CAG
Citizen consumer and civic Action Group

Linking plastics and public health in Kodungaiyur

Kripa Ramachandran

CAG | 2019

1. Background

CAG, as part of the ongoing project to assess the human rights impacts of businesses, conducted two research studies between October 2018 and June 2019 to understand the health impacts of plastics on people living and working around the Kodungaiyur dump yard. Two chief focus groups namely, residents and non-residents were identified for these exercises. Three sub-groups were identified within the non-residents group- conservancy workers, informal waste pickers and scrap shop workers. The team collected non-invasive health data (self-reported symptoms experienced and perceived) from 66 respondents for two periods of three months each. The first phase of data collection was done between October 2018 and January 2019, and the second phase of data collection was conducted between April 2019 and June 2019. The exercise, known as 'symptoms diary' is an exhaustive record of a respondent's health status for a period of three months, typically spanning over pre-monsoon, monsoon and post-monsoon months in the city. This was followed by in-depth interviews (IDIs) with 50 respondents, some of whom were also recruited from the symptoms diary exercise to gain a more nuanced understanding of their health statuses.

Literature review

The health and well-being of urban residents is intricately linked to the natural, built, and institutional elements of the urban context. As such, all dimensions of urbanisation and urban living and all socio-economic and environmental determinants of health are to be considered for assessing the health status (Oni, 2016). However, the key challenge facing urban health research is the lack of scientific certainty in directly linking health conditions to a particular determinant such as housing, water and sanitation, waste management, toxicity of waste, etc. Although certain unsustainable practices are known to have adverse impact on human health, to isolate these effects with absolute certainty is challenging. Businesses and governance tend to exploit this lack of scientific certainty to their own ends, to continue business as usual, overlooking the public health impacts of their profit making businesses.

Today, the plastic waste problem in our cities is assuming worrying proportions. According to Central Pollution Control Board (CPCB) data, India generates nearly 15,000 tonnes of plastic waste per day, out of which Chennai alone is known to contribute nearly 450 tonnes daily, making it one of the highest generators of plastic waste in the country. Plastic waste is proven to be a big cause of ill-health for those who are directly exposed to it, like the waste workers, and those indirectly exposed to it, like the residents living in proximity to plastic manufacturing, processing, and disposal sites(Rustagi, S.K, & Ritesh, 2011). Yet, the problem is viewed purely as a problem of disposal, by individual consumers and the local government, mostly attributing responsibility to each other. However, in recent times, the public perception of plastic pollution is beginning to change gradually, with the reach/spread of information necessary to view the impacts of plastic pollution on public health and the environment.

Over a few decades, humans have managed to dump tonnes of garbage into open dumps, and the dump yards, some of which leak into the waterways. Of the most devastating elements / nature/ properties of this pollution is that plastic takes thousands of years to decay. Studies have shown that chemicals in plastics are released into the water as well as the atmosphere. There is abundant literature on the effects of plastics in the ocean on living organisms, including humans through the food-chain exposure pathway. But a systematic review of open-source literature shows that there is a dearth of literature on the health effects of plastic that end up in the dump yard.

A review of the epidemiologic literature on health effects in relation to residence near waste sites has shown an increase in risk of adverse health effects (low birth weight, birth defects, and certain types of cancers) and although biases and confounding factors cannot be excluded as explanations for these findings, they may indicate real risks associated with residence near certain landfill sites. A general weakness in the reviewed studies is the lack of direct exposure measurement. While literature is abundant with self-reported symptoms among residents near waste sites, it is difficult to conclude whether these symptoms are an effect of direct toxicological action of the different chemicals present in waste sites, an effect of stress and fears related to the waste site, or an effect of reporting bias. Although a substantial number of studies have been conducted, risks to health from waste dumping sites are hard to quantify (Vrijheid, 2000).

The difficulty in quantification is compounded by the fact that there is insufficient information on exposure and effects of low-level environmental exposure in the general population, as these are difficult to establish. More interdisciplinary research can improve levels of knowledge on risks to human health caused by waste disposal in landfill sites. Research needs include epidemiologic and toxicologic studies on individual chemicals and chemical mixtures, well-designed single- and multisite landfill studies, development of biomarkers, and research on risk perception and sociological determinants of ill health (Vrijheid, 2000). In effect, the public health studies done to ascertain the ill-effects of plastics in various stages of its value chain need a major overhaul in its framework and lenses.

The objective of CAG's work on waste is to advocate for tighter regulations and liability laws for producer accountability by assessing the human rights impacts of businesses. The indiscriminate rise and use of plastics and its proven health and environmental impacts offers

a great possibility to apply the human rights framework and to demand robust regulations for producer accountability. Human rights are known to encompass many rights and freedoms to which all humans are entitled, the right to health being a fundamental one. It means that everyone has the right to the highest attainable standard of physical and mental health, which includes access to all medical services, sanitation, adequate food, decent housing, healthy working conditions, and a clean environment. The infringement of the right to health is one of the biggest injustices caused to humanity, as it can act as an impediment to achieving or enjoying all other human rights.

Kodungaiyur dump yard situated in Chennai offered the most appropriate location for assessing the human rights impacts of business practices that cause widespread and deep-cutting plastic pollution, riding the wave of rapid development. Dump yards have become an unmistakable feature of developing cities in the global south and therefore, offers a great external validity for the research. Dump yards are often complex ecosystems in themselves, where due to the presence of colossal amounts of mixed waste, it is impossible to isolate the effects of a class of materials such as plastics on human health and environment. But, that does not mean that plastics or other toxic materials do not adversely impact human health or the environment. There is abundant literature linking phthalates, one of the important additives used in plastic manufacturing with a variety of adverse outcomes on human health (Grun & Blumberg, 2009).

In public health research, researchers are careful to point out that correlation does not necessarily mean causation. It is recognised that the assumption that A causes B simply because A correlates with B may not be a legitimate form of argument. However, sometimes people commit the opposite fallacy – dismissing correlation entirely, as if it does not imply causation. This would dismiss a large swath of important scientific evidence. The uncertainty and the potential fallacy are typically overcome by triangulation with empirical evidence. The current research is premised on this postulation.

Methodologically, the HRIA project draws centrally on the domain of human rights. It consults work on sustainable development and environmental health in designing qualitative and quantitative indicators for assessing impacts to environment, health and wellbeing. An environmental health assessment was carried out in the month of September 2018, where samples of groundwater and samples of leachate from around the Kodungaiyur waste dump were collected to test for volatile organic compounds and heavy metals. The heavy metals found in each sample exceeded the permissible limit set by the Bureau of Indian Standards (BIS) and US Environment Protection Agency (US EPA). It is a matter of very serious concern that levels of these toxic metals detected in these samples were well above the permissible limit as the following impacts on human health have been long-established.

The current study seeks to understand the symptoms commonly and frequently experienced by those who reside and work around the dump yard. With the presence of several kinds of materials inside the dump yard and a Sewage Treatment Plant on one side, and the Indian Oil Corporation plant on the other, it is very challenging to control for other determinants that might have a potential impact on the health of the residents and other people working around the dump yard. Yet, that cannot be the reason to preclude the researchers from making a correlation between the toxic elements found in the samples collected from around the dump

yard, established links between the toxic materials and human health, and the health statuses of the residents and those who frequent Kodungaiyur for their livelihoods.

3. Methodology

This research used mixed methods, which is proven to be the most effective method of enquiry for community health research (Shema & Woodman, 2010). Sequential mixed method was used where a quantitative dataset is obtained from the symptoms diary exercise, followed by a qualitative exploration using the IDIs. The popular approach in the health sciences is one where the qualitative data helps to explain the in-depth factors (why and how) underlying the findings of quantitative data (what, who, where, and when).

