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Chemical Contaminants and Pollutants in the Measurable Life of Dhaka City

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ABSTRACT

Environmental pollution and food contamination are as old as the civilization itself. It is the result of the improvement of civilization, over usage of nature, industrialization and in certainty a cost for the advancement. It is exceedingly conspicuous in Dhaka city. Air pollution is chiefly because of the vehicle emanation, modern release and consuming of non-renewable energy source. The water asset of Dhaka turns into a noteworthy wellbeing danger because of arsenic contamination, insufficient family unit/modern/restorative waste transfer and mechanical emanating the executives. Food contamination originated from the commercialism of specialists who are doing this purposely to augment benefit. Fundamental advances are to be taken to secure nature for our own reality. This paper uncovers compound pollution and contamination issues of Dhaka city, the capital of Bangladesh. Brief review of chemical induced pollution and contamination, their consequences and control. Healthcare providers/Policy makers have a major role play to the concerned field. Comprehensive literature search followed by consulting healthcare professionals about environmental pollution and food contamination. Hospital, clinic and company personnel, newspaper journalists, NGO workers given their valuable suggestions and asked help for necessary books, journal, newsletters. A few western magazine and newspapers also observed to get the necessary concern. Projections were based on public life pattern, their food habits, pollution and contamination sources, waste disposal features of urban life as well as industry and hospital waste disposals. Pollution and adulteration are the most notorious enemy of mankind. Civilization has its own drawback that even causing destruction of itself. Very few people raised voice on this but crippled by the facts of commercialism. The scope of this article is limited to chemical pollution of air and water, medical or household waste products and food contaminants and adulterants. A few discussions based on real life experience and recent studies or reports from various journals and news articles are summarized here. Both general people and the old system, are responsible for this unlivable condition of Dhaka city. The population is not the sole for this instance. A sense of poor rules and regulation is always found everywhere. Negligence is becoming a wide spread disease contaminating illiterate to well educated, all kind of people. Many articles and documents found in concerned area of research, but the scope of this research is on its focus point chemical hazards and burdens of Dhaka city. Still the most important aspect is covered, but fact is less amount of recent data found in few areas. The language of this article is too simple to understand by people with simple literacy. Pharmacists, doctors, nurses, hospital authorities, public representatives, policy makers and regulatory authorities have to acquire much from this article. Any article or research is based on the think doing good for mankind, at least going ahead from the present situation, overcoming problems and measures. The article should create a guideline for the future policy makers of both government and other sectors to review the alarming situation of chemical pollutions and food contaminants of Dhaka, along with the whole Bangladesh. Again, world business is moving around Asian countries, Bangladesh will be an important business hub within next few decades. This article should remind policy makers that we should not forget mankind, giving places to industrialization and development.

Keywords: medical and household waste, health hazard, chemical intoxication, cancer, food poisoning, pathogen

INTRODUCTION

Contamination is the nearness of an undesirable substance where it ought not be or at fixations Contamination is the presence of an unwanted substance where it should not be or at concentrations above recommended.

Pollution is the contamination that results in adverse biological effects to resident communities. All pollutants are contaminants, but not all contaminants are pollutants. All elements of the natural environment can be altered, sometimes with harmful results. Air, food, water, and the earth can all become sources of illness, in the home, public, or work environments. In urbanization, all processes are viewed in relation to the city. Generally, better food supply, good medical care, education, jobs, industrialization, commercialization, electrification, specialization of professions, and entertainment are the basic causes of urban growth. Accessible energy plays an important role in our development -- with this, people can enjoy all the modern facilities. By establishing road communication, an undeveloped area may be connected with a developed area. It helps the people of the areas, the use of information, technology, and media for an improved standard of living. With increased industrialization, air, in Western, as well as developing countries, now contains noxious substances that are either direct results of combustion or produced by the photochemical change. Dhaka, being the capital of Bangladesh ranked 3rd worst in Air Quality Index (AQI) in the world. Besides, the city of nearly 20 million inhabitants, Dhaka faces challenges on this front, ranging from inadequate sanitation, polluted rivers, and chemical outpouring from the surrounding industries, all resulting from the unplanned nature of urbanization. Food contaminants and adulterants gave a new dimension in city life, together rest of the country. The healthcare providers role in environmental health is related primarily to being alert to the conditions prevailing in the community and of working with others to adequately control any of the attendant hazards.

