

# Social and Environmental Effects of Smog on Public Health

Quratulain Manzoor<sup>\*1</sup>

[am8832169@gmail.com](mailto:am8832169@gmail.com)

Hafiza Zainab Khatoon<sup>2</sup>

[zainab.khatoon@siss.uol.edu.pk](mailto:zainab.khatoon@siss.uol.edu.pk)

Sehrish Naz<sup>1</sup>

[sehrishnaz705@gmail.com](mailto:sehrishnaz705@gmail.com)

Dr. Usman Shaukat<sup>2</sup>

[usmantarar927.UT@gmail.com](mailto:usmantarar927.UT@gmail.com)

Dr. Bushra Yasmeen<sup>1</sup>

[bushrayasmeen@gmail.com](mailto:bushrayasmeen@gmail.com)

<sup>1</sup>Department of Sociology, Lahore Leads University, Lahore (Pakistan)

<sup>2</sup>University of Lahore, Sargodha (Pakistan)

\*Corresponding Author: [am8832169@gmail.com](mailto:am8832169@gmail.com)

## Abstract

All human behaviors, including social, psychological, and environmental actions, have an impact on human health, and are accountable for causing current environmental challenges and issues. This is advancing the importance of education, particularly environmental education, as a necessary factor to look after. International declarations have highlighted that investigating people's environmental awareness, attitudes, and behavior towards environmental issues could inform educational approaches geared towards a more sustainable future. The research explored the most toxic cause of smog, environmental Effects, social Effects, and behavior of human health in Lahore, Iqbal Town (A and D block of Johar Town). The aim of research is to investigate the current context of human health in smog episodes. An interpretive approach was used to explore participants' perspectives through a mix of quantitative and qualitative data, including questionnaires. Two populations were included: 13392 households (A block) and 672 (D block). Two different computer software programs (SPSS for quantitative and MS word for qualitative data) were used for data analysis, coding and writing. The findings indicated that people had reasonably high levels of understanding about environmental issues, particularly local issues which have greater impact on their everyday lives, such as air pollution. This highlights the important issue of context. Researches have shown that both social and environmental effects are responsible for human health and diseases and relevant daily routine disturbance. This includes modification of their environmental education, social education, and health awareness towards a more health conscious approach of living safe lives. In order to do this, the internal

and external obstacles described in this thesis will need to be addressed to help Lahore develop more environmentally.

**Keywords:** Social, Environmental, Smog, Public Health

## **1. Introduction**

Smog is the most alarming word taking all attention of public health towards itself. With the increasing population, many health issues are emerging like pollution of air, land and water that leads towards a number of diseases such as chest, cardiac, respiratory and pulmonary. Recently in few years' cases of death due to suffocation came to a highlight of news. Before one or two decades there were one or two cases were noticeable due to suffocation or air pollution. Now horrifying increase worsens the situation. In recent years, city smog has become one of the most serious environmental hazards confronting the government and affecting the country's citizens. The word of "Smog" is composed of two words "smoke" and "fog", which was termed in 1900s in London for the first time in 1900. (Chung, K. F., Zhang, J. J., & Zhong, N., 2015). The city experienced its week long episode of "killer smog" in December 1952 forwarding to increased morbidity and mortality that was resulted to smoke from coal combustion. Problem is increasing day by day, from California to China and now spreading all over the world through north and east areas too. Smog became cause of problems like difficulty in breathing, asthma, eye irritation and lung infections. Pakistan is also facing smog from a decade. Especially metropolitan areas like Lahore, Karachi and Faisalabad due to high population rate. "In 2018, Lahore ranked 10 in IQAir AirVisual's 2018 World Air Quality Report. Neighboring city Faisalabad's air pollution ranked number 3, while air pollution in Islamabad – Pakistan's capital city – came in significantly lower at number 239. Karachi air pollution was the lowest among the four cities at number 318. On the orders of court in start of 2017 government order IQAIR visuals to rank smog and report about it in Pakistan.

