

# Socio-Economic Perceptions and Carbon Footprints among the Residents of Guwahati City, during Covid-19 Pandemic

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## ABSTRACT

**Aim of the Study:** The Global pandemic, Covid-19, has rigorously affected the economies and societies all over the world but also provided an opportunity for self-restraint, developing new skills and family bonding. The carbon footprints of the people were also affected during the period. The study attempts to know the differences, if any, in carbon footprint emission among the different economic groups residing in Guwahati city. It will also gauge the psychological state of the individuals during the covid-19 pandemic.

**Methodology:** The study was conducted in Guwahati City among respondents belonging to different sections of the society between August to December, 2020. The respondents were interviewed with the help of an online questionnaire.

**Findings & Conclusion:** The results have indicated an increase in the carbon footprints in certain household utility items. On the other hand, a decrease in carbon footprints was also observed in case of certain other daily necessities.

**Keywords:** Covid-19 Pandemic, Carbon Footprint, Household Utility, Psychological State.

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## Introduction

The whole world was astounded by the immediate impact of the Covid -19 pandemic. All over the world people were forced to get inside their homes and encouraged to work from their homes rather than commuting to their respective locations. The immediate isolation inside their premises made people more anxious, frustrated and irritated to cope up with the prevailing situations leaving aside their scheduled life styles. It has been seen that most of the people were adversely affected economically, some have lost their jobs, some were working without any remunerations, and there was downfall in business and other related consequences. However, during the global pandemic, certain novelty has also been brought into light, for instance investing their time with family and friends, adopting new technical skills, learning new recipes, planting trees, completing different housework, etc., which could be regarded as positive results in the lifestyles of the people in collaboration with the pandemic situation.

The ongoing global climate change makes all these issues even more pertinent: developing a more sustainable mobility system will require us to reduce transport-related carbon emissions, of which

commuting constitutes a large share (Ferreira et al., 2017). Reducing mobility, however, has never been a popular idea among politicians (Nikolaeva et al., 2019): up to now, it has largely been seen as a radical proposition or even a “taboo” (Gössling & Cohen, 2014). In the spring of 2020, this “taboo” has unexpectedly been broken, enabling a broader societal and political debate on the role of mobility, and offering researchers an opportunity to study what a less mobile society might look like (Rubin et al., 2008).

### ***Aim of the Research***

The present study aims to investigate the impact of carbon footprints of the residents of Guwahati city taking into account a few parameters like use of mobile phones, television, during the covid-19 pandemic and also to investigate people’s experiences and perceptions during the Covid – 19 pandemic residing and working inside their homes including their income generation and mental health. The following sets of questions were examined /explored during the online based survey:

### ***Research Questions***

- 1) What is carbon footprint and what are the parameters related to the household carbon footprints?
- 2) What was the household income and emission pattern during the pandemic situation?
- 3) What were the major advantages and disadvantages that the residents encountered living and working from their homes?
- 4) Whether they were affected economically during the global pandemic?
- 5) How did they usually pass their time during “work from home”?
- 6) What did they miss during the experience of Covid – 19 pandemic?
- 7) What do they think about the digital platforms which has remarkably increased and brought about a change in the society during the Covid – 19 outbreak?

### **Calculation Methodology**

To calculate the emission of carbon footprints of the surveyed respondents of Guwahati City, the following formulas were used.

- **GHG inventory:** - A GHG (Green House Gas) inventory is a systematic accounting of existing GHG emissions for a defined entity over a given period of time. Inventories can be undertaken on any level: global, national, state, local, by company, educational institution, or by household. In an inventory, we can identify, calculate, verify and report the emissions. (Judith R. Purman, Tracking your Carbon Footprint)
- **Steps for comprehensive GHG inventory:** -
  - = determining inventory boundary
  - = selection of base year
  - = calculating GHG emissions
- **Emission Factor(s):** - A factor that converts activity data into GHG emissions data (e.g., kgCO<sub>2</sub>e emitted per liter of fuel consumed, kgCO<sub>2</sub>e emitted per kilometer travelled, etc.)