URBANISATION AND ITS IMPACT

Urbanization is one of 21st century's most transformative trends. Cities are the dominant force in sustainable economic growth, development, and prosperity in both developed and developing countries. In developed countries, the growth of the urban population has stabilized, and urbanization is taking place at a rapid pace. Currently, 55% of the world's population (four billion people) reside in urban areas which will be nearly 70% by 2050 (United Nations, 2018). By 2030, over 60% people will live in the cities (Megacity Challenges Siemens AG., n.a.), two billion more people will have migrated to cities-- placing unprecedented pressure on infrastructure and resources, particularly those related to water (According to UN and World Bank) (Benedito, 2018). From 2016 to 2030, a 35% population increase is expected in the top ten megacities. Furthermore, as more than three-quarters (76%) of the world's mega-cities are coastal, there will be a considerable impact on water ecosystems from ridge to reef. Because of this, local and regional authorities lead initiatives targeting water-related obstacles, including housing gaps, climate change and an increased demand for food, energy and water (NewNation, 2018; Daily Sun, 2018). Forecasts indicate cities in developing countries including Karachi, Lagos, and Dhaka will surpass cities like New York, Osaka, and Sao Paulo by 2030 (Joal et al., 2014). This represents a 50% increase in demand for energy and water, generating challenges that exert pressure on water resources and threaten global water security. This has a palpable effect on public health, economics, and development. It has been estimated that the urban population in Bangladesh will rise to between 91 and 102 million by 2050, which will be 44% of the total population (Shishir, 2017). The leather tanning industry has been identified as one of the main causes of environmental and water pollution in the Capital city of Dhaka of 10 million people. About 60,000 tons of row hides and skins are processed every year using dehairing, ammonium salt sulphate and chloride during de-liming, solvent vapors which releases a huge quantity of untreated effluent into the open causing air pollution and water bodies (Jahan et al., 2014).

CHEMICAL POLLUTION AND CONTAMINATION DUE TO URBANISATION

Smog results from the interaction of the ultraviolet rays in sunshine and the unburned hydrocarbons of automobile engines or factories and smokestacks. These products, when trapped by the thermal inversion engendered by local topography, cause damage to mucous membranes and lungs when inhaled (Timothy and Ara, 2006). Acute episodes of air pollution have been found to exacerbate illness and even cause death in people who already have respiratory and cardiovascular diseases. Supporting evidence exists demonstrating that second-hand tobacco smoke increases the risk of cardiovascular diseases or cancer as well (WHO, 2014). According to World Bank's Country Environmental Analysis (CEA) 2018 report, air pollution lead to deaths of 46,000 people in yearly in Bangladesh (Ahmad and Marziat, 2018). Waterborne infectious disease is very common today, all the public supplies are literally contaminated with water drainage system reported many places. Many complaints about the taste, appearance, and physical qualities of locally supplied water have led to a brisk in bottled water (Kun et al., 2012). Water contamination with ground-source chemicals (e.g., pesticides, fertilizers) remains an ongoing possibility. Food remains a significant vehicle of disease organisms (Wasim et al., 2009). Foodborne disease, more commonly but often incorrectly called "food poisoning," is grossly underreported. In most instances the illness produced by contaminated food is mild and of short duration, but more severe outbreaks (such as hepatitis A,

most commonly seen in public restaurants) can. Epidemics of food-borne disease are dramatic and sudden, and most people become sick within 6 to 24 hours after consuming the contaminated foodstuffs. The epidemic pattern of food-borne disease presents differently from the gastrointestinal symptoms (e.g., nausea, vomiting, and diarrhea) induced by intestinal enteroviruses occur (Foodborne Illness and Outbreak Investigation Manual, 2008).

THE DHAKA CITY AT A GLANCE

Living in Dhaka city endowed with a traffic jam, street foods, unplanned buildings, narrow road space, noise pollution along with environmental pollution and issues of contamination (Sadiqur and Rashad, 2018). Some people make joke like "Traffic jams teach us things like patience and how to plan ahead of time" (Azmin, 2015). Many people sleep roadsides, railway platforms, mosques and market places. People rushes to this city for job, business and other opportunities like uninterrupted utilities. Along with general people, the city is also heaven for muggers, robbers, thieves, pickpockets, frauds, drug dealers and organized criminals (Pooja, n.a.). People rarely can see the sunrise or sunset due to thousands of buildings. hawkers are illegally occupying the public walkways, pedestrians are now forced to walk on the roads which raises the risks of accidents and adds to the already unbearable traffic congestion in those areas. Economist Intelligence Unit (EIU) The EIU surveyed 140 cities around the world for its Global Live-ability Index 2018, scoring them on over 30 parameters under five categories: healthcare, infrastructure, culture and environment, stability, education and infrastructure (The Global Livability Index, 2018). All these things make this a difficult to breath place and a second worst place in the world to live in. Some 18,000 deaths from environmental pollution occurred in 2015 in Dhaka (Environment Desk World Bank report, 2018). As the motor vehicle industry grows in Bangladesh, the demand for lead acid batteries will increase, adding to the importance of small-scale recycling and manufacturing plants. The lack of engineering and other controls for lead emissions from the informal sector, including but not limited to the battery industry, poses health risks to both workers and the surrounding general population, thereby highlighting the continued need for environmental and occupational health and safety programs and research in developing countries.