### **1.1 Purpose of the Study**

This study is about the assessment of social and environmental effects of smog on public health. This is a very sensitive issue worldwide which is needs to research with different perspectives. Air pollution in summer vacation can cause many hazardous effects on human health. It can cause sudden and serious illness and deaths especially those people who have respiratory or lungs issues. Heavy polluted air causes eye irritation, lungs issues and skin allergy apparently. In previous years it has been seen that how pollution is getting strong day by day due to increase in population. Number of people is way more than the number of natural resources earth having. Increase in number of people also increases traffic which increases smoke.

### **1.2 Significance of the Study**

There is a need to study behaviors of people in smog days that how they feel and cope with the social and environmental changes, what remedies adopted presently and in and future. This study will observe social and environmental effects on public health. Study focuses on how smog is

affecting life i.e. to know the sources vehicles, burning, combustion and winter heating the main causes of air pollution and the precautionary measures to control the social, psychological and environmental Effects.

### **1.3 Objectives of the Study**

- To find out significant source of smog.
- To find out the environmental effects of smog on public health.
- To find out the social effects of smog on public health.
- Suggestions/public opinion regarding remedies.

## **2. Literature Review**

In a study of California many researches show that in previous fifteen years vehicles emissions is the biggest source of air pollution. Studies of “los Angeles” show that motor vehicles or automobile exhaustion are major cause of smog in these areas (Chaichan, M. T., Kazem, H. A., & Abed, T. A. 2018).

Another study in China with the rapid increase of population there is a big increment in industrialization which leads the social change towards a massive increase in vehicle exhaust by use of automobiles. The excessive consumption of fuel is directly related to smog. The more the population is the more the emission of smoke in environment which cause smog (Wang, F., Zheng, P., Dai, J., Wang, H., & Wang, R, 2019).

Automobiles and power plants leading to the production of airborne particles (other name called particulate matter) and ozone of ground level. Ozone effects human health according to its location. for example, if it is present in stratosphere it is beneficial to human health and when it is present on ground floor it is injurious to health (Schizer,2016; Park, A., & Conway, M. 2018).

Particulate matter (PM) is of different diameters but its PM10 and PM2.5 (particulate matter  $\leq$  2.5  $\mu\text{m}$  in diameter), which are main contributors for making human health ill. The small size of these pollutants are facilitators for their entry into lung alveoli, hampering gaseous exchange and even penetration of the lung to enter the blood stream significantly causing to health issues. Particulate matter and ozone are ranked at 5th and 33rd position respectively among the global ranking of risk Effects for total deaths from all causes in 2015 (Geng, G., & Ni, R. 2017).

Spontaneous and unchecked industrial development, growth of industry within urban and metro areas, unchecked industrial emissions, lack of air quality surveillance and arrangements, growing number of vehicles causing air pollution and sound pollution, lack of vehicular maintenance like no action regarding smoke and carbon waste deposit strategies (Park, A. 2018), coal plant emissions and coal combustion, uncontrolled tree felling and wood stealing, rapid infrastructure development without environmental consultant and open burning of rice stubble and solid waste and emission of all burned substances are the causes of smog production (Schizer, D. M. 2016).

Mohai also reported that the highest proportions of students who failed to meet state educational testing standards in schools located in areas with the highest air pollution levels in Michigan. In Social Effects we see traffic problems due to dust in air cause low visibility. (Zhang, K. 2016)

Low visibility causes many swear accidents in smog days. In a study of jing-jin-ji rejoin of china

a research says that there may be a chance of skilled labor sudden migration due to smog. Smog can cause brain drain, (Lu, H., Yue, A., Chen, H., & Long, R. 2018). It increases social distance and reduce social relationships due to less outdoor activities.

Awareness and knowledge of risk are usually not learnt through direct personal experiences (Chung, 2011). A variety of information sources subsidize to the way in which people react to risk. The source plays a central role in transferring risk information, which is based on the classic six-component communication model of source > channel > message > receiver > effect > feedback (Lindell et al., 2012).

