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Original Research Paper

Respiratory Medicine

THE HEALTH AND SOCIAL IMPLICATIONS OF HOUSEHOLD AIR POLLUTION AND RESPIRATORY DISEASES

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ABSTRACT With the larger population making use of biomass fuels such as wood, coal, dung, and agricultural wastes, many people are increasingly being exposed to household air pollution (HAP). Such a pollution comes about from inhaling smoke from thesefuels and it could result in respiratory diseases. This paper analyzes various materials that analyze the health and social impacts of household air pollution and respiratory diseases. The analysis shows that HAP can result in several health implications by causing respiratory diseases such as asthma, chronic obstructive pulmonary disease, tuberculosis, and lung cancer. The study further establishes that there are social impacts of HAP as it has a more impact on women. Various treatment options and implication to healthcare professionals are also considered.

KEYWORDS : House air pollution, respiratory diseases, biomass fuels.

Introduction

Household Air Pollution (HAP) comes from an incomplete combustion of biomass fuels such as coal, wood, dung, and agricultural crop waste. Approximately 42.2% or three billion people of the world population continue to make use of biomass fuels as a result of having a poor access to having clean energy (Bryden et al. 53). The relationship between household air pollution and respiratory diseases have not been adequately identified. Respiratory diseases have caused a significant burden to the world and have been found to have caused 92.5 million disability-adjusted life years (Hay et al. 1260). Additionally, respiratory diseases have resulted in further issues such as premature mortality, social consequences, lost productivity, and significant disability. With household air pollution being one of the risk factors to the development of respiratory diseases, there is a need to identify the relationship between HAP and respiratory diseases. The objective of this paper is thus to analyze the relationship between HAP and respiratory diseases and to observe the health and social implications and the treatment and interventions.

Methods

The method that was applied in the study was the use of both primary data and secondary sources to characterize the relationship between HAP and respiratory diseases. The data regarding the use of biomass fuels, household air pollution and the resultant respiratory diseases was retrieved from the world health organization. The data was critically analyzed in order to the social and health impacts of HAP. Peer-reviewed sources were also selected and critically used for the discussion. The objectives of the study thus included to show the relationship between HAP and respiratory diseases, to analyze the social impacts of HAP, to analyze the treatment option of respiratory diseases through physiotherapy, and to show implications of the relationship of HAP and respiratory diseases to health professionals.

Results

The results from the estimates of the population that is exposed to household air pollution was identified at 39%. The prevalence of household air pollution was prevalent in low and middle income countries with 83% in Africa, 55% in South-East Asia region, and 43% in the pacific region showing the highest percentage of being exposed to HAP. The data also revealed the burden of HAP as it showed that there were 4.2 million deaths that were reported in 2016 that could be attributed to HAP. 82% of the deaths were attributed to lung cancer, COPD, stroke, and acute lower respiratory infection. The data from the WHO further revealed that 26% of the deaths were attributed to acute lower respiratory infection (ALRI), 25% to COPD, 16% to Lung cancer, and 14% to stroke ("World Health Organization", 2018).

A sample country of India was selected from the World Health Organization for the analysis of household air pollution and respiratory diseases.The study revealed that more men (561,638) than women (524,229) died from HAP at all ages with the total number of deaths from HAP in India being 1,085,867 in the year 2016. However, more women (164,611) died as a result of COPD than men (142,129) (see table 1). The study thus indicated that both men and women equally experience the negative impacts of HAP. There were also other respiratory diseases such as lung cancer, stroke, and ALRI that the population suffered from

Table 1. Deaths from Household Air Pollution in India.

ISL	Iceland	2016	All diseas	m	All ages (AP)	-
IND	India	2016	All diseas	m	All ages (AP)	561,638
IND	India	2016	All diseas	b	All ages (AP)	1,085,867
IND	India	2016	All diseas	f	All ages (AP)	524,229
IND	India	2016	IHD	m	25+	216,617
IND	India	2016	COPD	f	25+	164,611
IND	India	2016	COPD	b	25+	306,740
IND	India	2016	IHD	b	25+	349,307
IND	India	2016	COPD	m	25+	142,129
IND	India	2016	ALRI	f	All ages (ALRI)	148,407
IND	India	2016	ALRI	b	All ages (ALRI)	258,172
IND	India	2016	IHD	f	25+	132,690
IND	India	2016	ALRI	m	All ages (ALRI)	109,764
IND	India	2016	Stroke	m	25+	70,313
IND	India	2016	Stroke	b	25+	138,645
IND	India	2016	Stroke	f	25+	68,332
IND	India	2016	ALRI	f	0	36,073
IND	India	2016	ALRI	b	0	66,891
IND	India	2016	Lung canc	m	25+	22,814
IND	India	2016	ALRI	m	0	30,817
IND	India	2016	Lung canc	b	25+	33,002
IND	India	2016	Lung canc	f	25+	10,188