AIR POLLUTION

The Exposure Level of Pollutants

The most profound chemicals found hazardous to human health and at high enough concentrations (**Table 1**) can even be fatal are Carbon monoxide (CO), Sulfur dioxide (SO_2), Nitrogen oxides (NOx), Ozone (O_3), Hydrocarbons (HC) and Suspended Particulate Matter (SPM) found in places surround Dhaka (**Table 1**). Possible health hazards found to be headache, eye-nose-throat irritation, allergy, lung injury, trauma and even death with long term exposure (Chen et al., 2007; Daily Prothom Alo, 2014; Mohammad et al., 2018). The AQI in Dhaka during the winter, where more than 4,500 brick kilns operate, typically hovers above 250 – a level considered unhealthy for all groups – but often spikes much higher (Stanford News, 2018). Brick kilns, unfit vehicles run by fuels with higher level Sulphur, as well as construction works, rundown roads have been identified as major sources of air pollution (Imtiaz, 2018; Independent Online Desk, 2018). Day by day the amount of dust include air pollution in the city has been increasing. The air quality, particularly in Dhaka has undoubtedly been getting worse. Air pollution, according to Thomson Reuters Foundation, caused largely by burning fossil fuels, is cutting global life expectancy by an average of 1.8 years per person, making it the world's top killer (Dhaka Tribune, 2018). AQI 201 to 300 is marked as "extremely unhealthy" or hazardous air. At present AQI level of Dhaka has 309, which is in extreme "unhealthy" position (Ahmad and Marziat, 2018).

Impact of Air Pollutants on Children

Children are especially vulnerable to the neurotoxic effects of lead exposure due to their developmental state, body weight, and behaviors that increase risk of exposures. Exposures in childhood have been shown to have significant long-term ramifications on both neurological and cognitive health and socioeconomic status over the life course. Lead is well established as an environmental health problem due to its neurotoxic effects in both children and adults. The negative impacts of exposures on cognitive decline and social mobility make it essential to mitigate lead exposures, particularly for at-risk populations. Lead poisoning rates have declined in the United States and other developed countries as a result of awareness campaigns and the phasing out of lead from gasoline, paints, and consumer products. However, childhood lead exposure remains an issue in Bangladesh, where epidemiological investigations have found high blood lead concentrations in children in and near the industrial center of Dhaka (**Table 2**). Children in surrounding communities of Dhaka have also been found to have elevated blood lead concentrations. Exposure in these communities may be due to continued use of leaded gasoline and

Table 1. Coefficient trend of air pollutant parameters at different locations in the city of Dhaka (July 2016- June, 2017) (Mohammad et al., 2018)

Air Pollutants	Estimated Coefficient Trend at Different Locations							
	Savar, Brick Field Areas	**Dhaka Cantonment**	**West Rasulpur, Dhaka**	**Birulia, Savar**	**North of DEPZ, Savar**	**South of DEPZ, Savar**	**East of DEPZ, Savar**	**West of DEPZ, Savar**
Volatile Organic Carbon (VOC) mg/kg	2.547*** -0.0017 [0.974]	1.571** -0.03166 [0.8291]	0.595*** -0.0023 [0.9687]	1.075*** -0.0042 [0.9541]	0.846** -0.0424 [0.793]	1.834** -0.0367 [0.811]	1.587** -0.04 [0.801]	0.819** -0.042 [0.7953]
Carbon dioxide (CO_2) mg/kg	0.070* -0.134 [0.580]	0.115** -0.0466 [0.78125]	0.088** -0.0217 [0.8659]	0.123 -0.302 [0.339]	0.024 -0.8596 [0.0122]	0.06 -0.00004 [0.9976]	0.181 - 	0.520** -0.046 [0.781]
Carbon monoxide (CO) mg/kg	0.218*** -0.0027 [0.965]	2.092** -0.0355 [0.815]	0.349 -0.00000661 [0.999]	1.268** -0.0388 [0.8053]	1.085*** -0.0002 [0.9934]	0.880*** -0.00146 [0.9772]	1.051** -0.013 [0.9038]	0.708*** -0.0009 [0.9827]
Oxygen (O_2) (%)	0.825 -0.32 [0.3200]	0.134 -0.854 [0.0131]	3.094** -0.0466 [0.78125]	0.392* -0.0605 [0.7422]	0.455 -0.1456 [0.560]	1.093*** -0.0018 [0.9730]	0.869 -0.000000005 [0.9999]	0.442 -0.14278 [0.565]
Relative Humidity (%)	0.165 -0.6392 [0.0825]	-0.082 -0.4686 [0.185]	0 	0 	0.125 -0.224 [0.4375]	-0.095* -0.0625 [0.7369]	0.125* -0.0823 [0.6879]	0.197*** -0.0004 [0.9889]
Sulfur Dioxide (SO_2) mg/kg	0.880** -0.0119 [0.9089]	4.616* -0.0546 [0.7582]	1.352*** -0.0008 [0.9836]	4.671** -0.0502 [0.7708]	0 - 	0 - 	8.377** -0.0137 [0.9005]	1.494* -0.0615 [0.739]
Nitrogen Oxide (NOx) mg/kg	3.233** -0.0144 [0.8972]	4.768** -0.0456 [0.7843]	2.770** -0.0508 [0.7689]	1.918** -0.0466 [0.78125]	2.920** -0.0466 [0.78125]	1.698** -0.0466 [0.78125]	1.671** -0.0466 [0.78125]	2.561** -0.0466 [0.78125]
Hydrogen Sulfide (H_2S) mg/kg	0.435*** -0.0003 [0.9917]	-2.35 -0.5512 [0.1298]	1.521** -0.0273 [0.8445]	0.547 -0.7802 [0.0301]	1.823** -0.0427 [0.7930]	1.806 -0.123 [0.600]	1.339 -0.153 [0.5458]	0.652* -0.0606 [0.7420]

older automobiles; local industries of ceramics, battery recycling, and mining; and other lifestyle characteristics, such as food items and product materials (Woo et al., 2018).

