risk for the workers that should also be taken account when the total effect of ventilation is considered.

In this paper, based on literature review the existing results dealing with productivity, health and IAQ in commercial kitchens are presented.

METHOD

The background information is collected from (1) Healthy Buildings workshops, (2) a study of IAQ-associated health and productivity factors in Singapore (Sultan 2001) and (3) lately published productivity pre-study in Finland (Niemelä 2001). All previous sources gave the list of the publications concern with productivity in working places.

To figure out the publications dealing particularly with commercial and residential kitchens, the literature review was carried out.

In table 1, the used keywords are shown in the literature study. The used database Science Citiation Index covers all sciences. The used keywords were quite "open" and they covered wide range of publications. This approach gives all possible reference in that database. On the other hand, it gives also quite many references that are not relevant.

TABLE 1
List of Keywords for Literature Searches and number of found articles

	Keywords	**Found Articles**
Main Search	Kitchen & Indoor Air	54
	Kitchen & Productivity	19
	Kitchen & Health	230
Others	Cook/Chief & lifetime/ life expectancy	1
	Cooking & emissions	0
	& Health hazard	0
	& Health	0

All in all, the search gave quite many references but not so much information about productivity in particular kitchens. Anyhow, it gives references dealing with the health risk of cooking. The main results of the literature search and other sources (like Healthy Building conference) are summarized in the following chapters.

PRODUCTIVITY

Productivity and indoor air quality in kitchens

In the literature search, the total amount of found publications dealing with IAQ and productivity in kitchen were 73 (=54+19). The available material is not giving any relevant information for this literature study. In fact, only one article that really deals with this issue is coming from Halton (by J. Pekkinen etc.). The found publications are concern e.g.:

- Indoor-outdoor pollution problem
- Cooking fuel and IAQ in developing countries
- General pollutants in homes (one source is kitchen)

Productivity in other working places

From other sources (like HB conference, Singaporean and Finnish studies), it is possible to find reference lists, which are deal with productivity issue. This is the summary of these sources. It should be noticed that most of the studies are focus on office environmental. Only few studies are focus on other working places than offices and the most of them are several decades old.

Economical aspects

Wyon (1996) has reviewed published analyses showing that cost-benefit analyses that assume an impact on overall productivity of as little as 0.5 % have shown that the payback time for a general upgrading of currently unhealthy office buildings, defined so as to include about 40 % of the building stock, would be as low as 1.6 years.

Mudarri (1999) has stated that there is a need for public policies that "include the establishment of protocols of good building practices; a rational integration of energy and indoor environmental policies; a guidance and software packages for building owners and others that assist in calculating bottom-line impacts of indoor environmental quality projects."

Dorgan et al. (1999) have stated that "the productivity benefits related to IAQ are an employee health issue" and that "further research is required including:

- Research studies to investigate fully the causal relationship between the indoor air quality of commercial buildings and hypersensitive pneumonitis (HP) and occupational asthma (OA)
- A set of guidelines to perform productivity studies and benchmark existing buildings properly
- Case studies to determine the actual health and productivity benefits that result from improved indoor air quality due to the implementation of HVAC improvement measures."

Productivity and performance of workers in controlled conditions

In simulated office work an extra pollution load, which was a 20-year old used carpet, increased the percentage of dissatisfied from 15 % to 22 %, increased the prevalence of sick building syndromes, and decreased the amount of typing by 6.5 %, Wargocki et al. (1999).

In computer-based neurobehavioral tests modest correlations between higher temperature, lower humidity, and lower air velocity, and lower test results have been observed, Nunes (1993).

Productivity and performance of workers in field studies

The direct measurement of productivity is the ratio of output to the input used to produce the output. Field studies have been conducted in real production environments with the research frames of "intervention" and "case-control". Most of the recently reported studies are conducted in office type workplaces.

One lately published study (Niemelä 2001) is focus on different working places. In this study, Niemelä analyzed productivity and IAQ before and after renovation. The case working-places were: (1) Stock- cold loading place, (2) Tire factory- hot manufacturing place and (3) Teleoperator- normal office (during summer too hot). The used productivity meters were " normal company production meters "; the used meters were direct the production per working hour in factories and handled calls per hour in the teleoperator. In the stock productivity improved 9.3 % and in the teleoperator the productivity deceased 1.8 % - 2.2 % per °C when the temperature rises over the optimal level. In the tire factory, any improvement was not noticed. The expected reason was too short review period.