In order to identify the household carbon footprints of different income groups, the following formula has been used:

### ***Energy Consumption***

$$\text{input value (in kwh/yr.)} \times (\text{emission factor}) = \text{output value in kgCO}_2\text{e}$$

Regarding household energy consumption two parameters were selected i.e., on mobile phone and television. Both of these parameters are calculated on the basis of the information of the households. During the pandemic, the people were spending much more of their time on these two gadgets to keep abreast of the happenings in the outside world from the safety and comfort of their households. So, the carbon inventory measures were taken to measure the emissions of the two gadgets used by the respondents during the pandemic situation. The input value here indicates the total energy consumed by the respective gadgets

during a month/year multiplying it with the emission factor, we will get the output value in kgCO<sub>2</sub>e i.e., per unit of energy consumption and release of carbon dioxide in kilogram is calculated.

### ***Carbon Footprint and Related Parameters***

Carbon footprint is a measure of an individual’s contribution to global warming (Carbon Calculator). Carbon Trust (2008) defines Carbon Footprint as “the total set of GHG emissions caused directly and indirectly by an individual, organization, event or product”. In short, we can say that Carbon Footprint is the total Green House Gases that are emitted by our actions.

Household carbon footprint has now become a global concern as consumption embedded with goods and services has tremendously increased within a few decades. The household size, composition, income, diet, energy supply and living standards are some of the important drivers of household carbon footprints. The average carbon footprint arises mainly from three sources, transportation, housing and food. Studies made on household carbon footprint found that activities with friends and families when performed jointly around homes enhance social well-being which should be encouraged rather spending time on individual recreation and leisure. It also leads to lower carbon emission per person.

### ***Pattern of Household Income and Carbon Emission during Pandemic Situation***

The immediate lockdown nationwide limiting movement of the entire 1.38 billion of population which slowed down the economic growth of the country. The GDP growth rate had fallen from 8.2% in January – March 2018 to 3.1% in January – March, 2020 (Infographic: India’s GDP Collapses in face of pandemic, Statistical Infographics, 4<sup>th</sup> September, 2020)

Majority of the surveyed respondents had a monthly income of Rs. 50,000 – 1,00,000. In a general term greater the number of members in a family, higher is the need and demand for goods and services in a family. So, the study found that in the lower income group of families with higher number of members, the consumption level tends to increase or the flow of energy increases. The major sources of energy consumption include watching TV, number of mobile phones and its uses per hour, number of electronic gadgets fixed for the lighting purposes, artificial decors, kitchen items including chimneys, etc. in a household. But variation regarding the use of energy on the one hand and the relatively same income on the other hand is also seen. Sometimes a middle-income household has all the facilities found in a higher-class family and vice versa. So, the amount of energy consumed may also sometimes vary in such particular situations.

Table.1: *Income and energy consumption of the surveyed households of Guwahati City during the Covid 19 Pandemic*

Sl. No.	Income (Rs.)	Mobile 0 - 3 hrs	TV 3 - 5 hrs	Mobile 5 - 8 hrs	TV 8 - 12 hrs	Mobile On anytime	TV
1	Rs.0 - 50000	10	8	4	2	1	2
2	Rs. 50000 - 100000	5	6	6	0	2	0
3	Rs. 100000 - 250000	3	2	5	5	0	0
4	Rs. 250000 - 500000	8	5	0	4	1	0
5	Above Rs. 500000	6	3	1	2	1	2