The multivariate regression for blood lead levels and inverse squared distance weighted air lead concentrations—adjusted for age, sex, and maternal education—found no statistically significant association for any covariate. The effect estimates of air lead concentration of 1.0 µg/m3 on BLL (µg/dL) was −0.40 (95% confidence interval (CI) −1.04, 0.34). Similar results were obtained for the study population excluding the two outliers with BLLs above 36 µg/dL, which were outside of 1.5 times the interquartile range of BLLs for the population. These results are summarized in **Table 2A**. The multivariate regression for blood lead levels and traffic and industrial proximity—adjusted for age, sex, and maternal education—found no statistically significant associations for any of the covariates. The effect estimates of number of industrial points of interest on BLL (µg/dL) was −0.01 (95% CI −0.64, 0.62), and the effect estimate of length of major roadways was −0.00008 (95% CI −0.00047, 0.0003). Similar results were obtained for the study population excluding the two outliers as well as for the industries and road length measures within the 250 m, 500 m, and 2500 m buffers. The results are summarized in **Table 2B**.

WATER POLLUTION

Moving on to the issue of water quality and pollution, the National Sustainable Development Strategy (NSDS) of Bangladesh identifies the following reasons behind degradation of surface water quality:

1. Unregulated industrial expansion,
2. Rural-to-city migration,
3. Encroachment of rivers and water bodies,
4. Overloaded infrastructure,
5. Confusion about institutional responsibility for the quality of urban water bodies, and
6. Insufficient enforcement of environmental regulations (Ferdous, 2017).

Table 2. Multivariate regression results for (A) the model evaluating the relationship between blood lead levels (BLLs) and air lead concentrations, interpolated by inverse squared distance weighting and adjusted for age, sex, and maternal education; and (B) the model evaluating the relationship between BLLs and number of industrial points of interest and length of major roadways within 250 m, 500 m, 1000 m, and 2500 m buffers of the residences (Woo et al., 2018)

Table 2A. Blood Lead Levels and Estimated Air Lead

	Full Dataset (N = 385)				Excluding 2 Outliers (N = 383)			
	Coefficient	**SE**	***t*-Value**	***p*-Value**	**Coefficient**	**SE**	***t*-Value**	***p*-Value**
Intercept	10.39	2.31	4.49	<0.001	9.94	2.04	4.86	<0.001
Estimated air Pb (μg/m³)	−0.40	0.38	−1.04	0.30	−0.31	0.34	−0.91	0.36
Age (months)	−0.04	0.08	−0.45	0.66	−0.04	0.07	−0.53	0.59
Sex (female)	0.16	0.46	0.35	0.73	−0.439	0.41	1.08	0.28
Maternal education (primary or less)	0.31	0.46	−0.68	0.50	0.61	0.41	−1.49	0.14
	Adjusted R^2 = −0.0047				Adjusted R^2 = 0.0028			

Table 2B. Blood Lead Levels and Traffic and Proximity

	Full Dataset (N = 385)				Excluding 2 Outliers (N = 383)			
	Coefficient	**SE**	***t*-Value**	***p*-Value**	**Coefficient**	**SE**	***t*-Value**	***p*-Value**
Intercept	10.44	2.32	4.49	<0.001	9.99	2.06	4.86	<0.001
No. of industrial sources within 1000 m	−0.01	0.32	−0.02	0.98	−0.14	0.31	−0.46	0.64
Length of major roads within 1000 m	−0.00008	0.0002	−0.53	0.59	0.00002	0.0001	0.19	0.85
Age (months)	−0.04	0.08	−0.59	0.56	−0.05	0.07	−0.74	0.46
Sex (female)	0.21	0.47	0.44	0.66	0.48	0.41	1.16	0.25
Maternal education (primary or less)	0.32	0.47	−0.75	0.45	−0.61	0.41	−1.48	0.14
	Adjusted R^2 = −0.01				Adjusted R^2 = −0.001			

There is a serious problem of water pollution in central Dhaka, in the Turag-Tongi-Balu River system in Bangladesh with the river system being one of the most polluted in the world at the moment. A baseline survey of water chemistry and total coliforms has been undertaken and shows dissolved oxygen close to zero in the dry season, high organic loading together with extreme levels of Ammonium-N and total coliform in the water (Whitehead et al., 2018). The city is suffering from an acute shortage of domestic water supply. Water is involved in the spread of communicable diseases in essentially two ways. The well-known direct ingestion of infectious agent when drinking contaminated water. The second is due to a lack of sufficient water for personal hygiene purposes (WHO, 2011). Approximately 80% of all sicknesses and diseases can be attributed to inadequate water supply and sanitation worldwide (UN Secretary General, 2003; Malik et al., 2012). However, the rivers and canals continued to be encroached upon, and more wastewater from houses and industrial units poured into the rivers without any treatment, with several major sources of pollution being outside the city area—in Ashulia, Savar, Tongi and Gazipur (UNDP, 2010). According to Dhaka Water Supply and Sewerage Authority (DWASA), it can currently supply 75% of water demand, out of which 85% is from groundwater sources (Deep Tube wells) (Manoj and Melissa, 2017). The presence of toxic metal lead in Elephant road, Dhaka.University, Jatrabari, and Demra area and toxic Penta Chloro Phenol (PCP) and existing pathogenic bacterial load in the WASA supplied drinking water from different areas of Dhaka city were found to be unsuitable for human consumption (**Table 3**).