## 2.1 Conceptual Frame Work of Study

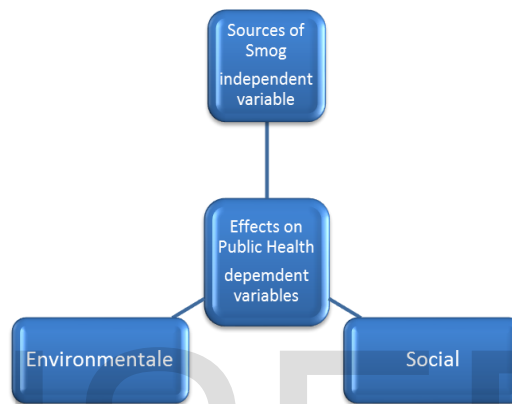


Figure: 1 Conceptual Frame Work

## 3. Methodology

A cross sectional survey method was used. Probability sampling procedure was adopted. To get in-depth information, quantitative and qualitative techniques were used. A questionnaire was designed having closed ended and open-ended questions. Lahore was selected – a metropolitan city and the capital of the Province Punjab and it is one of the biggest and developing cities where people used to come and live for the sake of studies and employment. Questionnaire was used for the data collection.

### 3.1 Universe

Lahore city was selected as a universe for data collection. The current metro area population of Lahore in 2020 is 12,642,000, a 3.72% increase from 2019. It is the capital city of the province of Punjab and is the main center for culture in both the Punjab region and in Pakistan as a whole. The population density currently sits around 6,300 residents per square kilometer (16,000 individuals per square mile). Lahore is divided into 9 administrative towns and one military designated area.

### 3.2 Sampling Frame

By using systematic random sampling technique, from Iqbal Town; Johar Town was selected. Two blocks A and D were randomly selected having households' (A-13392 and D-672). Total households were 14046 (Wei, 2016).

### 3.3 Sample Size

The researcher randomly selected every 36 houses to get a sample of 390. Sampling interval was 36. Research collected data one person from each household. Taro Yamane formula with 95 % confidence level was also applied (Yamane, 1973) presented as follows:

$$n = \frac{N}{1 + N(e)^2}$$

Where: n= sample size required: N = number of people in the population: e = allowable error (%) (0.05)  
According to formula  $n=14064/1+14064(0.05*0.05)$ . : Hence, N = 390 (approximately).

### 3.4 Pre-Testing

For better understanding of the questions, the questionnaire was translated into Urdu for public convenience and to get the appropriate responses from the population of 18+ who may easily read and write. To improve the quality of the statements and the appropriation of the response categories pre-testing was conducted.

### 3.5 Reliability and Validity of the Instrument

To address the reliability and validity of the questionnaire, Cronbach's Alpha-Coefficient was used. Formula is:

$$\alpha = \frac{n}{n-1} \left( 1 - \frac{\sum_i V_i}{V_i} \right)$$

Where  $\alpha$  = Reliability: n = Number of questions in questionnaire:  $V_i$  = Variability of each of question score: V- test = Variability of each of overall questions' score (not %'s) on the entire test: The reliability and validity of the instrument was 0.868 which was around 0.85 considered valid.

### 3.6 Data Collection

Due to covid-19 lockdown the questionnaires were sent through internet in Johar Town-a highly crowded and populated area of Lahore. Data collection was collected in Jun and July, 2020. This was a critical phase when people around the whole world were facing COVID-19 pandemic. People were performing intense social distancing. Strict orders have been issued from government to public for staying at home, try maximum not to touch anything or meet any one. Even highly precautionary measures have been issued to follow for self-care. So, it was very difficult to collect which took too much energy and time.

## 4. Results and Discussion

The data analysis is divided into five sections. First section is about the general information of the respondents. Section two includes cross tabulations among study variables. Section 3 is about the Chi-square Test for Independent Sample and Section 4 is about the Analysis of relationship between the variables. Correlation test was applied on the data set. Section 5 is about the qualitative data analysis which includes Remedies and Suggestions.

<b>Gender</b>	<b><i>f</i></b>	<b>%</b>
Male	213	54.6
Female	177	45.4
Total	390	100.0

Mean =1.4538; S.D =.49850

Table: 1 Gender

Data (Table 1) shows that out of 390 respondents, there were 213(55%) males and 177(45%) were females.