The participants for these studies were jointly identified and recruited by CAG and community-partner, Arunodhaya, a community-based organisation of repute in North Chennai. Popular settlement areas around the dump yard were identified based on the field work experience of the field researchers at CAG. Accordingly, three areas each with varying proximities to the dump yard, (very proximate, moderately proximate and slightly far) were identified.

For the symptoms diary exercise 38 residents comprising males, females and children, were recruited from all these three areas through random sampling. Non-residents such as conservancy workers and informal waste pickers were identified by trailing and through snowball sampling. Scrap shop workers were recruited based on their availability at the time of recruitment. Since most scrap shop owners worked under the direct supervision of their owners, it was difficult to get them on-board. It was challenging to recruit conservancy workers and informal waste pickers owing to the uncertainty in the time and place of their work. Despite these challenges, researchers recruited 28 non-residents, comprising 11 conservancy workers, 11 informal waste pickers and 6 scrap shop workers for the symptoms diary exercise.

The symptoms diary exercise was carried out continuously for two periods of 12 weeks each (Six months in all) where the researchers contacted the respondents during the time slot preferred by the respondents themselves. During the recruitment week, a detailed health history of the respondents was recorded. Between weeks 1 and 12, specific symptoms experienced by the respondents in different parts of the body (list of body parts and relative symptoms is attached in the Appendix), the severity of the symptoms, and the treatment sought by respondents were recorded.

Towards week 10 of the symptoms diary exercise, when the most experienced symptom/ most affected body part began to get fairly discernible, in-depth interviews (IDIs) were conducted. Unlike the symptoms diary exercise, the IDIs were conducted only during the first phase of data collection from October 2018 to January 2019.The IDIs framed deeper investigation into factors, external and internal, most responsible for the state of health and well-being of the respondents. The IDIs aimed to obtain a detailed, rich understanding of factors influencing health and well-being. An ethnographic approach was taken to complement the action research. The general area of inquiry was explained to the potential participants at the time of recruitment and obtaining consent. 50 respondents, comprising

both respondents of symptoms diary exercise and other respondents were interviewed for this exercise.

4. Findings from the studies

The symptoms diary exercise as stated earlier was conducted over two periods, amounting to six months overall. The findings can be categorised into three sections. First section of the analysis is to find out what is the most commonly affected body system across all focus groups. Secondly, the report categorises most affected body systems for each of the four focus groups viz, residents, scrap shop workers, conservancy workers and informal waste pickers. Third, the report analyses the kinds of treatment and medication availed by the focus groups.

4.1 Most commonly affected body systems across all focus groups

Within the three sections, there is a further subdivision in terms of analysis of symptoms diary data from Phase 1 and Phase 2 respectively, as well as cumulative findings from both the phases.

The following tables and charts indicate the most affected body systems in terms of the number of times diseases/disorders associated with the concerned body system were reported by the respondents.

Body Part	Residents	Scrap shop Workers	Conservancy Workers	Informal Waste Pickers	Total
Respiratory Abnormalities	96	12	21	21	150
Skeletal Muscular Systems	80	9	18	32	139
Central Nervous System	20	0	2	14	40
Eye Infections	24	1	5	5	35
Skin	26	3	3	1	33
Abdominal and Intestinal problems	17	2	1	3	23
Blood Disorders	7	5	8	5	21

Dental Disorders	12	0	1	7	20
Ear Infections	5	0	2	4	11
Mental Wellness	2	0	0	2	4
Menstrual and Reproductive System	3	0	0	1	4
Typhoid Fever	3	0	0	0	3
Amoebiasis	1	0	0	0	1
Chickenpox	0	0	0	0	0
Tuberculosis	0	0	0	0	0
Dysentery	0	0	0	0	0
Malaria	0	0	0	0	0
Dengue Fever	0	0	0	0	0
Filariasis	0	0	0	0	0
Cholera	0	0	0	0	0

Table 1: Consolidated number of times a body part was reported as affected by the respondents from Phase 1 of the Symptom's Diary

Body Part	Residents	Scrap shop Workers	Conservancy Workers	Informal Waste Pickers	Total
Skeletal Muscular Systems	**65**	**6**	**5**	**8**	**84**
Respiratory Abnormalities	**37**	**1**	**3**	**1**	**42**
Abdominal and Intestinal problems	**12**	**1**	**10**	**2**	**25**
Blood Disorders	**13**	**0**	**0**	**0**	**13**

Eye Infections	**7**	**0**	**0**	**0**	**7**
Central Nervous System	**1**	**0**	**0**	**4**	**5**
Skin	**0**	**0**	**0**	**5**	**5**
Dental Disorders	**0**	**0**	**0**	**0**	**0**
Ear Infections	**0**	**0**	**0**	**0**	**0**
Mental Wellness	**0**	**0**	**0**	**0**	**0**
Menstrual and Reproductive System	**0**	**0**	**0**	**0**	**0**
Typhoid Fever	**0**	**0**	**0**	**0**	**0**
Amoebiasis	**0**	**0**	**0**	**0**	**0**
Chickenpox	**0**	**0**	**0**	**0**	**0**
Tuberculosis	**0**	**0**	**0**	**0**	**0**
Dysentery	**0**	**0**	**0**	**0**	**0**
Malaria	**0**	**0**	**0**	**0**	**0**
Dengue Fever	**0**	**0**	**0**	**0**	**0**
Filariasis	**0**	**0**	**0**	**0**	**0**
Cholera	**0**	**0**	**0**	**0**	**0**

Table 2: Consolidated number of times a body part was reported as most affected by the respondents from Phase 2 of the Symptom's Diary

Body Part	Residents	Scrap shop Workers	Conservancy Workers	Informal Waste Pickers	Total
Skeletal Muscular Systems	**145**	**15**	**23**	**40**	**223**

Respiratory Abnormalities	**133**	**13**	**24**	**22**	**192**
Abdominal and Intestinal problems	**29**	**3**	**11**	**5**	**48**
Central Nervous System	**21**	**4**	**2**	**18**	**45**
Eye Infections	**31**	**1**	**5**	**5**	**42**
Skin	**26**	**3**	**8**	**1**	**38**
Blood Disorders	**20**	**1**	**8**	**5**	**34**
Dental Disorders	**12**	**0**	**1**	**7**	**20**
Ear Infections	**5**	**0**	**2**	**4**	**11**
Mental Wellness	**2**	**0**	**0**	**2**	**4**
Menstrual and Reproductive System	**3**	**0**	**0**	**1**	**4**
Typhoid Fever	**3**	**0**	**0**	**0**	**3**
Amoebiasis	**1**	**0**	**0**	**0**	**1**
Chickenpox	**0**	**0**	**0**	**0**	**0**
Tuberculosis	**0**	**0**	**0**	**0**	**0**
Dysentery	**0**	**0**	**0**	**0**	**0**
Malaria	**0**	**0**	**0**	**0**	**0**
Dengue Fever	**0**	**0**	**0**	**0**	**0**
Filariasis	**0**	**0**	**0**	**0**	**0**
Cholera	**0**	**0**	**0**	**0**	**0**

Table 2: Consolidated number of times a body part was reported as most affected by the respondents from Phase 1 and 2 data.

Most respondents experienced symptoms pertaining to a disease or disorder affecting the skeletal and muscular system, respiratory abnormalities, abdominal and intestinal problems and the central nervous system, in that order respectively. Persistent cold and cough, sneezing, wheezing and breathing difficulties were reported as the most common respiratory issues, whereas severe to mild pain in the limbs, stiff joints, back pain were reported as the most frequently experienced symptom affecting the skeletal and muscular system. Other symptoms affecting the central nervous system such as sleeplessness, frequent headaches and abdominal and intestinal problems such as gas, stomach pain, vomiting and difficulty in urination were also experienced by respondents. Skin problems, ear and eye infections, dental and blood disorders were also reported by some of the respondents. A few women also reported menstrual problems such as irregular periods. Anaemia was another common symptom experienced by the female respondents.