Some 80% of wastes are being dumped into the rivers in Bangladesh. No wonder our water supplies are in jeopardy. Around 250 industries are discharging chemical pollutants into the Buriganga and Sitalakhya river. Every day 4,000 tons of solid waste and 22,000 tons of tannery waste mixes with water in Buriganga river. Sewage is being discharged directly into the rivers, and the low-lying parts around urban areas (Daily Asian Age, 2018). By 2021 the garments export target has been set at $50 billion. But the success comes at a huge environmental cost. The dyeing and finishing plants are the major pollutants of water. Turag that flows by Tongi is almost dead with pollution. Its water looks ink black and gives out such a foul smell (Inam and Refayet, 2017). Wetlands around Dhaka city are being destroyed through land development and dumping of toxic effluents and untreated sewage. Industrial effluents have totally destroyed the ecology of rivers near these large urban areas (Shishir, 2018). In Dhaka, rivers near these large urban areas (Mitali and Anwara, 2017). In Dhaka, 20 canals have disappeared. Liquid and solid wastes, and heavy metals like copper, iron, lead, and nickel are distressing the BOD, COD, DO, TDS, PH of water (Jahan et al., 2014). In Dhaka, only 7 % of household members were exposed to greater than 0.3 mg/L iron in drinking water. Only 18 % households met WHO standards (≤0.3 mg/L), while a large proportion (82 %) were exposed to high concentrations of iron in drinking water (>0.3 mg/L). The highest proportion of household members exposed to more than 600 mg/L sodium chloride was found in Dhaka (40 %) among other places of Bangladesh. Arsenic testing in the field revealed high arsenic concentrations exceeding Bangladesh standards in Dhaka. About 68 and 77 % of household members in the Dhaka division were exposed to higher levels of arsenic with respect to WHO (0.01 mg/L) and Bangladesh standards (0.05 mg/L), respectively (Akter et al., 2016).

Table 3. Lead, Cadmium, Chromium and Arsenic content in first 14 water samples (Murshed et al., 2018) *

Sample No.	Sampling Area	Pb content (mg/L)	Cd content (mg/L)	Cr content (mg/L)	As content (µg/L)	Total Bacterial Count c.f.u./100mL
1	Dhaka University	0.52	0.05	BDL	0.78	4.0 × 105
2	Bangshal	BDL	0.03	BDL	0.43	2.1 × 104
3	DMCH	BDL	0.04	BDL	0.25	1.0 × 104
4	Basabo	BDL	BDL	BDL	5.12	4.2 × 106
5	Komlapur	BDL	BDL	BDL	0.21	
6	Badda	BDL	0.04	BDL	1.29	1.0 × 105
7	Sobujbagh	BDL	0.04	BDL	0.42	5.2 × 106
8	Shagun Bagichaa	BDL	0.06	BDL	BDL	5.0 × 103
9	Demra	0.46	0.07	BDL	0.44	-
10	Jatrabari	0.51	0.07	BDL	0.15	1.5 × 104
11	Mohammadpur	BDL	0.07	BDL	0.53	5.0 × 103
12	Panthapath	BDL	0.07	BDL	0.29	3.0 × 104
13	Elephant Road	0.53	0.08	BDL	0.10	2.5 × 104
14	Shampur	BDL	0.08	BDL	0.56	3.5 × 104