<b>Marital status</b>	<b><i>f</i></b>	<b>%</b>
Ever married	189	48.5
Never married	201	51.5
Total	390	100.0

Mean=1.515; S. D=0.50041

Table: 2 Marital Status

Data (Table 2) shows that out of 390 respondents, there were 189(48.5%) married and 201(51.5%) unmarried people.

<b>Age</b>	<b><i>f</i></b>	<b>%</b>
0 to 20	112	28.7
20 to 40	175	44.9
41 to 60	79	20.3
above 60	24	6.2
Total	390	100.0

Mean=2.0385; S. D=0.85808

Table: 3 Age

Data (Table 3) shows that out of 390 respondents, there were 112(28.7%) people having age 0 to 20, 175(44.9%) having age between 20 to 40, 79(20.3%) people's age is between 41 to 69 and 24(6.2%) people have age above 60.

<b>Education</b>	<b><i>f</i></b>	<b>%</b>
fundamental	81	20.8
Secondary	204	52.3
University	73	18.7
others	32	8.2
Total	390	100.0

Mean =2.1436 S. D=0.83920

Table: 4 Education

Data (Table 4) shows that out of 390 respondents, 81(20.8%) people have fundamental education, 204(53.3%) have secondary level education, 73(18.7%) have university level of

education and 32 (8.2%) people have other types of education.

Employment Status	<i>f</i>	%
Working	205	52.6
Nonworking	185	47.4
Total	390	100.0

Mean =1.4744; S. D=0.49998

Table: 5 Employment

Data (Table 5) shows that out of 390 respondents 205(52.6%) are working while 185(47.4%) are non-working people. To examine the relationships between multiple study variables/groups variables, cross tabulation method was adopted to understand the correlation between different variables. It also shows how correlations change from one variable grouping to another.

Source 1 (Motor vehicles and auto mobiles)		Gender		Total
		male	Female	
strongly agree	Count	200	149	349
	% within Source:1	57.3%	42.7%	
	% within q1	31.3%	28.1%	
	% of Total	17.1%	12.7%	29.8%
Agree	Count	245	196	441
	% within Source:1	55.6%	44.4%	
	% within q1	38.3%	36.9%	
	% of Total	20.9%	16.8%	37.7%
Neutral	Count	130	113	243
	% within Source:1	53.5%	46.5%	
	% within q1	20.3%	21.3%	
	% of Total	11.1%	9.7%	20.8%
disagree	Count	50	44	94
	% within Source:1	53.2%	46.8%	
	% within q1	7.8%	8.3%	
	% of Total	4.3%	3.8%	8.0%
strongly disagree	Count	14	29	43
	% within Source:1	32.6%	67.4%	
	% within q1	2.2%	5.5%	
	% of Total	1.2%	2.5%	3.7%
Total	Count	639	531	1170
	% of Total	54.6%	45.4%	100.0%

Table: 6 Motor vehicles/Auto-mobiles with Gender

Pearson's  $\chi^2 = .010$  significant at  $p < 0.05$

			Marital Status		Total
			ever married	never married	
Source:1 <sup>b</sup>	strongly agree	Count	162	187	349
		% within Source:1	46.4%	53.6%	
		% within q2	28.6%	31.0%	
		% of Total	13.8%	16.0%	29.8%
	agree	Count	210	231	441
		% within Source:1	47.6%	52.4%	
		% within q2	37.0%	38.3%	
		% of Total	17.9%	19.7%	37.7%
	neutral	Count	133	110	243
		% within Source:1	54.7%	45.3%	
		% within q2	23.5%	18.2%	
		% of Total	11.4%	9.4%	20.8%
disagree	Count	43	51	94	
	% within Source:1	45.7%	54.3%		
	% within q2	7.6%	8.5%		
	% of Total	3.7%	4.4%	8.0%	
strongly disagree	Count	19	24	43	
	% within Source:1	44.2%	55.8%		
	% within q2	3.4%	4.0%		
	% of Total	1.6%	2.1%	3.7%	
Total	Count	567	603	1170	
	% of Total	48.5%	51.5%	100.0%	