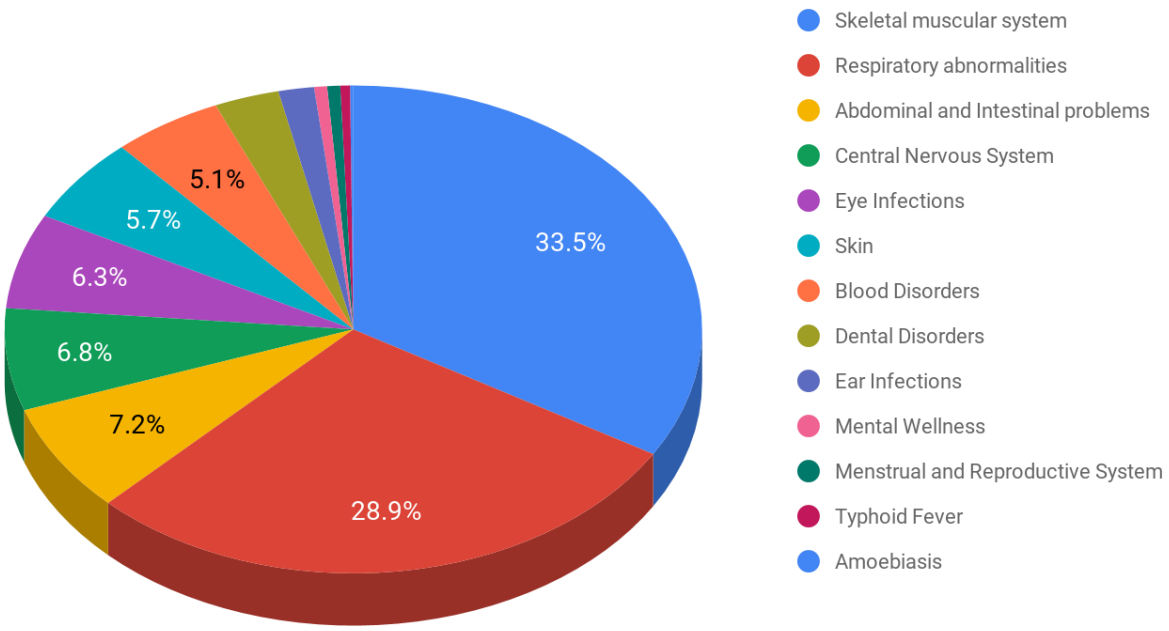

Image 1: Percentage distribution of most affected body systems across Phase 1 and Phase 2

4.1 Residents

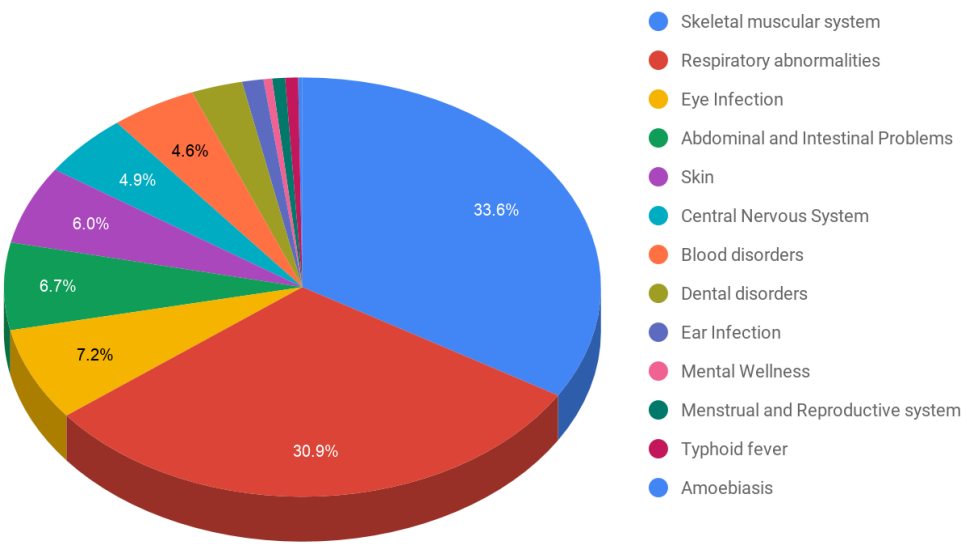

Image 2: Residents and most affected body system across the two phases of data collection

Among the residents, skeletal and muscular problems and respiratory abnormalities were the most reported as per the cumulative findings from Phase 1 and 2 of data collection (Image 2). On further exploration during the IDIs, most residents who lived in MGR Nagar (most proximate) and RR Nagar (moderately proximate) to the dump yard, complained of poor quality of air as perceived from the foul/pungent smell in the air. They attributed this to the dump yard and a few respondents categorised this as the smell of burning plastics or rubber. The residents living in Krishnamurthy Nagar (far from the dump yard) attributed poor quality of air to the plastic processing units operating out of small establishments situated within the residential area. A couple of respondents residing here also complained of jarring noise from the plastic processing industries which break hard plastics such as thermoplastics used in furniture and other household utility items.

Almost all the residents complained of heavy fumes and smoke ejected from the garbage trucks and compactor lorries as another reason for poor quality of air. Eye infections are also common among the residents (refer to Image 3) possibly from the poor air quality and presence of smoke, which results in burning sensation in the eyes (as reported in the IDIs).

Residents also complained of frequent headaches and sleeplessness, affecting their central nervous system. From the IDIs, we understood that it was because of mosquito menace and noise from the garbage trucks. We also learnt that the residents spent a good portion of their monthly income in buying mosquito repellents. Some of them even attributed the strong odour of the repellents such as citronella oil sticks for respiratory issues experienced by themselves and their family members.

Respondents in RR Nagar complained of unendurable smell from the open garbage trucks as they traverse through the main road before they enter the main gate which is located right opposite the RR Nagar tenements. The trucks ply up and down round the clock and transport the bulk of unsegregated waste from seven zones in the city to the Kodungaiyur dumpyard. Residents narrated that the odour from the garbage truck often smelled like decayed carcasses, sanitary and faecal waste. This, in combination with poor water quality as a result of the presence of sewage in drinking water, has caused abdominal issues including nausea, vomiting, headaches, nose-block and other physical discomfort. The open trucks also spill the garbage on the road, which attracts rodents and other scavenging birds and animals.

In addition to the symptoms affecting the physical health experienced by the residents, they also expressed concerns about the frequent accidents that the local people meet with because of the garbage lorries and trucks. During the IDIs, the residents also pointed to a particular location at the intersection of the road running parallel and perpendicular to the entrance of the dumpyard as an accident hotspot. Infact, the residents themselves have installed a signage that reads 'accident prone zone', to warn the pedestrians and vehicle drivers. Some residents who have seen and heard accounts of such accidents also shared stories of trauma experienced by the families of the victims.