** 2 table contents accommodated in 1*

MEDICAL AND HOUSEHOLD SOLID WASTE

Dhaka City Corporation (DCC) is unable to impose rules on the public. On the institutional side, rules and regulations are not clear. The role and responsibilities of waste generators are not clearly defined i.e., the present law does not provide penalties for illegal disposal of waste or littering. Lack of scientific approaches for problem solving and DCC has shortages of skilled human resources and finances (Mitali and Anwara, 2017). The accumulating waste is dumped by the residents in the city's streets, open storm water and wastewater drains or open water bodies where and whenever the collection service is inexistent or dysfunctional (Abu, 2018). In particular, slum or periphery areas are affected by such a situation. During the annual monsoon rains wastewater and storm water drains which are clogged by solid waste overflow, creating an acute sanitary and hygienic threat in low-lying slum areas particularly. Solid waste generation profile is Per Capita Waste Generation: 0.56 kg/cap/day, Total Waste Generation DCC Area: 5000 tons/day and 70% - 80% of the solid waste is organic. Approximately 200 metric tons of medical wastes are generated in the city per day (Approximately 6% of total waste) (Mohiuddin, 2018). Different industries and their contribution to pollution in Dhaka are: Pulp and paper (47.4%), pharmaceuticals (15.9%), metals (14%), food industry (12.1%), and fertilisers/pesticides (6.6%) (Shishir, 2017; Daily Asian Age, 2018; Mohammad, 2006). Medical waste may contain highly toxic chemicals and can present a mechanism for transmission of diseases (**Table 4**). The growth of the medical sector around the world over the last decade combined with an increase in the use of disposable cheap medical products has contributed to the large amount of medical waste being generated. For a megacity like Dhaka, even low hazardous wastes generation rates can lead to the accumulation of large quantity wastes (Manzurul et al., 2008). This enormous amount of medical waste poses from different healthcare establishment (HCE) (**Table 5**) significant health risks to the people associated with waste disposal and treatment. During monsoon, the situation gets worse as medical, toxic chemicals and sewage waste flood Dhaka streets, contaminating dozens of neighborhoods in the process. The reuse of syringes by the general public represents one of the greatest public health problems in the developing world related to health care waste. Worldwide, an estimated 10 to 20 million infections of Hepatitis B and C and HIV occur annually from the reuse of discarded syringe needles without prior sterilization (Simonsen et al., 1999).

FOOD CONTAMINATION

Dhaka city now alone generates huge solid wastes per day from industrial discharge, fertilisers, fossil fuels, sewage sludge and municipality wastes and they are the major sources of heavy metals in soils and subsequent uptake by crops, vegetables and other food items causing serious health hazards to human beings (Hashem et al., 2017; Mahmudul, 2015; Rahaman et al., 2016). A significant transfer of heavy metals like arsenic, cadmium, chromium, copper, lead, mercury, nickel, zinc, molybdenum and vanadium took place from soils to vegetables (spinach, tomato and cauliflower) grown in industrially polluted soils of Konabari at Gazipur and Keraniganj in Dhaka (Rafiqul et al., 2013). Industrial wastes and effluents are being discharged randomly on soils, into canals, rivers, along the road sides or in the vicinity of the industrial areas without any treatment where polluted river

Table 4. Medical Waste of different categories (Mohiuddin, 2018)

Waste Category	Description with Examples
Infectious waste	Pathogens may be present. E.g. excreta, laboratory cultures, tissues, materials or equipment that have been in contact with infected patient.
Pathological waste	Human tissues or fluids. E.g. blood and other body fluids, fetuses.
Pharmaceutical waste	Wastes containing pharmaceuticals. E.g. pharmaceuticals that are no longer needed or expired
Genotoxic waste	Waste containing substances with genotoxic properties. e.g. waste containing cytotoxic drugs (often used in cancer therapy); genotoxic chemicals.
Chemical waste	Chemical substances present in a waste. E.g. laboratory reagents, film developer; disinfectants that are expired or no longer needed; solvent.
Wastes with high content of heavy metals	Batteries, broken thermometers, blood-pressure gauges.
Pressurised containers	Gas cylinders, aerosol cans
Radioactive waste	Radioactive substances present in a waste. e.g. unused liquids from radiotherapy or laboratory research, contaminate glassware, packages or absorbent paper.
Sharps	Sharp wastes. E.g. needles, knives, blades, broken glass infusion sets.

Table 5. Amount of wastes with types generated in different HCEs in Dhaka city (Mohiuddin, 2018)

Color	Type of wastes	Amount (in kg)					
		DMCH	BMCH	GH**	PC**	DC**	Total
Black	General waste (Kitchen waste, medicine box)	2587 (79.01)	563 (83.65)	729 (77.31)	286 (75.26)	143 (48.97)	4308 (77.45)
Yellow	Infectious waste (Cotton bandage, amputated body parts, placenta, blood & urine bags)	489 (14.94)	59 (10.57)	132 (14.00)	46 (12.10)	57 (19.52)	783 (14.08)
Green	Plastic waste (Syringe without needle, saline bags, gloves)	79 (2.41)	18 (3.22)	32 (3.39)	21 (5.53)	63 (21.57)	213 (3.83)
Red	Sharp items (needle, blade, knife, Vial-ampoule)	36 (1.10)	6 (1.07)	12 (1.27)	9 (2.37)	6 (2.06)	69 (1.24)
Blue	Liquid waste	83 (2.53)	27 (4.83)	38 (4.03)	18 (4.74)	23 (7.88)	189 (3.40)
	Total:	**3274** (100%)	**673** (100%)	**943** (100%)	**380** (100%)	**292** (100%)	**5562** (100%)

DMCH: Dhaka Medical College Hospital; BMCH: Bangladesh Medical College Hospital; GH: General Hospitals; PC: Private Clinics; and DC: Diagnostic Centers

water is being used for irrigation purpose in paddy and vegetable cultivation causing absorption of heavy metals through the food chain by human beings (Zubair et al., 2013).