Table: 7 Motor Vehicles/Auto-mobiles) with Marital Status

Pearson's  $\chi^2 = .421$  insignificant at  $p < 0.05$

			Age				Total
			0 to 20	20 to 40	41 to 60	above 60	
Source1	strongly agree	Count	94	165	69	21	349
		% within Source1	26.9%	47.3%	19.8%	6.0%	
		% within q3	28.0%	31.4%	29.1%	29.2%	
		% of Total	8.0%	14.1%	5.9%	1.8%	29.8%
	Agree	Count	117	202	94	28	441
		% within Source1	26.5%	45.8%	21.3%	6.3%	
		% within q3	34.8%	38.5%	39.7%	38.9%	
		% of Total	10.0%	17.3%	8.0%	2.4%	37.7%
	Neutral	Count	68	112	46	17	243
		% within Source1	28.0%	46.1%	18.9%	7.0%	
		% within q3	20.2%	21.3%	19.4%	23.6%	
		% of Total	5.8%	9.6%	3.9%	1.5%	20.8%
Disagree	Count	41	27	22	4	94	
	% within Source:1	43.6%	28.7%	23.4%	4.3%		
	% within q3	12.2%	5.1%	9.3%	5.6%		
	% of Total	3.5%	2.3%	1.9%	0.3%	8.0%	
strongly disagree	Count	16	19	6	2	43	
	% within Source:1	37.2%	44.2%	14.0%	4.7%		



	% within q3	4.8%	3.6%	2.5%	2.8%	
	% of Total	1.4%	1.6%	0.5%	0.2%	3.7%
Total	Count	336	525	237	72	1170
	% of Total	28.7%	44.9%	20.3%	6.2%	100.0%

**Table: 8 Motor vehicles/Auto-Mobiles with Age**

Pearson’s  $\chi^2 = 0.37$  insignificant at  $p < 0.05$

This data shows that majority of people 47.3% having age group 20-40 strongly agree with source 1 4.7% which is traffic cause smog while only 2 people having age above 60 strongly disagree with this source. 31.4% respondents strongly agreed with the question statement while 2.5% of age group 40 to 60 strongly disagrees with the question statement.

In total 14.1% having age group 20-40 years strongly agree with the statement that motor vehicles/automobiles causing smog. While 0.2% respondents of above 60 years strongly disagree with this.

			Education				Total
			fundamental	secondary	university	others	
Source1	strongly agree	Count	70	189	62	28	349
		% within source1	20.1%	54.2%	17.8%	8.0%	
		% within q4	28.8%	30.9%	28.3%	29.2%	
		% of Total	6.0%	16.2%	5.3%	2.4%	
Agree	Agree	Count	97	231	85	28	441
		% within source1	22.0%	52.4%	19.3%	6.3%	
		% within q4	39.9%	37.7%	38.8%	29.2%	
		% of Total	8.3%	19.7%	7.3%	2.4%	
Neutral	Neutral	Count	47	125	43	28	243
		% within source1	19.3%	51.4%	17.7%	11.5%	
		% within q4	19.3%	20.4%	19.6%	29.2%	
		% of Total	4.0%	10.7%	3.7%	2.4%	
Disagree	Disagree	Count	16	50	20	8	94
		% within source1	17.0%	53.2%	21.3%	8.5%	
		% within q4	6.6%	8.2%	9.1%	8.3%	
		% of Total	1.4%	4.3%	1.7%	0.7%	
strongly disagree	strongly disagree	Count	13	17	9	4	43
		% within source1	30.2%	39.5%	20.9%	9.3%	
		% within q4	5.3%	2.8%	4.1%	4.2%	
		% of Total	1.1%	1.5%	0.8%	0.3%	
Total	Total	Count	243	612	219	96	1170
		% of Total	20.8%	52.3%	18.7%	8.2%	

**Table: 9 Motor vehicles/Auto Mobiles with Education**

Pearson’s  $\chi^2 = 0.856$  insignificant at  $p < 0.05$

Data shows that people from secondary education level strongly agree with a count of 189 where majority of people from secondary group having count of 231 “agree” with the question statement. In minorities 4 % from other education level people strongly disagree with the statement.