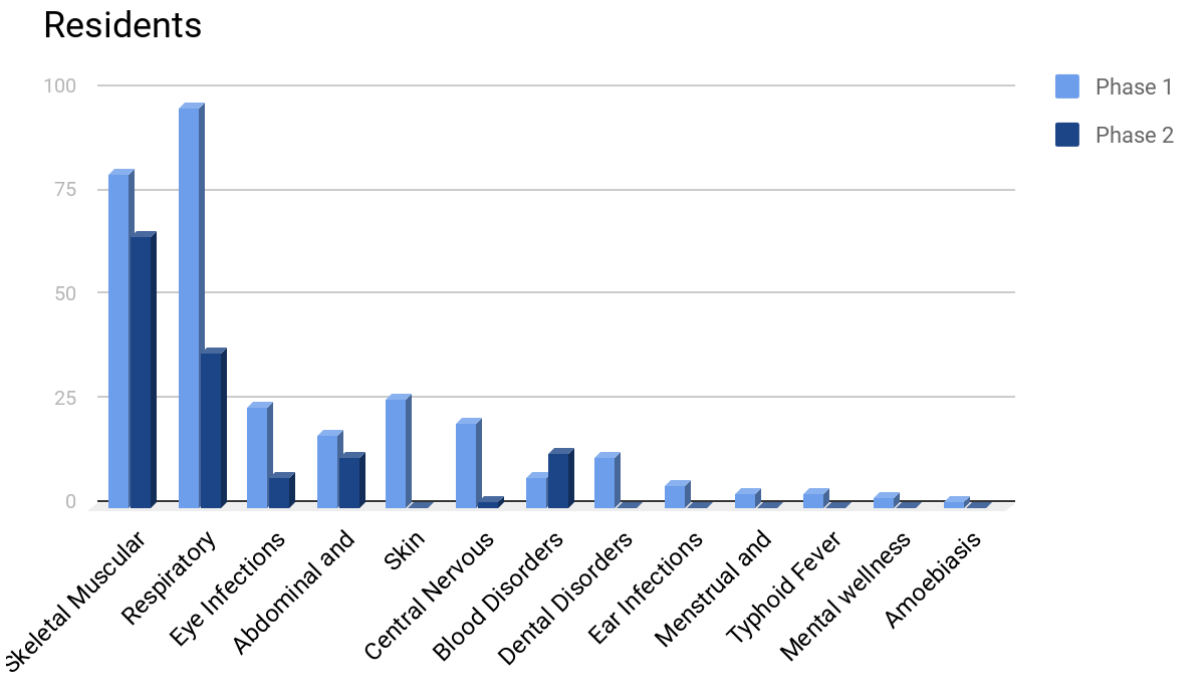

Image 3: Comparative analysis of reported diseases/disorders across Phase 1 and 2.

4.2 Informal Waste Pickers (IWPs)

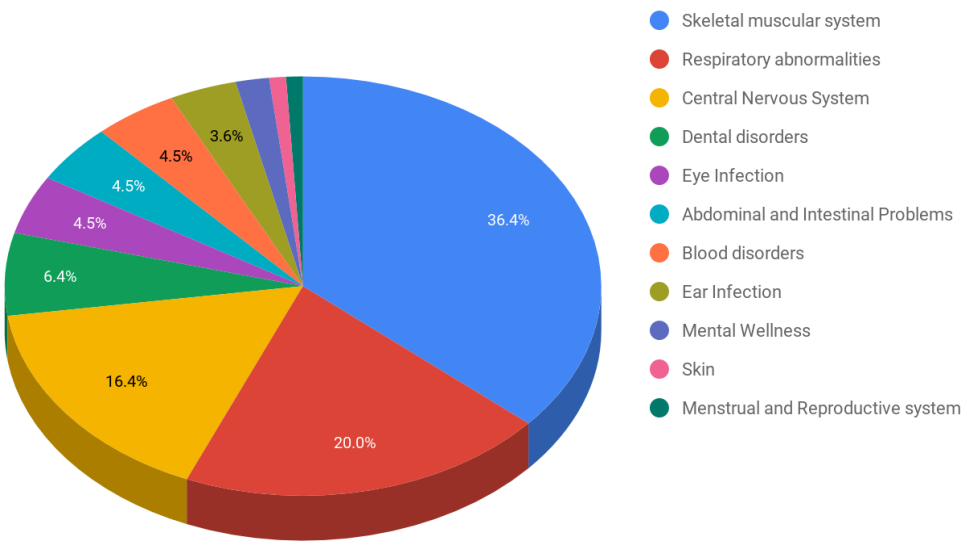

Image 4: Informal Waste Pickers and most affected body system across the two phases of data collection

Informal waste pickers, some of whom also reside in the proximate and moderately proximate areas, experienced skeletal muscular problems, followed by respiratory abnormalities (Image 4). They attributed the respiratory abnormalities to the exposure to poor quality of air, which they reported as often leading to irritated airways, feeling out of breath and burning sensation in the eyes. Symptoms affecting the skeletal muscular system including back pain, stiff joints and pain in the leg or feet were reported to be experienced as an occupational hazard endemic to the waste picking community. The IWPs also reported experiencing headaches due to inhaling virulent substances in the dump yard, and sleeplessness, mostly due to the mosquitoes in the areas they reside.

While recruiting the IWPs and collecting preliminary data on their health status, we expected that they would report a lot of symptoms due to consistent, direct exposure to different kinds of waste. However, we learnt later that the IWPs or anyone who regularly works in the dump yard do not easily profess any ill effects from waste during non-invasive studies, often due to the fear of being displaced from their livelihood which is already under severe surveillance and stress. We gathered that conducting health camps at regular intervals to investigate through invasive testing may be necessary to establish the real health impacts for IWPs.

In general, from the symptoms diary exercise and the IDIs, we learnt that it was difficult to break the conversational barrier with the IWPs, primarily because they continue to live under the trepidation that they may be stopped from accessing the dump yard or pursuing their livelihood.

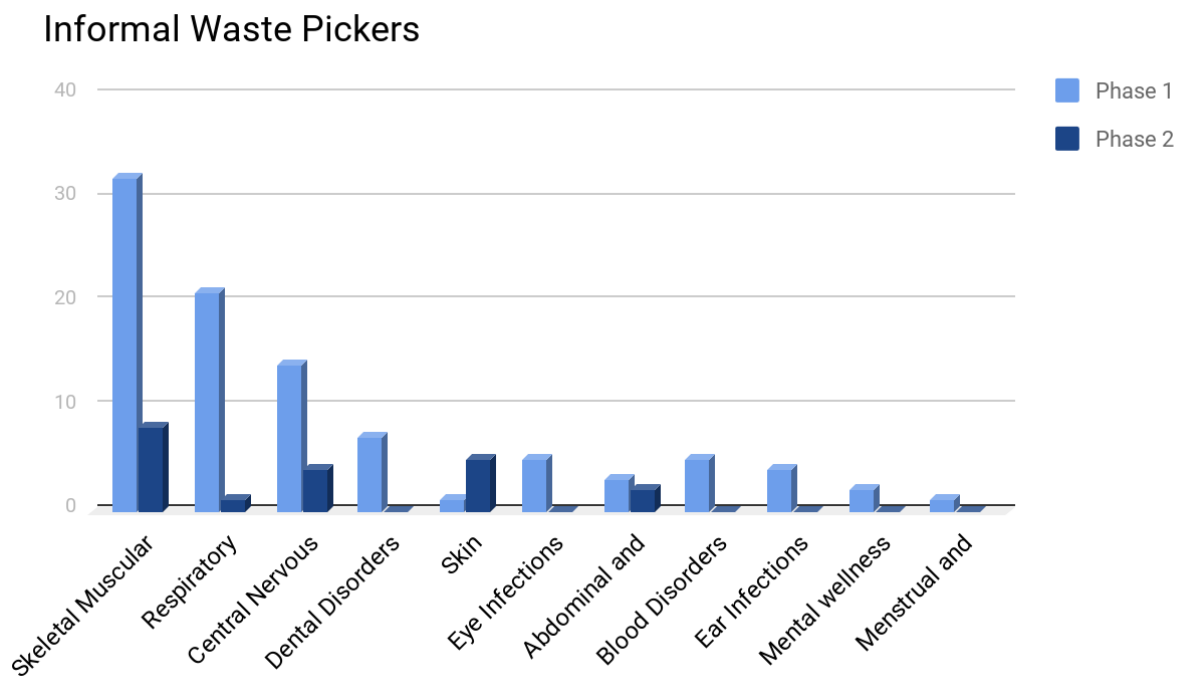

Image 5: Comparative analysis of reported diseases/disorders across Phase 1 and 2.