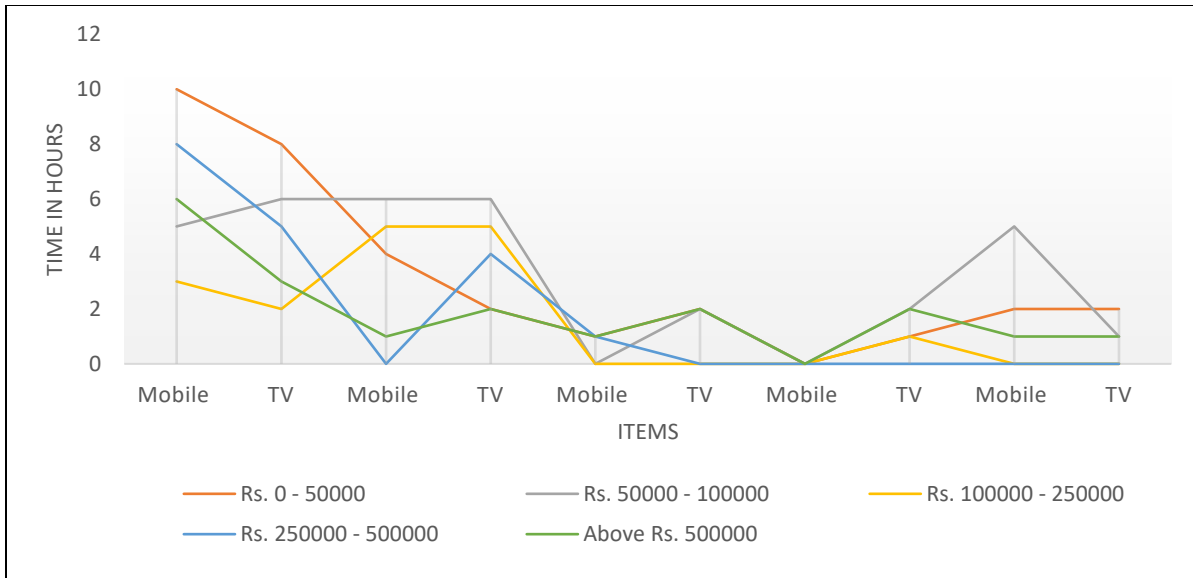


Fig.1: Time spent in mobile and television by the respondents of Guwahati City during Covid -19 pandemic.

### Activities of the Respondents' during the Pandemic

The survey revealed that due to “work from home” most of the respondents perceived advantages and disadvantages in their lives. Most of them spent their time talking to friends and family, reading books, listening to music, doing different housework, learning new skills (recycling waste items, colouring pots and glass bottles, etc.), cooking new recipes (specially cake, pastries), engaging in different social platforms, watching YouTube, playing video games, making videos (specially for YouTube, Tiktok, Facebook, etc.), maintaining proper balance on mental and physical health with workout and pranayama (meditation) on daily basis, etc. The younger age groups found it difficult to focus, lacked social contact with peers and spent most of their time watching TV or on the computer. The old age group suffered from stress as they had to combine office work with household tasks, take care of children, as in most cases no domestic helpers were there to reduce their burden (Fig. 2).

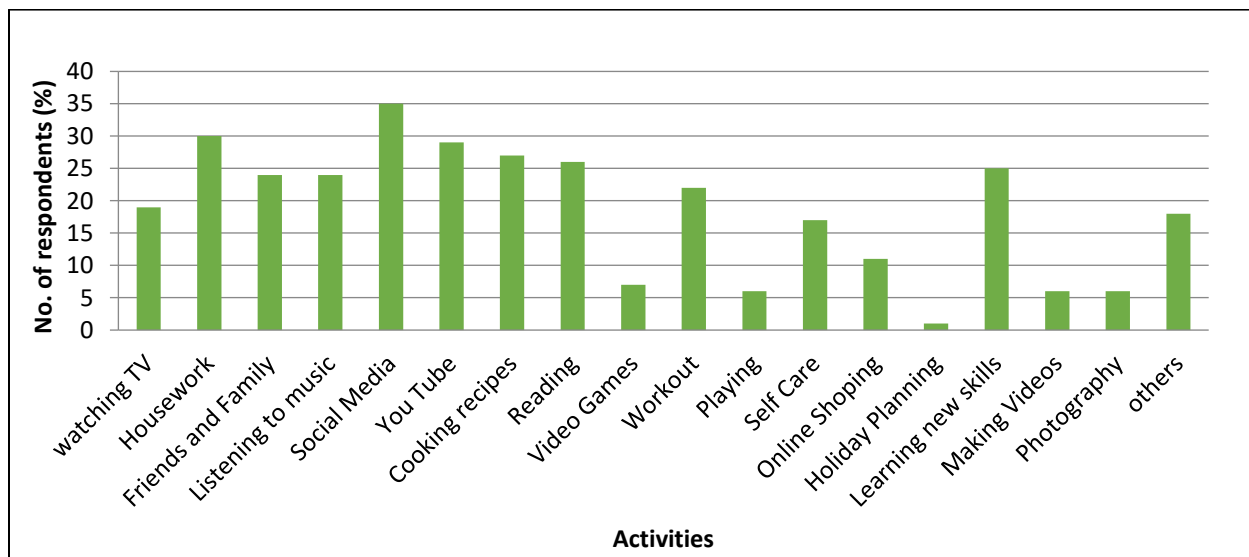


Fig.2: Different activities of the respondents during the Covid-19 pandemic (source – Primary Survey)

The highest percentage of respondents, 35% spend their time on social media, 29% on you tube, 30 % on housework, etc. The lowest amount of time spent was on holiday planning (1%) as travel destinations were fully shut down during the pandemic.