Lorsch (1994) has described the results of three large studies of office worker productivity involving almost 6000 employees in the USA. Lorsch has concluded that "while there is a preponderance of opinion that improving the work environment leads to higher productivity, quantitative proof of this statement is sparse and controversy. A minority believes that influences outside the workplace primarily determine productivity. Claims of increased productivity due to improved environmental conditions are usually based on surveys, questionnaires, interviews, self- evaluations, and other qualitative measures. Few data exist to evaluate this effect quantitatively. Among the items that affect office-worker productivity, HVAC and IAQ are rated well below such items as privacy, interpersonal communications and relationships, office arrangements, and managerial attention."

The studies in industrial workplaces have mostly covered the influence of very high and very low indoor air temperatures on labour productivity, and accident rates in industrial work. Many of the studies date from former decades. Clements-Croome at al. (1995) have concluded: "research is needed in the following areas

- The meaning of comfort and differences between comfortable, acceptable, preferable and tolerable thermal environments.
- The link between productivity, well-being and comfort or discomfort.
- The relationship between thermal comfort and other design requirements such as air quality, noise and light.
- Optimal design and the relationship between temperature, economics, health, productivity, energy use and comfort."

Boyce (1989) has reviewed a number of case studies of the direct effects of lighting conditions on task performance both in industrial and office type workplaces. Variables used are the illuminance, illuminance uniformity, luminance, glare, the color properties of the light sources and the presence of flicker. Performance is measured in terms of speed or accuracy of production or indirectly in terms of fatigue, absenteeism rate and the incidence of complaints. Boyce has concluded: "case studies tend to have a low degree of experimental control compared to laboratory studies."

As indirect measurement of productivity, the following productivity measures have been recommended in ASHRAE Workshop "Indoor Quality" in Baltimore September 1992 as being significant:

- Absence from work, or workstation

- Health costs including sick leave, accidents and injuries
- Interruptions to work
- Controlled independent judgments of work quality
- Self-assessments of productivity
- Speed and accuracy of work
- Output from pre-existing work groups
- Cost for the product of service
- Exchanging output in response to graded reward
- Volunteer overtime
- Cycle time from initiation to completion of process
- Multiple measures at all organizational levels
- Visual measures of performance, health and well-being at work
- Development of measures and patterns of change over time.

Clements-Croome (1999) has concluded, "A good working environment will help to provide the user with a good sense of well-being, inspiration and comfort. The main advantage of good environments is in terms of reduced upgrading investment, reduced sickness absence, an optimum level of productivity and improved comfort levels. Individuals respond very differently to their environments and the research supports the correlation between worker productivity, well-being and environmental comfort."

Levin (1995) has reviewed that the body's response to its environment is an integration of responses to the separate indoor air quality factors, and there are many possible outcomes of combined or multiple exposures. The combined effects of the thermal environment may be more important than acoustics, lighting and air quality.

Wyon (1996) has shown that individual control equivalent to $\pm$2 °C would satisfy more than 90% of the employees and $\pm$3 °C would satisfy 99 % of the employees, and concluded following a review of the literature that "published experimental data indicate that conventionally acceptable indoor working environments may be affecting human performance by various mechanisms by as much as 5 % to 15 %." The review distinguished between six types of productivity metrics, and cited published work in which each of them had been used:

1. Simulated work - subject performs a realistic but artificial task
2. Diagnostic tests - subject performs a test procedure unlike any real task
3. Embedded tasks - outcome metric derived from part of an existing task
4. Existing measures - existing outcome metrics are made available
5. Absenteeism - new or existing records of sick leave are used
6. Self-estimates - subjects are asked to report their own perceived level of efficiency

HEALTH EFFECT

There are some studies dealing with health effect of cooking. Four found studies present emission of cooking fumes and clarify how much hazardous compounds is in fumes. Three found studies are focus on to show the link between cooking and lung cancer. One study is dealing with cook’s lifetime.

Cooking fumes

Four studies that deal with cooking fumes and health effect were found. Thiebaud (1995) indicates that the fumes generated by frying pork and beef were mutagenicity. So, the cooks are potentially exposed to relatively high levels of airborne mutagens and carcinogens.