4.3 Scrap shop workers

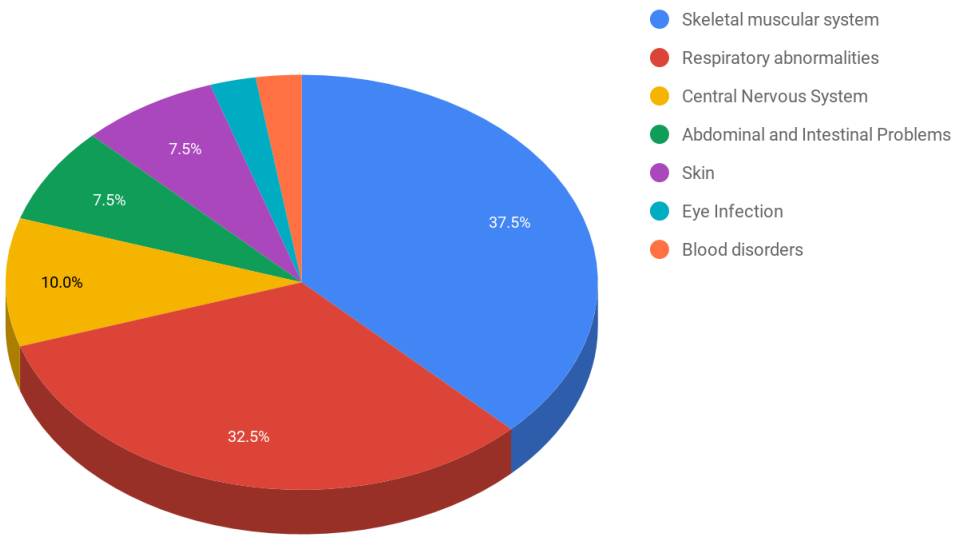

Image 6: Scrap shop workers and most affected body part across the two phases of data collection

Since a few of the scrapshops were part of the local traders association, the workers were very hesitant to participate in the study, which by its title in the vernacular language **வணிகங்களின் வணிக நடைமுறைகளால் ஏற்படும் மனித உரிமை மீறல்களின் மதிப்பீடு**, suggested that the objective of the study was to conduct an investigation on the human rights impacts of unsustainable businesses practices. This gave them an impression that they would be subjected to uncomfortable questions on their work environment and their occupation. During the recruitment phase, the researcher rephrased the objective clause to remove any scepticism from the minds of the respondent and explained that the overarching objective was to target the global plastic manufacturing and packaging industry and not the local traders.

Most scrap shop workers were very much under the supervision of their masters at the time of the symptoms diary exercise, therefore it was challenging to recruit them for the study. Once recruited, it was still challenging to extract any information on their health statuses, perhaps due to fear of maltreatment by their bosses. It was only after a few weeks into the study that the scrap shop workers began reporting their symptoms. Skeletal and muscular problems and respiratory abnormalities were reported to be the highest (Image 6). As gathered from the IDIs, it could be because they were more exposed to burning of materials such as wires for the extraction of copper and other valuable materials for the scrap market.

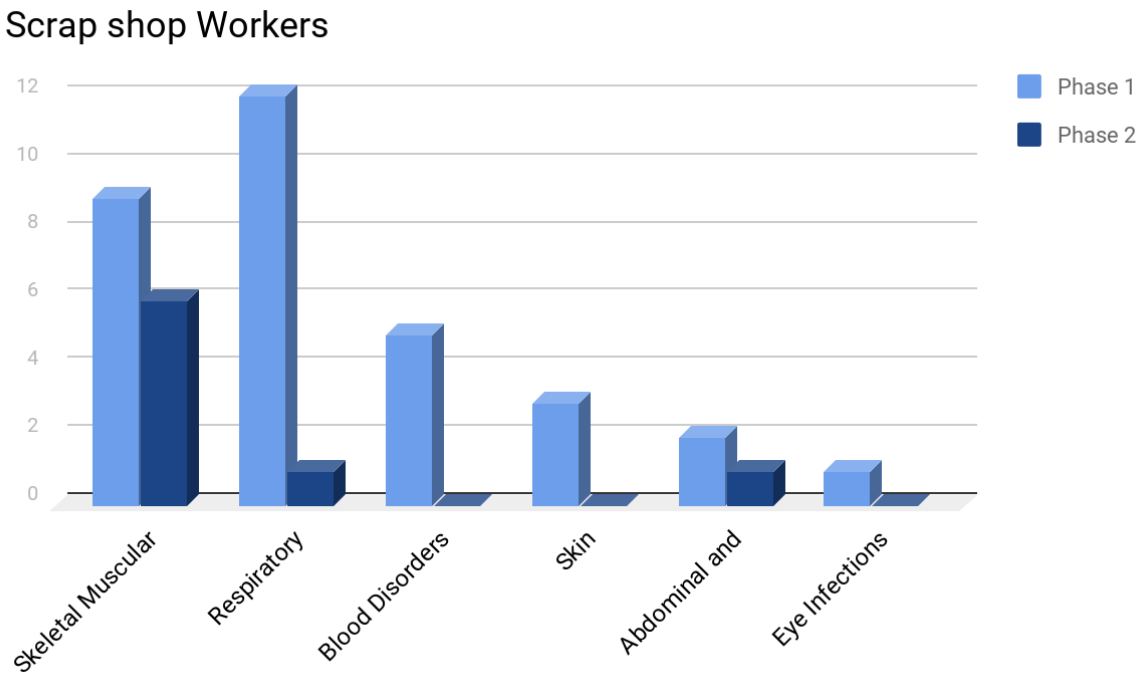

Image 7: Comparative analysis of reported diseases/disorders across Phase 1 and 2.

4.4 Conservancy workers

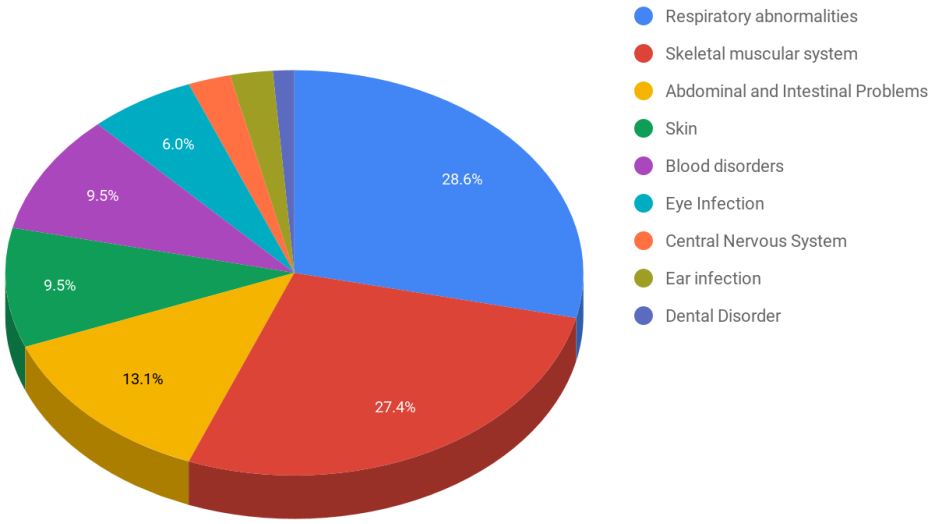

Image 8: Scrap shop workers and most affected body part across the two phases of data collection

The conservancy workers also experienced a high degree of respiratory problems (Image 7). This is partially because most conservancy workers were deployed in areas closer to the dump, where they have high degree of exposure to the smoke, bad odour and other contaminants to the air. Conservancy workers were also engaged in day-to-day activities such as street sweeping, which emits a lot of fine dust which they inhale. Twenty-three conservancy workers also reported to be suffering from orthopaedic issues affecting skeletal and muscular systems owing to activities such as pulling the garbage tricycle, lifting heavy drums of unsegregated waste to be emptied into the dumpster. A few female conservancy workers also reported anemia.