FOOD ADULTERANTS

Important food hazards include microbial hazards, pesticide residues, misuse of additives, chemical contaminants, including biological toxins and adulteration. Although microbiological contamination and chemical hazards have received the most attention, it is recognised that food adulteration and food fraud should not be neglected considering their role in public health (Nasreen and Ahmed, 2014). Food adulteration includes various forms of practices, such as mixing, substituting, concealing the quality of food by mis-labelling, putting up decomposed or expired food, and adding toxic substances (Park, 2005). About the proportion of adulterated food items in the market varied between 70% to 90%. More than 76 percent food items in the market were found adulterated in a random survey by public health laboratory of Dhaka City Corporation in 2004 (Staff Correspondent, 2011; Mirza, 2014). According to the International Centre for Diarrheal Disease & Research, Bangladesh (ICDDR, B), there is approximately 150 food items in the country. A study by the Institute of Public Health (IPH) revealed that more than 50% of the food samples they tested were adulterated. Textile dyes, which are highly injurious to health, are being randomly used to color many types of food. Fish is considered to be an essential protein for people of all ages. Many fish sellers spray fish with formalin in an indiscriminate manner, it makes the fish or fruits stiff and keeps them looking fresh for longer. Undoubtedly human health is now under the possession of formalin, in our country about 400 tons formalin is being imported which are goes to human stomach, even though for laboratory or research purposes 100 tons of Formalin is quite enough, 80% of the imported formalin being added to food only for business purposes (**Table 6**).

Milk in rural areas is usually adulterated with dirty water, which can cause hepatitis. People have now come to know about a new milk adulteration technique that uses a thickening agent, sorbitol, and detergent. ICDDR, B recent studies shows nearly 75% samples from primary-level producers were contaminated with coliform and more than 50% with fecal coliform bacteria. At the collection points, samples were found contaminated with a high number of coliform bacteria and fecal contamination of more than 90% while more than 40 % of the samples had a high E coli count (News Desk, 2018). Vegetable and fruit samples collected from around Savar, Dhamrai and Tongi show the presence of textile dyes, which, in the short-term, will cause diarrhea, food poisoning and gastrointestinal problems, but in the long-term toxic materials will accumulate in the body with serious health implications. In the absence of effluent treatment plants (ETP), the factory wastes are drained out at will into the

Table 6. Toxic elements in noxious addition of food/additives (Zubair et al., 2013; Nasreen and Ahmed, 2014; Staff Correspondent, 2011; Mirza, 2014; News Desk, 2018; Mohammad, 2018; Arifur et al., 2015; Nishat, 2017; Noman and Mohammad, 2013; Nehreen et al., 2016; Shafkat, 2013; Rajib, 2015; Editorial, 2014; Mahboob, 2015)

Contaminants	Food/Additives	Possible Outcome
Coloring agents chrome, tartzine and erythrosine	Spices, sauces, juices, lentils and oils	Cancer in kidney, liver, skin, prostate and lungs
Rye flour (ibid)	Barley, bread and wheat flour	Convulsion and miscarriage
Hormone (ibid)	Cauliflower	Infertility of women
Coal tar and industrial Dyes	Sweets, Sauce, Pastry cream, powders spices	Carcinogenic
Burnt oil	Crispy snack	Food poisoning, reflux, heartburn
Shad Fish (Imported)	Heavy Metal (Cadmium, Lead)	Over safe consumption level shows heavy metal toxicities.
Agenomato or monosodium glutamate (ibid)	Chinese restaurant food items	Nervous system disorder and depression
Flour	Chalk Powder	GI problems
Soap	Ghee (Clarified butter made from the milk of a buffalo or cow, used in South Asian cooking)	GI problems
Calcium Carbide/Ethylene dioxide	Ripening of fruits	Cancer in kidney, liver, skin prostate and lung
Urea (ibid)	For whiten rice and puffed rice	Damage of kidney & nervous system, Respiratory problem
Brick Dust	Chili powder	Respiratory problem
Sulfuric acid and palm oil	Condensed milk	Cardiac function problem
Saw dust, Used and exhausted tea leaves	Loose Tea	Respiratory problem
Sodium cyclamate	Sweetmeat	Cancer, Fetal abnormality
Metanil Yellow Aniline dyes	Turmeric powder	Carcinogenic
Melamine	Milk Products	Kidney malfunction
Oleomargarine or lard	Butter	Asthma and weakened kidney function
Yellow and Sudan Red colors (ibid)	Chili powder	Tumors in liver and bladder and finally for cancer
DDT	Dried fish (Shutki)	Cancer especially breast cancer, liver cancer and pancreatic cancer, reproductive damage (Weaken semen, early menopause, exposure of teratogen and birth defects) and some neurological damage reported.
Coliform Bacteria	Bottle and Jar water	GI problems
Formalin	Preservation of fish, meat, fruit and milk	Throat cancer, blood cancer, childhood asthma and skin-diseases.
Poisonous coloring agents like auramine, rhodamine b, malachite green, yellow G, Allura red, and Sudan red	Applied on food items for coloring, brightness and freshness	Damage liver and kidney and cause stomach cancer, asthma and bladder cancer

farmlands, and ultimately contaminate the farm produce (uhavepassed.com). In Bangladesh, people allowed things like pollution and food contamination to run riot. Till now, no agency, either under the health ministry or the ministry of science and technology or the ministry of industries, has conducted any examination of the pesticide-residue levels or toxic chemicals in the foodstuff being marketed. These merchants and traders are the enemy not only of the nation and their own children but of the entire mankind. The holy Prophet (PBUH) has disowned those who indulge in this immoral business. He said " The adulterator is not one of us" (Editorial, 2017). Apart from these severe noxious pathogens found in different food samples (**Table 7**), that are potential causes of stomach problems.