Shuguang (1994) analyzed various samples of cooking oil fumes. They found out that there is high concentration of carcinogens in cooking oil fumes. This is likely the reason for high incidence of pulmonary adenocarcinoma in Chinese women.

Vainiotalo (1993) carried out measurements at eight workplaces. The survey confirmed that cooking fumes contain hazardous components. It also indicated that kitchen worker may be exposed to relatively high concentration of airborne impurities.

Li (1993) measured particle size distribution from scrambling eggs, frying chicken and cooking soup. Based on measurements, the concentrations of submicrometer particles increased 10-times during cooking. On the average, the median diameters of scrambling eggs, frying chicken , cooking soup, and of the background conditions were 40 nm, 50 nm, 30 nm, and 70 nm, respectively. Regarding the surface

area-weighted size distributions, the surface median diameter of the four situations were 180 nm, 300 nm, 150 nm, and 220 nm, respectively.

These studies indicate quite clear that cooking fumes contain hazardous components which are potential health risk. The abstracts of the previous studies are shown in Annex 1.

Cooking and lung cancer

Although cigarette smoking is considered to be the most important cause of lung cancer, smoking behavior cannot fully explain the epidemiological characteristics of lung cancer in Asian women, who rarely smoke but contract lung cancer relatively often. Three studies dealing with cooking and lung cancer risk were found. Two of them are from Singapore and the third one is coming from Taiwan.

Seow (2000) results show that inhalation of carcinogens generated during frying of meat may increase the risk of lung cancer among smokers. The risk was further increased among women stir-frying meat daily whose kitchens were filled with oily fumes during cooking.

Ko (1997) reported that the risk of contracting cancer for nonsmoking women appears to be associated with how efficient is the fume extractor.

Based on Ng (1993) study over 97 % of women in Singapore do not smoke, and principle source of indoor air pollution for housewives is passive smoking and cooking. Greater relative odds of respiratory symptoms were associated with the weekly frequency of gas cooking (although statistically insignificantly). Statistical link between chronic cough, phlegm and breathless on exertion were found.

There is statistical link between lung cancer and cooking. The frequency of cooking and inoperative ventilation system increases the risk. The abstracts of the previous studies are shown in Annex 2

Cook’s lifetime

One study dealing with cook’s lifetime was found. Notami (1993) analyzed the association between occupation and cancer of lung and bladder in a case-control study in India. In this study, statistically significant link between the lung cancers with cooks was found. For lung cases, comparing 'ever' employed with 'never' employed in a particular occupation, significantly elevated risks (adjusted for smoking) were found for cooks

SUMMARY

This paper provides an overview of the current publications regarding the link between indoor air quality and productivity in working places and cooking and health issue in kitchens. Based on the literature review there is no relevant paper on significance of indoor air quality for productivity in kitchen. On the other hand, there are some studies dealing with cooking and health issue.

The surveys confirmed that cooking fumes contain hazardous components in both Western and Asia type of kitchens. In one study, the fumes generated by frying pork and beef were found to be mutagenicity. In Asia type of kitchen high concentration of carcinogens in cooking oil fumes has been found out. All this indicates that kitchen worker may be exposed to relatively high concentration of airborne impurities and so the cooks are potentially exposed to relatively high levels of airborne mutagens and carcinogens.

Chinese women are recognized to have a high incidence of lung cancer despite a low smoking prevalence e.g. only 3 % of women smoke in Singapore. The carried out studies show that inhalation of carcinogens generated during frying of meat may increase the risk of lung cancer. The risk was further increased among women stir-frying meat daily whose kitchens were filled with oily fumes during cooking. Also, the statistical link between chronic cough, phlegm and breathless on exertion and cooking were found. In addition, for lung cases significantly elevated risk were found for cooks in India.