Women conservancy workers also reported verbal abuse by the residents of the areas where they do door-to-door collection with their tricycle. They are subjected to expletives, often indicating their caste or female body parts. The respondents also reported other indirect forms of abuse such as improper disposal of sanitary waste such as diapers with faecal matter and unwrapped sanitary pads and condoms. The conservancy workers also mentioned that the mandatory door-to-door segregation put a lot of stress on them since most residents willfully refused to comply with the rule and as a result, they had to segregate a lot of plastic waste with bare hands.

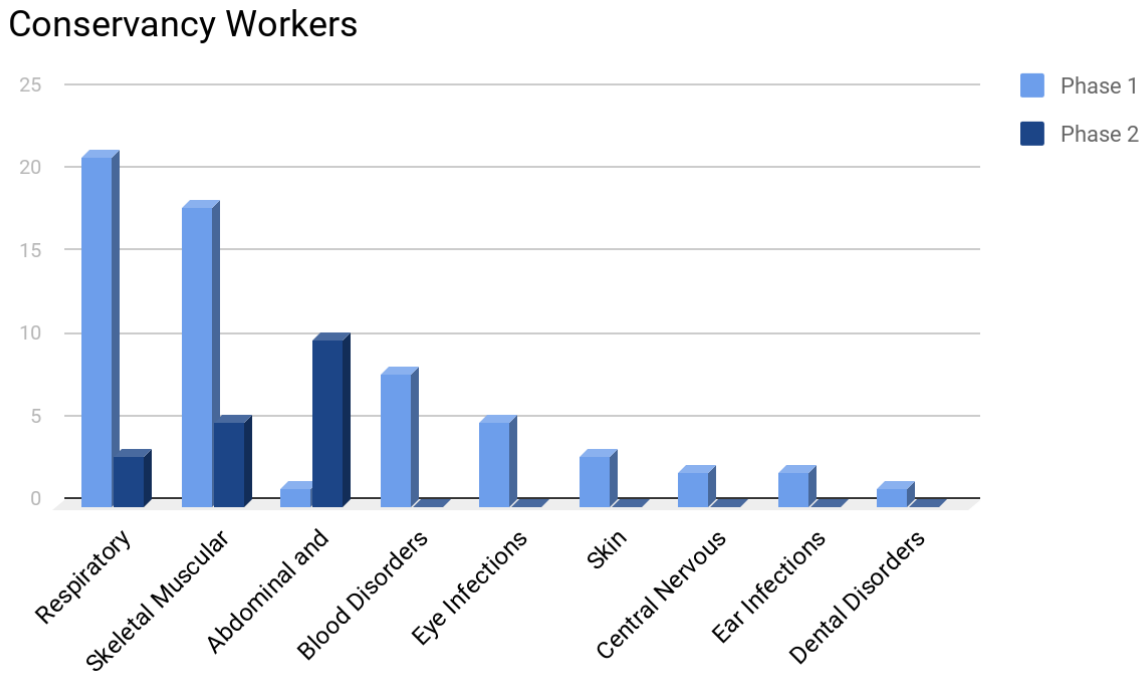

Image 9: Comparative analysis of reported diseases/disorders across Phase 1 and 2.

4.5 Treatment and medication

The World Health Organisation (WHO) defines right to health as a claim to a set of institutional arrangements and environmental conditions that are needed for the realisation of the highest attainable standard of health. This right cannot be experienced or enjoyed in silos and must be complemented with the availability of services for the fulfilment of right to health in its entirety.

During the symptoms diary exercise and the IDIs, we also collected information on the different kinds of medication and health services accessed by the respondents. We broadly categorised this into formal and informal ways in which people sought services. Under the formal ways, we sought to capture information on public and private services for conventional medicines and alternative medicines (Ayurveda, Yoga & Naturopathy, Unani, Siddha and Homeopathy) and for the informal ways, drugs and medicines prescribed by the pharmacists and traded across the counter, home remedy and other commonly available self-medication drugs available in the market were sought to be collected.

Type of Medication	Conservancy Worker	Informal Waste Picker	Resident	Scrap shop worker	Total
GP Government	18	8	107	5	138
GP Private	10	9	108	19	146
Pharmacist Prescribed	7	31	49	7	94
Self - Medication	3	5	27	2	37
Home remedy	3	1	13	0	17
Alternate Medicine	4	0	6	0	10

Table 4: No of times of uptake of a medical service or medication by respondents

As among the residents, most respondents visited a government facility first, but often followed it up with a visit to a private clinic either because the service was dissatisfactory or that they continued to experience symptoms of the ailment for which they sought treatment . Most residents referred to the private doctors with esquires such as '40 Rupees doctor' or '100 Rupees doctor', perhaps as an allusion to the fees they charge.

From Table 4, the heavy reliance on informal medication channels such as getting drugs across the pharmacy counter prescribed by a pharmacist can be inferred. The IDIs confirmed that most residents found it convenient to get drugs from the nearest pharmacy for minor ailments such as cold and cough, pain in the body and mild fever. They also admitted to visiting the pharmacy first for minor issues and only then accessing formal services such as primary health care centres or clinics, whether managed by private or by government.

Diagnostic services	Residents	Scrap shop Workers	Conservancy workers	Informal Waste Pickers
Blood	10	3	1	2
X-Ray	2	0	0	1
Urine	4	0	0	0
Blood Pressure	1	0	0	0

Table 5: Diagnostic services availed by the respondents during the study period

This informality in healthcare access also explains the low uptake of diagnostic services, typically prescribed by the formal healthcare system (Table 5).

The following pie-charts elaborate on the link between the diseases/disorders reported by the respondents and the kind of medication services viz, Government, Private, Pharmacist-prescribed, Alternate Medicine, Self-Medication and Home Remedies, availed by the respondents to seek treatment for the same.

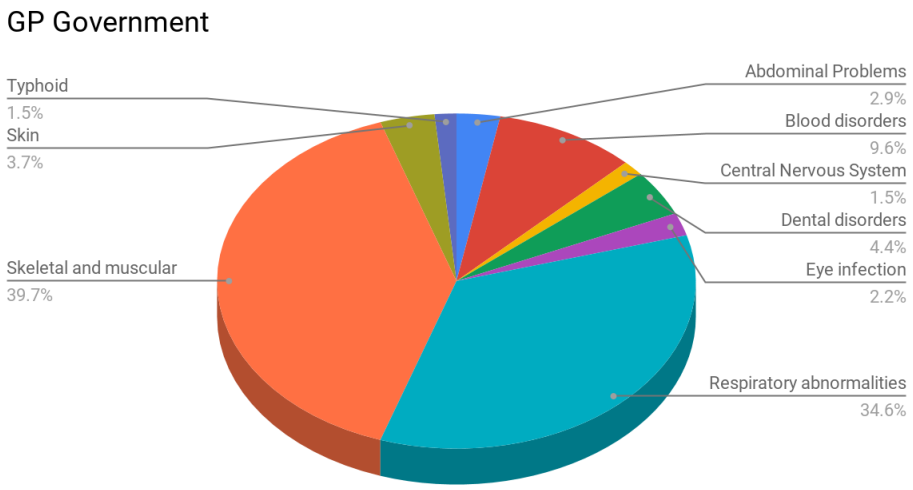

Image 10: Percentage distribution of diseases/disorders reported to GP Government by the respondents.

Most respondents visited a government facility for various disorders including respiratory abnormalities, skeletal and muscular problems, and blood disorders majorly. This is in consonance with the findings from the most reported diseases/disorders, which were skeletal and muscular system problems and respiratory abnormalities respectively. There was also a higher percentage of blood disorders being reported to GP Government as the blood tests herein are significantly cheaper in comparison to private facilities.