			Employment		Total
			working	nonworking	
Source:1	strongly agree	Count	189	160	349
		% within Source1	54.2%	45.8%	
		% within q42	30.7%	28.8%	
		% of Total	16.2%	13.7%	29.8%
Agree	Agree	Count	228	213	441
		% within source1	51.7%	48.3%	
		% within q42	37.1%	38.4%	
		% of Total	19.5%	18.2%	37.7%
Neutral	Neutral	Count	124	119	243
		% within source1	51.0%	49.0%	
		% within q42	20.2%	21.4%	
		% of Total	10.6%	10.2%	20.8%
Disagree	Disagree	Count	55	39	94
		% within source1	58.5%	41.5%	
		% within q42	8.9%	7.0%	
		% of Total	4.7%	3.3%	8.0%
strongly disagree	strongly disagree	Count	19	24	43
		% within source1	44.2%	55.8%	
		% within q42	3.1%	4.3%	
		% of Total	1.6%	2.1%	3.7%
Total	Total	Count	615	555	1170
		% of Total	52.6%	47.4%	100.0%

Table: 10 Motor vehicles/Auto-Mobiles with Employment  
Pearson's  $\chi^2 = 0.746$  insignificant at  $\rho < 0.05$

To find out the relationship among environmental and social Effects, correlation test was applied on the data set. Results are presented in the presented table 4.33.

	1	2	3	4	5	6	7	8	9	10	11	12
Automobiles	1.000											
Burning	1.63**	1.000										
Construction	0.00	1.54**	1.000									
Winter heating	0.051	0.189**	0.397**	1.000								
Eye problem	0.074	0.249**	0.103*	0.140**	1.000							
Pulmonary problem	-0.012	0.060	0.040	0.017	0.376*	1.000						
Cardiology cal problems	-0.018	0.007	0.034	0.035	0.036	0.240**	1.000					
Skin problem	-0.039	-0.009	-0.070	-0.047	0.063	0.028	0.436**	1.000				
Traffic issues	0.010	0.054	0.006	0.055	0.098	-0.003	0.262**	0.397**	1.000			
Emergency situations	-0.106*	0.020	0.044	0.060	0.039	0.032	0.314**	0.250**	0.338**	1.000		
Less outdoor activities	-0.032	0.084	-0.003	0.102*	-0.011	-0.074	0.073	0.087	0.232**	0.393**	1.00	
Social distancing	0.021	0.068	-0.108*	-0.018	-0.011	0.054	0.033	0.133**	0.090	0.178**	0.297**	1.000

Table: 11 Correlations

\*\*Correlation is significant at the 0.01 level (2-tailed).

\* Correlation is significant at the 0.05 level (1-tailed).

## 4 Conclusion

It is concluded that people who were “strongly agree” with Motor Vehicles caused smog were mostly male, unmarried, mostly had secondary education and were working. Similarly, for burning and combustion, most of the people considered it a cause of smog, very few found “strongly disagree” with it. For construction work, most of the people were “strongly agree” and very few were “disagree” that construction causes smog. For winter heating, results indicate that mostly people were ‘strongly agree ‘ and very few were ‘strongly disagree’ that winter heating cause smog. From this research, a reader came to know about sources of smog. This research shows that how public acts are leading nature towards its distraction through polluted air. Motor vehicles/automobiles used by the public, factories used to burn on daily basis, winter heating and its arrangements, and massive constructional work like mega projects of public transports and buildings specially in Lahore polluting air of this city. There are no ways of its compensation as smog is getting dancer day by day. Public need to get aware of their responsibilities and precautionary behaviors about smog for self-safety otherwise smog is going to affect their life entirely.

### 4.1 Recommendation for Future Research

Public should be aware of the acts which are going to pollute air, like excessive use of transport instead of walk. A man should adapt a behavior in which he prefers walk instead of personal transport. Public should use carbon filters everywhere they are going to expose environment with combustion and burning. In factories, there should be filters in carbon ways, so because air entering in atmosphere from factories should be clean and breathable. Born fires and extra arrangements of fire in winter should be avoided because it makes uncertain carbonated smoke. Government should run campaigns for its awareness and its effects. Public should avoid areas crowded areas.