### ***Experience and Personal Feelings of the Respondents’ on the Current Pandemic Situation***

As might be expected, most of the respondents have a variety of work with different sets of targets to be achieved in the given period of time. The normal activities like daily classes, office work, daily news digests, architecture designs, daily diagnoses of the patients, supply of goods and services, etc. had suddenly stopped. Some of them often worked at home, taking and attending to classes throughout the day, an unusual practice of using computers for the first time, attending patients face to face with only a mask and gloves during the corona crisis, collecting and distribution of goods and services to the hospitals, Covid centers on daily basis, maintaining duty as a police person on an empty street for whole day long without a drink of water, expectedly made them worried, frustrated, irritated, lonely, and anxious, etc. This sometimes became a psychological issue leading to symptoms of mental health disorder including anxiety and depression in some of the respondents. They had to live within a fixed set of boundaries maintaining a minimum of 1-meter social distance from every individual, wear a mask mandatorily, wash hands with soap and sanitize hands repeatedly and survive with the limited stock of rations available with them.

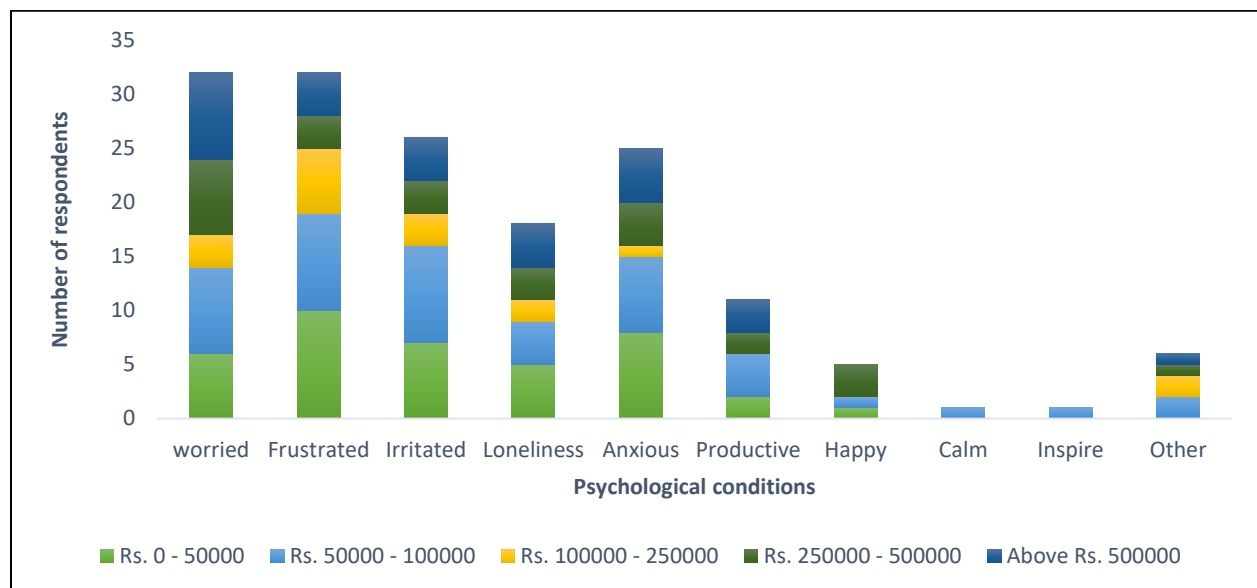


Fig.3: Mental health status of the respondents during the Covid-19 pandemic

Reflections by few of the Surveyed respondents are stated below:

*“I was in fear of losing my life during my duty as a doctor in hospital during the pandemic; even PPE kit was also not yet supplied to us in the first phase of lock down, and had to serve unknown patients”*

*“My fellow mates in police control room got positive; I was losing my mind, worried and frustrated, duty to serve the nation on one hand and a mother to care for my child on the other hand....”*

### ***Economic Condition of the Households during Pandemic***

In a general perspective it was already evident that the country’s economy had almost slowed down during the Covid -19 lock down phases. “GDP growth has been on a constant downward slope since Q4 FY 2021, and slowed to an 11 year low of 3.1 % in Q4 FY20. India’s GDP is estimated to contract by 7.7% in FY2020-21” (source - The Hindu, 2021). In connection between the global pandemic and the economy a

question was raised which was: “For how long the pandemic will impact upon the economy in India?” The analysis revealed that almost 70% of the respondents’ thought there is an extreme possibility of contraction of the economy for almost a year. “The notable lack of consumption and investment demand had already persisted before the pandemic; Covid-19 pandemic heightened those trends” (A. Mukhopadhyay, 2021). The revival of the economy is crucially dependent on demand generation by direct government intervention. The fall in the GDP (Gross Domestic Product) and the deep contractions in the April – June quarter of 2020 was named as “historic technical recession” by RBI (Reserve Bank of India).