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Vainiotalo, Sinikka; Matveinen, Katri (1993), Cooking fumes as a hygienic problem in the food and catering industries , American Industrial Hygiene Association Journal, Volume 54, Issue 7, 1993, Pages 376-382

ANNEX 1- COOKING FUMES

Airborne mutagens produced by frying beef, pork and a soy-based food

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Abstract

Airborne cooking by-products from frying beef (hamburgers), pork (bacon strips) and soybean-based food (tempeh burgers) were collected, extracted, tested for mutagenicity and chemically analysed. The fumes generated by frying pork and beef were mutagenic, with 4900 and 1300 revertants/g of food cooked, respectively. No mutagenicity was detected in fumes from frying tempeh burgers. Bacon fried to a well-done but non-charred state was eight times more mutagenic in a microsuspension Ames/Salmonella test (TA98 with S-9) than hamburgers and about 350 times more mutagenic than tempeh burgers. Among food samples cooked to a well-done, non-charred state, bacon strips had almost 15-fold more mass (109.5 ng/g) than that of the beef, whereas no heterocyclic amine (HCA) was detected in the fried tempeh burgers. 2-Amino-1-methyl-6-phenylimidazo(4,5-b)pyridine (PhIP) was the most abundant HCA, followed by 2-amino-3,8-dimethylimidazo(4,5-f)quinoxaline (MeIQx) and 2-amino-3,4,8-trimethylimidazo(4,5-f)quinoxaline (DiMeIQx). No 2-amino-9H-pyrido(2,3-b)indole (A-alpha-C) was detected in the food samples fried at about 200 degree C, although it was present in the collected airborne products. The total amounts of HCAs in the smoke condensates were 3 ng/g from fried bacon, 0.37 ng/g from fried beef and 0.177 ng/g from fried soy-based food. This study indicates that cooks are potentially exposed to relatively high levels of airborne mutagens and carcinogens and that long-term sampling inside restaurants and kitchens may be warranted in order to assess the potential risk of prolonged exposure.

Analysis of polycyclic aromatic hydrocarbons in cooking oil fumes

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Abstract

Various samples of cooking oil fumes were analyzed to an effort to study the relationship between the high incidence of pulmonary adenocarcinoma in Chinese women and cooking oil fumes in the kitchen Polycyclic aromatic hydrocarbons (PAHs) in samples of cooking oil fumes were extracted, chromatographed, and measured by fluorescence spectrophotometer. The samples included oil fumes from three commercial cooking oils and fumes from three catering shops. All samples contained benzo(a)pyrene (BaP) and dibenzo (a,h)anthracene (DBahA). In addition, the concentration of DBahA was 5.7 to 22.8 times higher than that of BaP in the fume samples. Concentrations of BaP and DBahA were, respectively, 0.463 and 5.736 mu-g/g in refined vegetable oil, 0.341 and 3.725 mu-g/g in soybean oil, and 0.305 and 4.565 mu-g/g in vegetable oil. Investigation of PAH concentrations at three catering shops showed that the level of BaP at a Youtiao (deep-fried twisted dough sticks) shop was 4.18 mu-g/100 m-3, 2.28 mu-g/100 m-3 at a Seqenma (candied fritters) workshop, and 0.49 mu-g/100 m-3 at a kitchen of a restaurant; concentrations of DBahA were 33.80, 14.41, and 3.03 mu-g/100 m-3, respectively. The high concentration of carcinogens, such as BaP and DBahA, in cooking oil fumes might help explain why Chinese women, who spend more time exposed to cooking oil fumes than men, have a high incidence of pulmonary adenocarcinoma.

Cooking fumes as a hygienic problem in the food and catering industries

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Abstract

There are limited data on the emission of cooking fumes into work atmospheres although it is known that these fumes may contain irritants or other harmful substances. Field measurements were carried out at eight workplaces (two bakeries, a food factory, and five restaurant kitchen. Air samples were collected during frying/grilling of meat or fish or during deep-frying, at stationary sampling points close to the cooking apparatus and the active working area. The highest concentrations of fat aerosol (9-16 mg/m-3) were measured in kitchen using the ordinary frying method; lower concentrations were found at other workplaces (lt 0.01-3.2 mg/m-3). The concentrations of acrolein ranged from 0.01 to 0.59 mg/m-3, exceeding the current threshold old limit value (0.23 mg/m-3) in two kitchen The highest concentrations of formaldehyde were found in grill kitchen (0.24 and 0.75 mg/m-3) and the highest concentrations of acetaldehyde in bakeries (0.67 and 1.5 mg/m-3). The concentrations of 2-amino-3,8-dimethylimidazo(4,5-f)quinoxaline (MeIQx) and 2-aminotrimethylimidazo(4,5-f)quinoxalines (DiMeIQx), selected as indicators of the group of mutagenic heterocyclic amines, were below the detection limits, whereas low concentrations of polycyclic aromatic hydrocarbons were encountered. This survey confirmed that cooking fumes contain hazardous compounds. It also indicated that workers may be exposed to relatively high concentrations of airborne impurities.