NGOs working in country should be socially active about it. Public have to wear mask in smog days to avoid breathing issues and disease. Most of the population is students, so its duty of schools to aware their students of their responsibilities of environment and its precautionary measures.

## REFERENCES

1. Albert, E., Klingman, K., Sullivan, S., Xu, W. and Titus, A., 2016. Hitting home with technology development for asthma. *The Lancet Respiratory Medicine*, 4(2), pp.102-103.
2. Annals of Tropical Research, 2014. Fruit Bronzing, a New Disease Affecting Jackfruit Caused by (Smith) Mergaert Pantoea stewartii et al. pp.17-31.
3. Castner, J., Klingman, K., Sullivan, S., Xu, W. and Titus, A., 2016. Hitting home with technology development for asthma. *The Lancet Respiratory Medicine*, 4(2), pp.102-103.

4. Chafe, R., et al, B. and et al, P., 2016. Improving the Treatment and Assessment of Moderate and Severe Pain in a Pediatric Emergency Department. *Pain Research and Management*, 2016, pp.1-6.
5. Chaichan, M. and Kazem, H., 2018. Single slope solar distillator productivity improvement using phase change material and Al<sub>2</sub>O<sub>3</sub> nanoparticle. *Solar Energy*, 164, pp.370-381.
6. Geng, G., 2017. Field Test for Heat and Humidity Environment and Analysis of Air-Conditioning System Consumption. *Advanced Materials Research*, 610-613, pp.2875-2878.
7. Lillevik, R., 2019. Better together? Multicultural dilemmas and practices in funding of Muslim civil society organisations. *Journal of Ethnic and Migration Studies*, 46(9), pp.1941-1958.
8. Long, R., 2018. Cultural differences in paradoxical tensions in strategy episodes. *Long Range Planning*, p.101849.
9. Ma, D., Zhang, Z., Wang, M., Lu, L., Zhong, H. and Leung, C., 2015. Recent Developments in G-Quadruplex Probes. *Chemistry & Biology*, 22(7), pp.812-828.
10. Meade, H., 2014. Caprines expressing genes of pharmaceutical applications. *BMC Proceedings*, 8(S4).
11. Park, A. and Conway, M., 2018. Leveraging Discussions on Reddit for Disease Surveillance. *Online Journal of Public Health Informatics*, 10(1).
12. Park, A. and Conway, M., 2018. Leveraging Discussions on Reddit for Disease Surveillance. *Online Journal of Public Health Informatics*, 10(1).
13. Schizer, D. and Schizer, M., 2016. Adolescent Drug Testing Policies in Schools. *PEDIATRICS*, 135(4), pp.782-783.
14. Schizer, D., 2016. Between Scylla and Charybdis: Taxing Corporations or Shareholders (or Both). *SSRN Electronic Journal*,.
15. Sheng, L., 2017. Explaining urban economic governance: The City of Macao. *Cities*, 61, pp.96-108.
16. Wang, F., Zheng, P., Dai, J., Wang, H. and Wang, R., 2019. Fault tree analysis of the causes of urban smog events associated with vehicle exhaust emissions: A case study in Jinan, China. *Science of The Total Environment*, 668, pp.245-253
17. Xu, F., Liu, X., Chen, Y., Zhang, K. and Xu, H., 2016. Self-assembly modified-mushroom nanocomposite for rapid removal of hexavalent chromium from aqueous solution with bubbling fluidized bed. *Scientific Reports*
18. Young, 2017. Health impacts of smog pollution: the human dimensions of exposure  
ZHANG, Y., LI, A., ZHANG, S. and ZHANG, M., 2017. Detection methods of microsaccades. *Advances in Psychological Science*, 25(1), p.29.
19. Mishra, 2017, Is smog innocuous? Air pollution and cardiovascular disease Indian heart journal 69 2017(425-429)