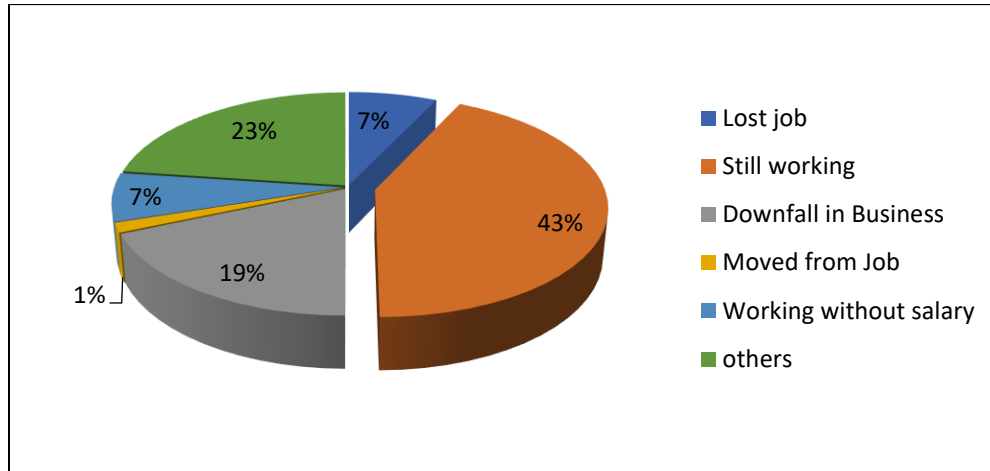


Fig.4: Economic effect of lockdown on households (source – Primary Survey)

The immediate effect of Covid -19 pandemic brought about a serious impact leading to unemployment, job loss, sudden downfall in business, shifting from one job, working without any remuneration, etc. (Fig.4). Many respondents reported feeling lonely, anxious and depressed.

During the survey period most of the respondents were of the view that the impact of covid-19 pandemic on the Indian economy would last for more than a year (40%) and 5% were of the view that the impact of covid-19 pandemic will last for 3 -5 months, 4% respondents thought that the impact would last for 7 – 12 months and 2% each of the respondents were of the view that the impact of the covid-19 pandemic would have no impact on the economy, would have an impact upto 3 months respectively (Fig.5).

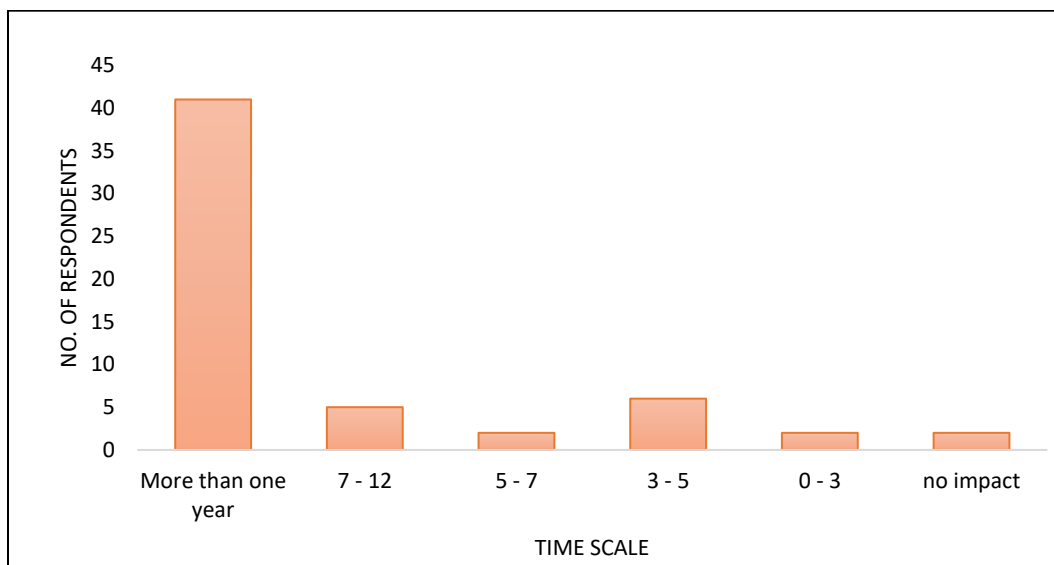


Fig.5: Timeframe of probable Impact of Covid – 19 pandemic on economy (source – Primary Survey)