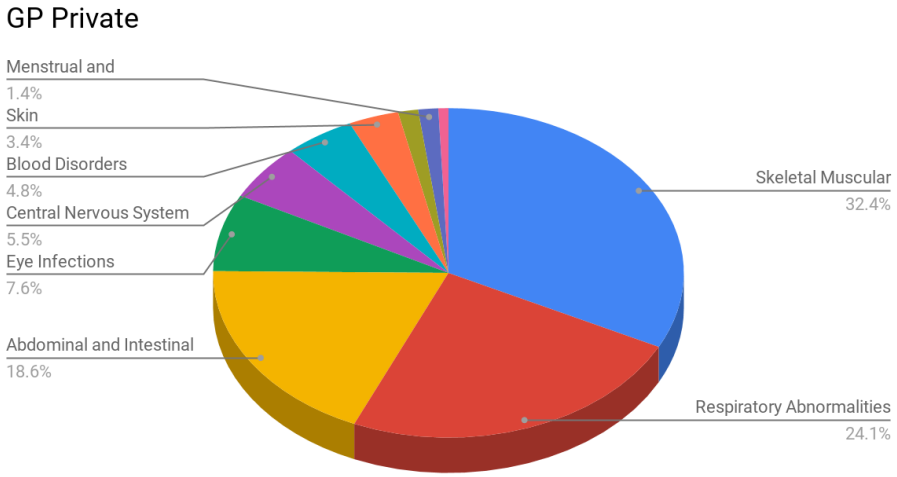

Image 11: Percentage distribution of diseases/disorders reported to GP Private by the respondents.

The top three most reported symptoms to GP Private are skeletal and muscular systems, respiratory abnormalities, and abdominal and intestinal problems respectively. The above three are the most affected body systems in general (Refer to Image 1) and hence are the top three reported symptoms at all the different medication services. There is a higher percentage of eye infections, central nervous system problems, menstrual and reproductive problems reported to GP Private as these are specialised problems requiring treatment from the concerned specialist doctors.

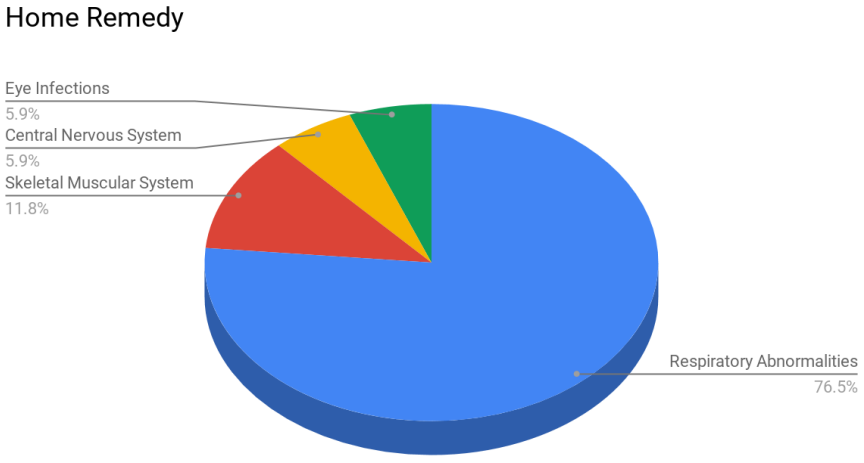

Image 12: Percentage distribution of diseases/disorders treated by home remedies by the respondents.

Home remedies were used by the respondents to treat respiratory problems, skeletal and muscular system problems, central nervous system issues and eye infections. These tend to be chronic illnesses especially those related to the central nervous system, which require prolonged care and hence are typically treated at home, in addition to a number of less severe illnesses such as common cold etc.

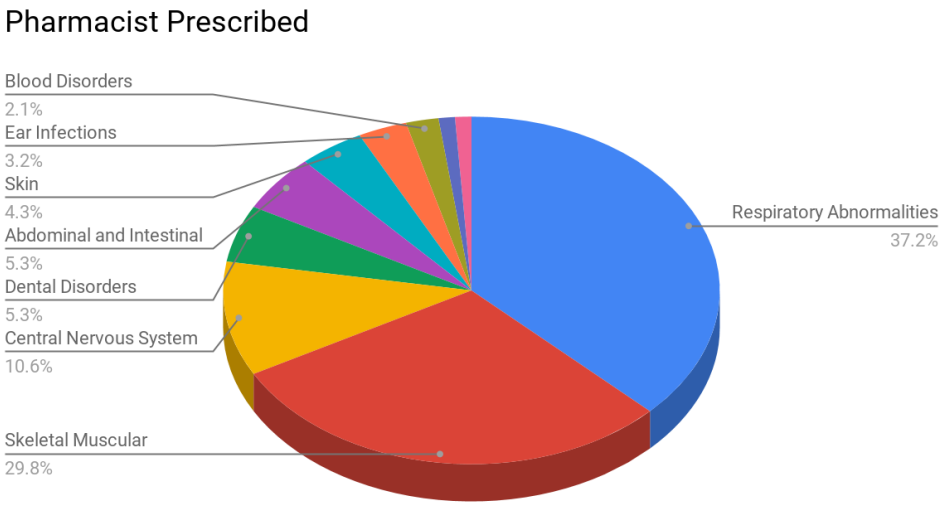

Image 12: Percentage distribution of diseases/disorders treated by pharmacist-prescribed medicines by the respondents.

There is more diversity in the number of diseases/disorders self-treated by the respondents through pharmacist-prescribed medication. This is the consequence of self-medication being cheaper to avail as opposed to treatment at a private medical facility or even government hospitals/public health centres.

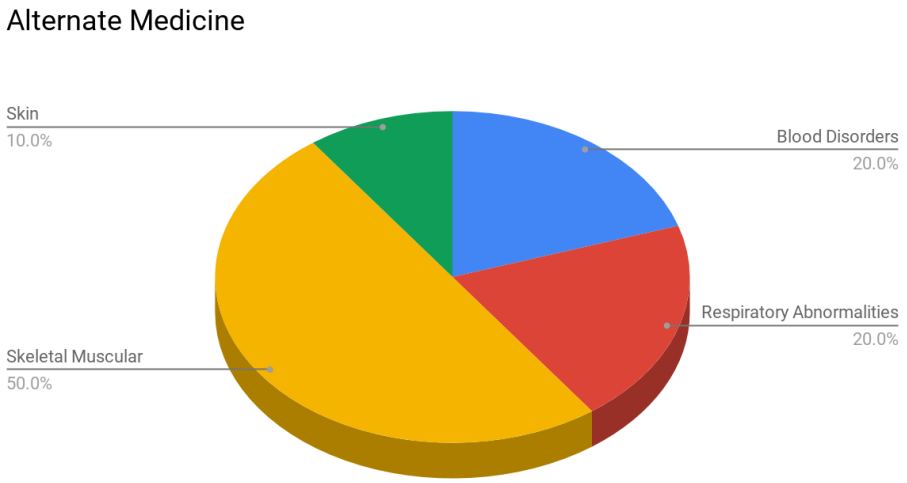

Image 13: Percentage distribution of diseases/disorders treated by alternate medicine by the respondents.

Again, respiratory abnormalities, skeletal and muscular system problems, blood disorders and skin issues are commonly treated by the respondents by alternate medicine including Ayurveda, Homeopathy etc. People tend to resort to alternate medicine wherein they are unsatisfied with the results of conventional treatment or wherein they believe that the diseases in question can be treated through more holistic lifestyle changes. This holds true especially in cases of disorders relating to the blood and skin, which traditionally have a lot of alternate medical treatments related to them.