Source: "Air Pollution". *Who.Int*, 2018,

https://www.who.int/airpollution/data/hap_bod_may2018_v0.xlsx?ua=1

Discussion

Health Impacts

Household air pollution has been identified as one of the significant risk factors for an increase in respiratory infections and respiratory symptoms. The odds of the development of respiratory disorders has been identified to be more than one among individuals that have been exposed to household air pollution (Jindal, Aggarwal, & Jindal 128). The specific respiratory disorders that can be caused by HAP include asthma, COPD, tuberculosis, and lung cancer. HAP can also lead to non-respiratory problems such problems with pregnancy like prematurity and low birth weight.

Lung Function

The lung function of patients is one of the critical factors that can be used to analyze the relationship between household air pollution and respiratory diseases. Individuals that have been exposed to HAP were found to have a more significant decline in their lung function compared to individuals that were not exposed to HAP. Simkovichanalyzed such a relationship and the results were as shown in figure 1 (2). The lung function was measured according to the forced expiratory value in one second (FEV1). The results varied and there was a more significant predicted decline when one had been exposed to HAP. Those that had not been exposed to HAP showed the least decline and those that were no longer exposed to HAP at the later stages of their lives also experienced a lesser decrease in their lung function.

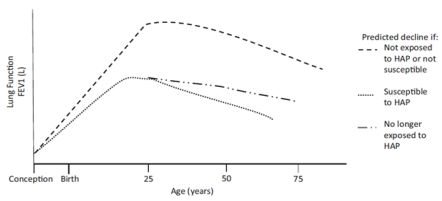

Fig. 1. Lung Function (FEV1) and Age for HAP exposed and Not Exposed to HAP Individuals from: Simkovich, Suzanne M., et al. "The health and social implications of household air pollution and respiratory diseases." NPJ primary care respiratory medicine 29.1 (2019): 2.

Chronic Obstructive Pulmonary Disease (COPD)

COPD, a common lung disease that makes it difficult to breath, can be associated with household air pollution. The results of the study revealed that there were high occurrences of COPD among patients that had been exposed to household air pollution. Siddharthan et al. observed that participants that had been exposed to HAP were 41% more likely to have COPD compared to those that had not been exposed (611). The results also revealed that the association of HAP and COPD was stronger in women than in men. Figure 2 shows the relationship between the prevalence of COPD by age among patients that used biomass as their main fuel source (B) and those that did not use biomass as their main fuel ©.

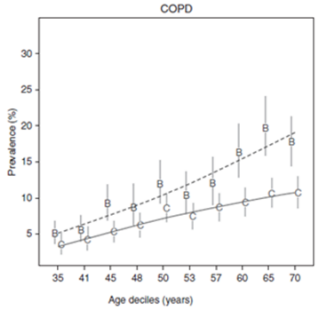

Fig. 2. Rela... ...OPD Patients from:Siddharthan et al. Association between household air pollution exposure and chronic obstructive pulmonary disease outcomes in 13 low-and middle-income country settings. American journal of respiratory and critical care medicine, 197(5), 617.

Asthma

The development of asthma has also been closely associated with exposure to household air pollution. Ranathunga et al. studied 260 children that had incidences of infection-induced asthma (306). The results showed that the incidences of infection-induced asthma were significantly higher among children that lived in resident households that made use of kerosene and biomass fuel. The results were as shown in the table 2. The high exposure group (exposed to kerosene and biomass fuel) and the low exposure group (not exposed to household air pollution) were compared. The results of the study showed that infection-induced asthma had 124 episodes for the high-exposure group compared to 42 for the low exposure group. The incidence rate was 70.1 for the high exposure group and 34.5 for the low exposure group (Ranathunga et al.8).

Table 2 Respiratory Diseases for High Exposure VsLow Exposure Group

Respiratory diseases	High exposure group[d]	Low exposure group[e]
URTI[a]		
Number of episode	91	61
Total child months	1768	1218
Incidence Rate (Number of episodes / 1000 months of observation)	51.5	50.1
LRTI[b]		
Number of episodes	166	70
Total child months	1768	1218
Incidence Rate (Number of episodes / 1000 months of observation)	93.9	57.5
RTI[c]		
Number of episodes	257	131
Total child months	1768	1218
Incidence Rate (Number of episodes / 1000 months of observation)	145.4	107.6
Asthma		
Number of episodes	378	264
Total child months	1768	1218
Incidence Rate (Number of episodes / 1000 months of observation)	213.8	216.7
infection induced asthma		
Number of episodes	124	42
Total child months	1768	1218
Incidence Rate (Number of episodes / 1000 months of observation)	70.1	34.5
Rhinitis		
Number of episodes	249	181
Total child months	1763	1217
Incidence Rate (Number of episodes / 1000 months of observation)	141.2	148.7

Source: Ranathunga, Nayomi, et al. "Effect of household air pollution due to solid fuel combustion on childhood respiratory diseases in a semi urban population in Sri Lanka." BMC pediatrics 19.1 (2019): 8.