## Results and Discussion

### *Use of different Applications in Smart Phone Generates Emission*

Most of the respondents specially the younger generations are found to be much addicted to smart phones as a part and parcel of their life, playing mobile games, watching videos, web series (on YouTube, Netflix, MX player, etc.) making videos, as an amusement instrument, chatting for long time with friends, attending video calls, conferences, etc. in different meeting platforms which has deliberately increased the consumption of energy leaving traces of carbon footprints in the environment.

*“We found that the relative emissions share of smartphones is expected to grow from four per cent in 2010 to 11 per cent by 2020, dwarfing the individual contributions of PCs, laptops and computer displays.”*

*In absolute values, emissions caused by smartphones will jump from 17 to 125 megatons of CO<sub>2</sub> equivalent per year (Mt-CO<sub>2</sub>e/yr) in that time span, or a 730 per cent growth.”*

**Source-** McMaster University, Research Article, Environment & Sustainability, (How smartphones are heating up the planet, March 26, 2018)

Table 2: Duration of using mobile phone and emission by an individual per day among the respondents.

Duration (in hours)	No. of respondents	Percentage (%)
0 – 3	97	48
3 – 5	48	24
5 – 8	18	9
8 – 12	8	4
All the time	31	15

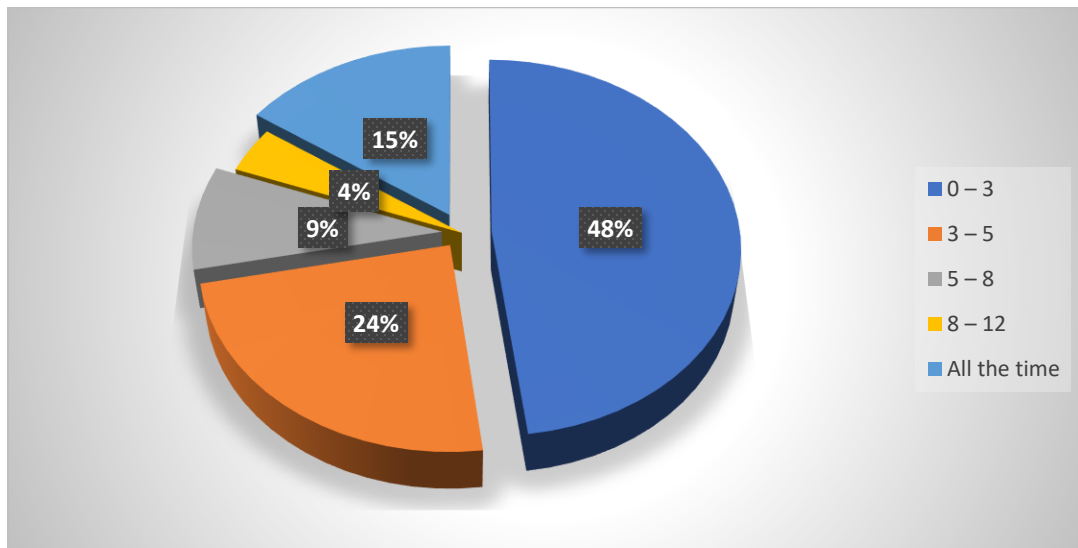


Fig.6: The amount of time spent in smart phone applications per day by the respondents.

Based on the above formula the consumption of electricity as a result of using mobile phone is stated below:

In a general perspective a mobile phone consumes 0.0124 kwh (kilo watt hour) of energy and emits 1.33 kgCO<sub>2</sub>e (kilogram carbon dioxide emission). The capacity of consumption of energy may vary depending upon the size of the mobile which will be 4 – 15 watts (source-www.electrical4u.net). Most of the

respondents kept their mobiles switched on throughout the day while only a small percentage of the respondents (35 percent) switched off their mobiles after bedtime.