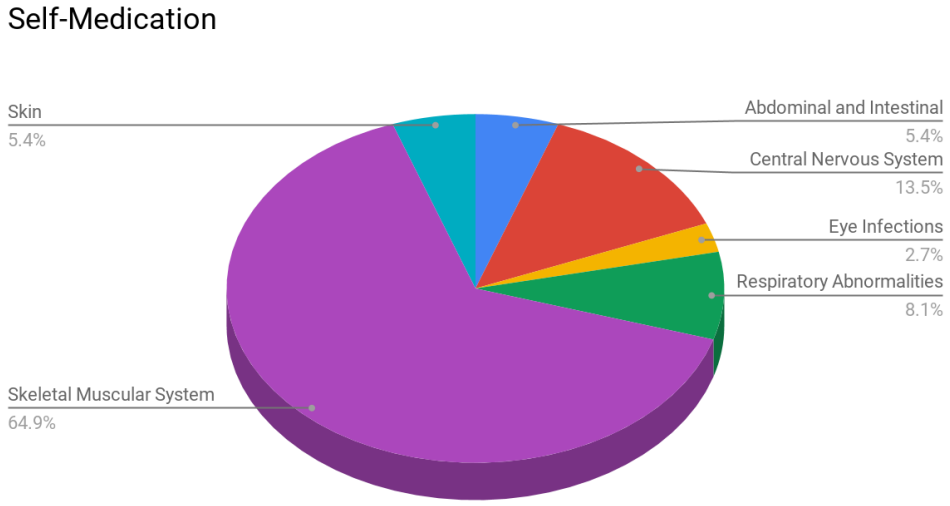

Image 14: Percentage distribution of diseases/disorders treated by self-medication by the respondents.

Self-medication such as the use of aromatic oils, balms, and such other drugs with popular brand names were reported to be widely used. During the field visits, the field researchers observed large amounts of stocks of popular drugs for instant pain relief such as Vicks, Amrutanjan, Tiger balm, and Gold medal oil in small shops located in the high-density population areas such as RR Nagar and Ezhil Nagar.

5. Conclusion

While urban living offers opportunities, jobs and services, today's urban environments can concentrate health risks and introduce new hazards. In many developing cities, population growth is far outstripping the capacity of municipal governments to plan and build infrastructure. The role of businesses is often overlooked from the development paradigm. Unfortunately, economic development, environment and health sectors are not well aligned on pollution issues and actions, and implementing integrated strategies is becoming the biggest challenge of our times (World Health Organization and UN Habitat, 2016).

Research shows that rapid expansion of low and middle-income cities has increased health risks on multiple fronts. Air pollution, road traffic congestion, and lack of safe spaces for walking, cycling and physical activity all contribute to rising death rates from stroke, heart disease, cancer, respiratory illness and injuries. Poor urban sanitation and waste management are known to perpetuate transmission of vector-borne and infectious diseases such as diarrhoea and TB. In addition, urban health risks are distributed unequally among social groups, with most of the burden borne by vulnerable populations, particularly those living in fragile areas, like slums and low-income settlements, where almost 40% of urban population growth is occurring. All these could mean only one thing- the implications for health are huge, as is the agenda for urban health research. Flagrant violations of human rights of health by businesses may provide a vital lens to strengthen this agenda.

References

Grun, F., & Bllumberg, B. (2009). Endocrine disruptors as obesogens. *Mol Cell Endocrinol*, (304), 19–29.

Oni, T. et al. (2016). Urban Health Research in Africa: Themes and Priority Research Questions. *Journal of Urban Health : Bulletin of the New York Academy of Medicine*, *93*(4), 722–30.

Rustagi, N., S.K, P., & Ritesh, S. (2011). Public health impact of plastics: An overview. *Indian Journal of Occupational and Environmental Medicine*, *15*(3), 100–103.

Shema, T., & Woodman, J. (2010). Using mixed methods in health research. *Journal of the Royal Society of Medicine Short Reports*, (10), 1–8.

World Health Organization and UN Habitat. (2016). *Global report on urban health: equitable healthier cities for sustainable development*.

Appendix

Symptom's Diary Legend

Health issue organ based	Keywords for the symptoms
Skin	Rashes
	Itching
	Scaly patches
	Ringworms
Respiratory abnormalities	Sneezing
	Wheezing
	Asthma
	Persistent cold and cough
Abdominal and Intestinal Problems	Vomiting
	Excessive burping
	Burning in the throat or upper chest
	Diarrhea
Dental Disorders	Dental carries
	Dental pain
Ear Infections	Ear ache
	Puss from ear
Skeletal Muscular Systems	Stiff joints
	Twitching muscles
	Back pain
Central Nervous System	Impaired mental ability
	Memory loss
	Partial or complete paralysis
	Seizures
	Headaches
Eye Infections	Aversion to bright light
	Pain, itching or sensation of a foreign body in the eye
	Swollen eyelids
	Discharge of yellow pus
Blood disorders	Iron deficiency
	Fast heartbeat
	Blood blisters
Mental Wellness	Memory loss
	Stress/ Depression
	Schizophrenia
	Anxiety
Chickenpox	Boils
Tuberculosis	Persistent Cough
Amoebiasis	Diarrhea
Typhoid Fever	Fever and rash spots
Dysentery	Diarrhea with blood

Health issue organ based	Keywords for the symptoms
Malaria	Shivering and sweating
Dengue Fever	Fever with Muscle and Joint Pains
Filariasis	Swollen leg
Cholera	Nausea
Menstrual and reproductive system (For women and mature girls)	Identified as a high-risk mother
	Antenatal development delay
	Low birth weight (less than 2500 g/2.5 Kg)
	Fetal mortality
	Infant mortality
	Spontaneous abortion
	Early onset of puberty
	Delayed periods
	Menstrual cramps and stress

Symptom's Diary Form

Symptoms diary for different focus groups வெவ்வேறு கவனக் குழுக்களுக்கான அறிகுறிகளின் குறிப்பேடு			
Name of the Respondent / பதிலளிப்பவரின் பெயர்			
Focus Group கவனக் குழு:	1) Resident 2) IWP 3) Conservancy worker 4) Scrap shop 1)குடியிருப்பவர் 2) குப்பை பொறுக்குபவர் 3) துப்புறவு தொழிலாளர் 4) காயலான் கடை		
Gender / பாலினம்: Male / ஆண் Female/ பெண்		Age / வயது: _____	Identity Proof & No/ அடையாள அட்டை மற்றும் எண் :
Date / தேதி:	Start Time/ தொடங்கும் நேரம் :	End Time/ முடிவு நேரம் :	Week/வாரம் :
Location / இடம்:		Name of the Interviewer பேட்டியாளர் பெயர் :	

1. In the last one week, have you availed any of the diagnostic services? 1. கடந்த ஒரு வாரத்தில் , நோய் கண்டறியும் சேவைகளில் ஏதேனும் ஒன்றை நீங்கள் பெற்றுள்ளீர்களா ?			
Diagnostic service நோய் கண்டறியும் சேவை	**Tested for** சோதனை	**Diagnosis** நோய் கண்டறிதல்	**Medication Type** சிகிச்சை முறை
Blood / இரத்தம்			
Urine / சிறுநீர்			
Xray / எக்ஸ்ரே			
Blood pressure / இரத்த அழுத்தம்			

2. Can you list what are the common symptoms exhibited by you in the last one week ?
2. கடந்த ஒரு வாரத்தில் தங்கள் உடல்நிலையில் காணப்பட்ட அறிகுறிகள்

Health issue organ based	Symptoms	Severity [On a scale of 0 to 5]	Medication Type
உறுப்பு அடிப்படையிலான சுகாதார பிரச்சினை	அறிகுறிகள்	தீவிரத்தன்மை [அளவு 1 முதல் 5 வரை] (1) (2) (3) (4) (5)	சிகிச்சை முறை