Tuberculosis

The global burden from tuberculosis has been increasing and it can be attributed to exposure to household air pollution. Petersen et al. examined the relationship between exposure to air pollution such as cooking fires (30). The results showed a positive associationbetween the high rates of tobacco use and the use of polluting biomass fuels for cooking.The implications of the results showed that the prevention of illnesses such as TB should focus on both environmental health programs that focus on reducing use of biomass fuels.

Lung Cancer

The risks of lung cancer can also be associated with the increased exposure to household air pollution (HAP).The results from the study showed that lung cancer could be attributed to 25% of the deaths from household air pollution. Raspanti et al. analyzed the risk of lung cancer among individuals that were exposed to household air pollution (141). The study established that there was a significant increase in risks of lung cancer with exposure to HAP from biomass combustion. The studied population was identified as never-smokers but exposure to biomass combustion increased the risks of acquisition of lung cancer.

Social Impacts

The social impacts of household air pollution are usually

caused by the high incidences of mortality that lead to a reduction in the working population.The analysis of the data revealed that there was approximately 82% of deaths from 2016 that could be attributed to HAP. The burden of HAP significantly falls on women and children who spend most time around the home breathing harmful smoke and from polluted fires (Lee &Wankyo3l).This can socially affect women who have an increased mortality rate leading to an impact on a specific population. The mortality can also result in labor and welfare and income losses that could amount to $94 billion and $1.6 trillion respectively as a result of exposure to HAP (Washington). Such huge amount of losses can be associated with the poverty trap where those that have poor health get exposed to HAP and thus cannot work as a result of respiratory problems making their wages become smaller. Children may also be forced to miss schools and women have fewer opportunities to engage in other economic activities.

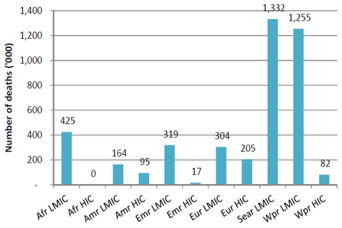

Fig. 3. Deaths Attributed to Household Air Pollution in 2016 (Afr: Africa; Amr: America; Emr: Eastern Mediterranean; Eur: Europe; Sear: South-East Asia, Wpr: Western Pacific; LMIC: Low- and middle-income; HIC: High-income.) from: World Health Organization. "Burden of Disease from Ambient Air Pollution." Glob. Health Obs. Data (2018).

Treatment

One of the treatment options for patients with respiratory disease is through physiotherapy specifically through respiratory physiotherapy. Respiratory physiotherapy techniques include huffing and puffing, postural drainage, percussions, and vibrations. The use of respiratory physiotherapy has been found effective in increasing vital capacity and reducing hospital stay (Mane &Luisiana 83). The use of after-hours physiotherapy for community-acquired pneumonia was also found to have a high response rate of 72% and a treatment response of 83% (van der Lee 349). The results indicated that the use of respiratory physiotherapy can be used to improve the conditions of patients that have respiratory diseases.

Implications to Medical Professionals

The implications of the study with respect to the exposure of household air pollution and high incidences of respiratory diseases has several implications for medical science research, the chest disease doctor, and the medical social worker. Medical science research should critically explore the problem over a wider population and track various individuals over several years. This should potentially show a more accurate relationship between the risk factors of respiratory diseases such as HAP. The chest disease doctor should be aware of patients that have been actively exposed to HAP and identify that these patients may not reach their optimal lung function (Vogelmeier et al. 557). Although a patient may not have smoked cigarettes, the exposure to HAP should be identified by medical professional as a risk factor for the development of respiratory diseases (Tammemägiet al. 728). The medical social worker should also be involved in teaching the community regarding the risks of HAP. They should ensure that the community is educated regarding new technology that would have lower levels of pollution.

Conclusion

The findings from the study showed a potential relationship between household air pollution and respiratory diseases. HAP was found to cause several health complications such as lung cancer, COPD, asthma, and tuberculosis. These health complications and the mortality associated with it could have social implications as it could decapitate the workforce leading to a poverty trap. The treatment option that was identified was through the use of respiratory physiotherapy that could improve one's health condition in the long term. The findings also had several implications for medical science research, the chest disease doctor, and medical social worker. All these individuals should be involved in educating the community with regard to the risks of HAP and the potential respiratory diseases.

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