Table 3: *Inventory data and carbon footprint estimates*

Items	Unit of energy consumed	Emission factor of electricity	kWh/month	KgCO <sub>2</sub> e/month
Mobile Phone	0.0124 kWh (kilo watt hour)	1.33 kg CO <sub>2</sub> e/kwh	0.372	0.4123

Source - (*Carbon Footprint Calculation*), *kwh* = *kilo watt hour*, *KgCO<sub>2</sub>e* = *kilogram carbon dioxide emission*

Where,

$$\begin{aligned} \text{Unit of energy consumed in kilo watt hour} &= 0.0124 \text{ kWh} \\ \text{Emission factor} &= 1.33 \text{ kgCO}_2\text{e} \\ \text{kWh/month} &= 0.0124 \times 30 \\ \text{KgCO}_2\text{e/month} &= \mathbf{0.4123 \text{ kgCO}_2\text{e}} \end{aligned}$$

$$\begin{aligned} \text{Consumption of Electricity} &= \text{input value (in kWh/year)} \times (\text{emission factor}) = \text{output Value in Kg of CO}_2 \\ &= (0.372 \text{ kWh} \times 12) \times 1.33 \text{ KgCO}_2\text{e} \\ &= 4.464 \text{ kWh/yr} \times 1.33 \text{ KgCO}_2\text{e} \\ &= \mathbf{5.94 \text{ kgCO}_2\text{e /yr}} \end{aligned}$$

Based on the above formula the consumption of electricity as a result of watching television (TV) is stated below:

Table.4: *Duration of watching TV and emission by an individual per day among the respondents.*

Duration of watching TV in Home (in hours)	Frequency (No. of respondents)	Wh (watt hour) of television (Normal average of a TV)	Wh (watt hour) consumed per person/day	kWh (kilo watt hour)	kWh x emission Factor = kgCO <sub>2</sub> e/day	kWh x emission Factor = kgCO <sub>2</sub> e/month
0 – 3	32		450	0.45	0.3825	11.47
3 – 5	15		750	0.75	0.6375	19.12
5 – 8	25	150	1200	1.2	1.02	30.60
8 – 12	20		1800	1.8	1.53	45.90
Anytime	8		3600	3.6	3.06	91.80

Source -Primary Survey 2020

Highest emission is recorded from watching TV was found to be 91.80 KgCO<sub>2</sub>e/month (8 respondents), 45.90 KgCO<sub>2</sub>e/month (20 respondents), 30.60 KgCO<sub>2</sub>e/month (25 respondents), 19.12 KgCO<sub>2</sub>e/month (15 respondents). Lowest carbon emission was 11.47 KgCO<sub>2</sub>e/month (32 respondents) of Guwahati City during the pandemic period (table 2).

Almost all of the respondents said that watching television had drastically increased during the pandemic. Before the pandemic situation most of the respondents stated that they watched television for 1 – 3 hours. But during the covid -19 pandemic the duration of watching television increased to a great extent as the



respondents were confined inside their homes and as they were eger to keep abreast of the happenings of the covid-19 pandemic ridden world.

***Simple Equation to Calculate the Electricity Consumption of a Television is***

Power consumed (kWh) = wattage of the appliance (kW) x operational hours

For TV,

Power = 100 watt

Operational hours = 12 hours

Power consumed by TV in a day (kWh) = 100 x 12  
 = 1200 watt hours  
 = 1.2 kWh (kilo watt hour)  
 = **1.596 kgCO<sub>2</sub>e**

Therefore,

Power consumed in a month (30 days) = 1200 x 30  
 = 36,000 watt hours  
 = 36 kilo watt hours (kwh)  
 = **47.88 kgCO<sub>2</sub>e**

Calculating CO<sub>2</sub> emission of normal average of a TV:

Input value (in kwh/year) x 1.33 (emission factor) = output Value in Kg of CO<sub>2</sub>  
 = (36 kWh x 12 months) x 1.33 kgCO<sub>2</sub>e  
 = 432 kWh x 1.33 kgCO<sub>2</sub>e  
 = **574.56 kgCO<sub>2</sub>e/year**

Most LED TVs has rated power between 60 to 150 watt/hr. Generally speaking, larger the screen size higher is the consumed power. A 150-watt TV running for 12 hours every day will consume 1800-watt hour = 1.8 kWh (units) of electricity in a day and 54 kwh of electricity in the entire month.