Size distributions of submicrometer aerosols from cooking

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Abstract

Although gas stove usage varies from country to country, it is still one of the major indoor combustion sources. In order to assess the health effects of using gas stoves, the physical characteristics of the particle emissions from cooking were conducted in a first-floor apartment in the Taipei area. The particle size distributions from scrambling eggs, frying chicken, and cooking soup were measured in the kitchen by a high resolution particle sizer, which could measure the particles in the size range of 0.01 mu-m to 1 mu-m. The concentrations of the submicrometer particles increased significantly from 15,000 cm-3 to 150,000 cm-3 during cooking. Additionally, the ultrafine particles constituted 60%-70% of the total submicron aerosols. The changes in the size distributions and the concentrations of the submicrometer aerosols before, during, and after the aerosol generations were compared. On the average, the median diameters of scrambling eggs, frying chicken, cooking soup, and of the background conditions were 40 nm, 50 nm, 30 nm, and 70 nm, respectively. Regarding the surface area-weighted size distributions, the surface median diameters of the four situations were 180 nm, 300 nm, 150 nm, and 220 nm, respectively. Furthermore, the volume median diameters in the conditions mentioned above were almost similar, namely 300-350 nm.

Annex 2- Cooking and Lung Cancer

Fumes from meat cooking and lung cancer risk in Chinese women

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Abstract

Chinese women are recognized to have a high incidence of lung cancer despite a low smoking prevalence. Several studies have implicated domestic exposure to cooking fumes as a possible risk factor, although the exact carcinogens have yet to be identified. Heterocyclic amines are known carcinogens, which have been identified in cooked meat, and also in fumes generated during frying or grilling of meats. We conducted a case-control study of 303 Chinese women with pathologically confirmed, primary carcinomas of the lung and 765 controls to examine the association between exposure to meat cooking and lung cancer risk. Data on demographic background, smoking status, and domestic cooking exposure, including stir-frying of meat, were obtained by in-person interview while in hospital. The response rates among eligible cases and controls were 95.0 and 96.9%, respectively. The proportion of smokers (current or ex-smokers) among cases and controls was 41.7 and 13.1%, respectively. Adenocarcinomas comprised 31.5% of cancers among smokers and 71.6% among nonsmokers. When cases were compared with controls, the odds ratio (OR) for lung cancer (all subtypes) among ex-smokers was 4.3 (95% confidence interval (CI) 2.7-6.8) and that among current smokers was 5.0 (95% CI, 3.4-7.3). Among smokers, women who reported that they stir-fried daily in the past had a significantly increased risk of lung cancer (adjusted OR, 2.0; 95% CI, 1.0-3.8) and among these women, risk was enhanced for those who stir-fried meat daily (OR, 2.7; 95% CI, 1.3-5.5). Women who stir-fried daily but cooked meat less often than daily did not show an elevated risk (OR, 1.0. 95% CI, 0.5-2.4). Risk was further increased among women stir-frying meat daily who reported that their kitchen was filled with oily fumes during cooking (OR, 3.7; 95% CI, 1.8-7.5). These cooking practices on their own did not increase risk among nonsmokers in our study population. Our results suggest that inhalation of carcinogens, such as heterocyclic amines generated during frying of meat, may increase the risk of lung cancer among smokers. Further studies in different settings are warranted to examine this possibility, which may also help to explain the higher risk observed among women smokers compared with men.

Risk factors for primary lung cancer among non-smoking women in Taiwan

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Abstract

Background. Although cigarette smoking is considered to be the most important cause of lung cancer, smoking behaviour cannot fully explain the epidemiological characteristics of lung cancer in Taiwanese women, who rarely smoke but contract lung cancer relatively often. There are other causes of lung cancer that have produced variability in lung cancer incidence. Methods. A case-control study involving interviews with 117 female patients (including 106 non-smoking) suffering from lung cancer and the same number of individually matched hospital controls was conducted in Kaohsiung, Taiwan between 1992 and 1993. The questionnaire administered to cases and controls collected information on cigarette smoking and suspected risk factors for lung cancer. Multivariate logistic regression analysis was applied to assess smoking for all women and suspected risk factors for non-smoking women. Results. The relationship between cigarette smoking and lung cancer was statistically significant although only a small proportion (9.4%) of female patients had smoked. However, the risk of contracting cancer for non-