It is an unfortunate reality that adulteration, especially in food, has become ubiquitous in the society. No one can justify or defend it. Most food products available in the market are adulterated. The average family is eating dangerous colors, chemicals like formalin and carbide, sawdust, soapstone, harmful chemicals and other harmful substances mixed with consumable goods. High level of pesticides content is present in grains, pulses, in fruits and vegetables that we eat (Kamruzzaman, 2016). Fecal bacteria found in 97% bottled water (Staff Correspondent bdnews24.com, 2017). Brick dust in chili-powder, colored chalk powder in turmeric, injectable dyes in watermelon, peas, capsicum, brinjal, papaya seeds in black pepper etc. are frequently used (Editorial, 2017). Even more unfortunate is the fact that this nefarious practice increases exponentially during the month of Ramadan. The shopkeepers and the merchants–many of them with a pious façade– try to earn a large amount of profit by this unethical practice, and so they play with the life and health of the people (Star Business Report, 2018; Zamir, 2017). They mix dangerous things in the daily eatables. Even the medicine and drugs are adulterated. Most people can't even think of having the commodities like ghee, oil, salt and milk, free from impurities.

Table 7. Detection of foodborne pathogens in food and household water samples collected at point of use from four slums of Dhaka city, Bangladesh, December 2015 to May 2016 (Ishita et al., 2018)

Presence of organisms in food/water	**Overall n = 56**	
A. Organisms present in Food	**n (%)**	**95% CI**
Yeast and mould (>100 CFU/mg)	48.0 (85.7)	0.74–0.93
Coliforms (>100 CFU/mg)	41.0 (73.2)	0.59–0.84
B. cereus (>100 CFU/mg)	27 .0 (48.2)	0.35–0.62
E. coli (>100 CFU/mg)	17.0 (30.4)	0.19–0.44
Staphylococcus (>100 CFU/mg)	8.0 (14.3)	0.08–0.27
V. cholera	2.0 (3.5)	0.01–0.14
B. Organisms present in Water	**Overall n = 16 n (%)**	**95% CI**
Total coliforms	16.0 (100)	–
Faecal coliforms	16.0 (100)	–
Total aerobic bacterial count	16.0 (100)	–
Yeast	16.0 (100)	–
Mould	16.0 (100)	–
Staphylococcus	16.0 (100)	–
E. coli	10.0 (62.5)	0.35–0.86
Faecal streptococci	9.0 (56.3)	0.29–0.79
Pseudomonas	7.0 (43.8)	0.21–0.71

Total coliforms and fecal coliforms count (CFU/g).

RECOMMENDATIONS

Pollution and contaminant control are a never ending, on the other hand a continuous process. It will increase with time as the civilization go ahead. Pharmacists should be aware of the local occupations, companies, and factories and to be cognizant of the initial symptoms of disease. Again, pharmacists should become acquainted with the local community and to adapt the principles of health and medical care to the particular situations encountered. The pharmacist's continuing education requirements should include watching the local pattern of society and its diseases, and changing the emphasis toward evolving disease patterns and their control. Included in the current environmental issues are the workplace and the future of occupational safety and health regulations, hazards of local ambient environments, such as hazardous and other waste dumps, radioactive waste from weapons production, air emissions, and groundwater contamination of unknown magnitude; the Clean Air act and other and regulatory initiatives; waste reduction and minimization, and radioactive waste and weapons production; global pollution, chlorofluorocarbons and the land ozone layer, the greenhouse effect, and global climate change; and conserving the tropical forest and biological diversity. Government and regulatory authorities are to play strong role in controlling food contaminants and adulteration. An out of the box thinking is decentralization i.e. to move few many important originations away from Dhaka city. With this decentralization, population density will be declined, the ill movement of business Crips will also be diluted.

CONCLUSION

With constant change to the physical, biological, cultural, social, and economic environment, both pharmacists and citizens should cultivate an informed awareness of these changes, and health providers should adapt their methods of health education, disease prevention, and disease control to the changes in each community. With an unusually large number of people seeking relief from health hazards, providers may play a much more fundamental and personal role in controlling food-borne diseases. The necessary role in environmental health is related primarily to being alert to the conditions prevailing in the community and of working with others to adequately control any of the attendant hazards.

COMPETING INTERESTS

Author has declared that no competing interests exist.

ABBREVIATIONS

BDL (Below Detection Limit); BOD (Biochemical Oxygen Demand, also called Biological Oxygen Demand); COD (Chemical Oxygen Demand); DO (Dissolved Oxygen); Healthcare Establishment (HCE); TDS (Total Dissolved Solid); PH (A logarithmic scale used to specify the acidity or basicity of an aqueous solution).

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