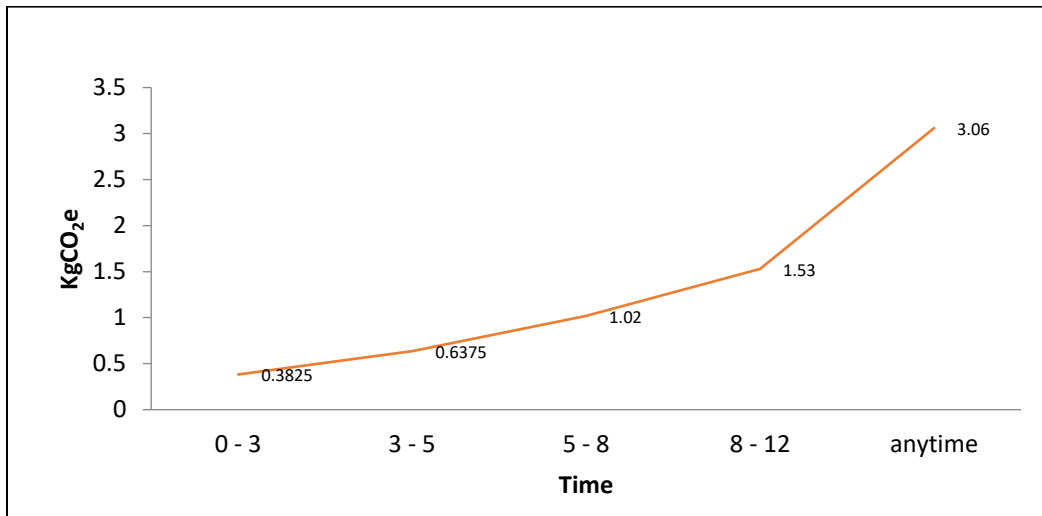


Fig.7: Representation of line graph of CO<sub>2</sub>e per hour/day from television by the respondents

Table 3 & Table 4 represents the inventory data and carbon footprints of the two items; mobile phone and the television. From the survey, only these two items were considered based on the maximum uses during Covid – 19 lockdown period. For people, the ‘per capita’ consumption of energy in social media is evaluated based on the time accounted by the respondents, where we found that a mobile phone consumes 0.0124kwh of energy and produces 0.4123 kgCO<sub>2</sub>e monthly. Similarly, while watching TV it generally consumes 1.2 kWh of electricity producing 1.596 KgCO<sub>2</sub>/hr in a day.

But there is a variation among the individuals regarding the usability of these two items. The duration of time is directly proportional to the increase in the production of CO<sub>2</sub>. Longer the time of watching TV higher will be the consumption of energy and vice-versa. Besides the application software’s that are in-built in mobile phones have the extra set of emission which is directly connected to the source of network and the data they are using in respective devices. Meanwhile, in case of a television it is revealed that most of the respondents have never turned off their TV which results for heavy consumption of (3.6 kWh/day) energy and equates to 3.06 kgCO<sub>2</sub>e per day during the lockdown period which is much higher (0.6375kg CO<sub>2</sub>) assuming 3 – 5 hours of more television watching than that of the normal days.

### ***Emission from Transportation***

During the pandemic situation the immediate lockdown had stopped the transportation of people and goods which has not only impacted the economy but also provided a positive check in lowering the emission level of CO<sub>2</sub> in the city. None of the surveyed respondents had used private transportation during the surveyed period.

### **Conclusion**

The study reveals that there is a complex relationship between the income structure, the domains of work, and the level of emission. Many people with a low level of income seem to get frustrated, worried, and irritated during the lockdown period. The desires, needs and wants among the said income level groups have mostly been affected during the lockdown period. Most of them have lost their jobs; some have to work without any remuneration. Keeping in view the prevailing situation humanitarian activities of some people played an important role in the life of the victims, as for example distributing different foodstuffs and necessities as per their capabilities along with the Non-Governmental Organizations (NGO) and government representatives.

Most of the time the younger generations had seen many of their wishes unfulfilled like the desire face-to-face contact, being outdoors and playing, gossiping, spending some time alone, long commutes, especially by car, etc.

Further, with an exception of ‘work from home,’ people’s experiences and perceptions were examined by the study keeping in view their time spent on watching TV, social media, YouTube, etc. Staying in an isolated state for a long duration led to the occurrence of psychological strain, where our respondents are facing tremendous challenges in respect of the health, income, job security, and especially in the welfare of their loved ones.

Finally, the methodological contribution of this study has showcased how to gauge the GHG (Green House Gas) emission attributed to work from home, daily activities, and experiences during the Covid-19 pandemic period. The Covid-19 pandemic has indicated a potential for growth of online education and work culture in the future. The study has revealed that social and economic perceptions of people of Guwahati City have been altered during the Covid-19 pandemic.

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## Conflict of Interest

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