smoking women appears to be associated with certain cooking practices, especially preparing meals in kitchen not equipped with a fume extractor at cooking age of 20-40 years (odds ratio (OR) = 8.3; 95% confidence interval (CI): 3.1-22.7. These factors and a history of pulmonary tuberculosis plus low consumption of fresh vegetables explained 78% of the summary attributable risks for non-smoking women in a multivariate logistic regression model. Conclusions. Exposure to fumes from cooking oils, when not reduced by an extractor, may be an important factor in causing lung cancer in non-smoking Taiwanese women.

Respiratory symptoms and lung fuction effects of domestic exposure to tobacco smoke and cooking by gas in non-smoking women in Singapore

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Abstract

Study objectives - To investigate the effects of passive exposure to tobacco smoke and gas cooking at home on respiratory symptoms and lung function of non-smoking women. Setting - Evidence on the effects of passive smoking and exposure to nitrogen dioxide from gas cooking on the respiratory health of adults is limited and variable. Over 97% of women in Singapore do not smoke, and a principal source of indoor air pollution for housewives is passive smoking and gas cooking. Design - This was a cross sectional (prevalence) study of a population based sample of 2868 adults aged 20 to 74 years in Singapore. A structured questionnaire administered by trained interviewers was used to collect data on passive smoking, gas cooking, respiratory symptoms, and other relevant variables. Passive smoking was defined as exposure to cigarette smoke from one or more members of the household who had ever smoked. Gas cooking was defined in terms of the weekly frequency of gas cooking, as well as the frequency with which the respondent's kitchen was filled with heavy cooking fumes (rarely, occasionally, often). Forced expiratory volume in one second (FEV_1) was measured by using a portable Micro-spirometer. Multivariate analyses were used to estimate relative odds of association for respiratory symptoms and FEV_1 effect, with adjustment for potential confounding variables. Participants - Of a total of 1438 women in the sample, 1282 women who had never smoked provided questionnaire data and 1008 women provided acceptable readings of FEV_1 for analysis. Main results - Passive smoking was significantly associated with greater relative odds of usual or chronic cough and phlegm, wheezing, and breathlessness on exertion, as well as lower FEV_1. Greater relative odds of respiratory symptoms were also associated with the weekly frequency of gas cooking, although these results were statistically insignificant. Chronic cough and phlegm and breathlessness on exertion, however, were significantly associated with the frequency with which the kitchen was filled with heavy cooking fumes. A lower FEV_1 was found in women who cooked frequently (more than thrice a week). Conclusion - Domestic exposure to cigarette smoke and gas cooking is associated with increased risks of respiratory symptoms and impairment of lung function in non-smoking women in Singapore.

ANNEX 3- COOK`S LIFETIME

Occupation and cancers of the lung and bladder: A case-control study in Bombay

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Abstract

Associations between occupation and cancers of the lung (n = 246) and bladder (n = 153) were examined in a case-control study (India). Controls (n = 212) comprised cases of oral (75%) and pharyngeal cancers (13%) and non-neoplastic oral diseases (12%) at the same hospital. Only males were studied. A personal interview was conducted and a lifetime occupational history and information on demographic and relevant confounding factors including tobacco use were obtained. For lung cases, comparing 'ever' employed with 'never' employed in a particular occupation, significantly elevated risks (adjusted for smoking) were found for textile workers (odds ratio (OR) = 1.99, 95% confidence interval (Cl): 1.3-3.6) and cooks (OR = 4.48, 95% Cl: 1.2-16.9). High risks were also observed among ship and dockyard workers (OR = 2.87, 95% Cl: 0.8-10.1) and wood workers (OR = 2.88, 95% Cl: 0.9-9.6). For bladder cancers, significantly elevated risk was observed only for chemical/pharmaceutical plant workers (OR = 4.48; 95% Cl: 1.20-16.5). Two other sets of risk estimates were obtained: one by comparison with a second unexposed group made up of occupations where there was little likelihood of exposure to any cancer-causing occupational agent, and the other by fitting logistic regression models to the data. All methods yielded similar risk estimates. Tobacco smoking but not tobacco chewing was a risk factor for both sites.