

# Status of Health and Healthcare in Gas exposed and Unexposed populations

**Report Prepared by the Community Research Unit of**

The Sambhavna Trust Clinic, Bhopal

Bhopal, December 1, 2018



# Status of Health and Healthcare in Gas exposed and Unexposed populations.

## Introduction

In 2004, the apex research agency, Indian Council of Medical Research published its technical report on death and illness caused by the Union Carbide gas disaster till 1994. The report was based on information collected on 80,021 gas-affected and 15,391 persons of similar socio-economic status without gas exposure.<sup>1</sup> Statistical analysis of the ICMR data till 1993 shows estimated total death of 8489 caused by the gas disaster.<sup>2</sup> The report also presented statistical evidence of a number of diseases related to the respiratory, ocular, gastrointestinal, reproductive, neurological, immunological, psychological and other systems caused by toxic gas exposure.<sup>1</sup>

However, a second technical report published in 2013 based on information collected on death and disease from 1996 to 2010 indicated that these information could not be collected from 79% of the gas-affected persons and 64% persons in the unexposed control population. While the report is silent on the cause for this huge loss of cohort population, national and international experts of epidemiology have expressed serious doubts on the reliability of the information on long term health impact of exposure to Union Carbide's gases.<sup>4</sup>

The negligence, deliberate or otherwise, by the apex research agency caused a situation in which no credible information could be generated on deaths and diseases caused by the disaster in the long term. In anticipation of this scientific and medical disaster, the Community Research Unit of the Sambhavna Trust Clinic made focused efforts from 2010 to 2011 to register a cohort population for studying the long term health impact of exposure to Union Carbide's poisons, in the form of gas or contaminated ground water.

The cohort population registered by the CRU at the Sambhavna Trust Clinic includes about 94000 persons who had had exposure to Union Carbide's gas, water contaminated by Union Carbide's hazardous waste, to both gas and contaminated water and persons of similar socio-economic status without exposure to gas or contaminated water. A team of 25 research workers collected data on rates of deaths, cancers, birth defects, tuberculosis, growth and development of infants and young adults, spontaneous abortions and other indicators of health status. The technical report on this massive exercise is being prepared and will be sent for publication in international peer reviewed journals. Incidentally, the Sambhavna Trust Clinic has published its research work on the impact of the Union Carbide disaster on the growth of children of gas exposed parents, a significant area left un-researched by ICMR, in international peer reviewed journals.<sup>5-7</sup>

From 2015 to 2017, Sambhavna CRU carried out a study to find out the status of health and healthcare of the gas affected people in comparison to the unexposed population. The study was carried out in a sample from the cohort population that included those directly exposed to gas in 1984 or exposed in the wombs of the exposed mothers. Information was collected from 2221 gas exposed persons residing in the two Municipal wards (Nos. 13 and 20 in 1984) that were identified by the ICMR to be severely affected by the disaster. Information was also collected from 953 persons in the same age group (above 30 years) randomly selected from the unexposed population.

**Table 1. Cohort Population and Subset of cohort Population**

Study Population	General cohort Born before Sep. 30, 1985	Subset of Cohort Born before Sep. 30, 1985
Gas Exposed	7676	2221
Unexposed	9574	953

As can be seen below, the percentages of females and males of different ages in the gas exposed and unexposed populations are close to be comparable.

**Table 2. Sex and Age breakdown of Gas exposed and Unexposed Populations**

Age in years	Gas exposed Population						Unexposed Population					
	Female	%	Male	%	Total	%	Female	%	Male	%	Total	%
31 – 60	751	77.34	1039	83.12	1790	<b>80.59</b>	416	88.70	423	87.40	839	<b>88.04</b>
61 – 80	210	21.63	200	16.00	410	<b>18.46</b>	48	10.23	59	12.19	107	<b>11.23</b>
Above 80	10	1.03	11	0.88	21	<b>0.95</b>	5	1.07	2	0.41	7	<b>0.73</b>
<b>TOTAL</b>	<b>971</b>	<b>100.00</b>	<b>1250</b>	<b>100.00</b>	<b>2221</b>	<b>100.00</b>	<b>469</b>	<b>100.00</b>	<b>484</b>	<b>100.00</b>	<b>953</b>	<b>100.00</b>

The findings of the study are described below.

## 1. Deaths

Data collected from the gas exposed and unexposed populations on deaths in their immediate families between January 1, 2012 and March 31, 2017 shows that the rates of deaths for causes other than accidents in exposed and unexposed populations are 63.48 and 49.32 respectively. This shows 28 % more deaths in the gas exposed population in comparison to the unexposed population pointing to the fact of continuing deaths associated with gas exposure in December 1984. It needs to be mentioned that almost all cases of death were verified by looking at death certificates and or medical records.

**Table 3. Non-accidental deaths in gas exposed and unexposed population between January 1, 2012 and March 31, 2017**

Population	Female	Deaths	Per thousand	Male	Deaths	Per thousand	Total	Deaths	Per thousand
Gas exposed	971	53	<b>54.58</b>	1250	88	<b>70.40</b>	2221	141	<b>63.48</b>
Unexposed	469	14	<b>29.85</b>	484	33	<b>68.18</b>	953	47	<b>49.32</b>

## 2. Cause of Death

**Table 4. No. of Deaths of females and males per thousand in Gas exposed and Unexposed population due to different Causes.**

Cause of Death	Gas exposed Population						Unexposed Population					
	Female		Male		Total		Female		Male		Total	
	Nos.	Per '000	Nos.	Per '000	Nos.	Per '000	Nos.	Per '000	Nos.	Per '000	Nos.	Per '000
Heart	15	15.22	19	15.37	34	15.31	7	14.07	4	8.26	11	11.54
Cancer	10	10.30	13	10.40	23	10.36	3	6.40	2	4.13	5	5.25
Lungs	9	9.27	16	12.80	25	11.26	1	2.13	4	8.26	5	5.25
Kidney	4	4.12	11	8.80	15	6.75	0	0	2	4.13	2	2.10
TB	3	3.09	8	6.40	11	4.95	0	0	3	6.20	3	3.15
Stroke	1	1.03	3	2.40	4	1.80	0	0	2	4.13	2	2.10
Typhoid	2	2.06	0	0	2	0.90	1	2.13	0	0	1	1.05
Other*	9	9.27	18	14.40	27	12.16	2	4.26	16	33.06	18	18.89

\* includes anemia, cyanosis, HIV, tetanus, paralysis, jaundice, diabetes, fever of unknown origin and convulsions. In two cases of death in the unexposed population, the cause of death could not be ascertained.

As can be seen from Table 4 above, twice as many persons are dying of cancers, diseases of the lungs and tuberculosis and thrice as many of kidney diseases compared to the unexposed population. Deaths due to other causes are twice as many in the unexposed population.

## 3. Illness and Disease

Information was collected from persons in both gas exposed and unexposed population on whether they were currently ill (ill at the time of data collection). The data presented in Table 5 below shows that illness in gas exposed population is 62.63 % more than in unexposed population. The difference in the proportion of persons with illness is most pronounced in the age group 41 to 50 and least in the age group 51 to 60.

**Table 5. Persons in different ages who were ill at the time of the study**

Age in years	Gas exposed population			Unexposed population		
	No. of Persons	No. of Persons with Illness	Percentage of Persons with Illness	No. of Persons	No. of Persons with Illness	Percentage of Persons with Illness
Under 40	728	188	25.82	357	58	16.25
41- 50	581	252	43.37	296	75	25.34
51-60	481	277	57.59	186	79	42.47
Above 60	431	329	76.33	114	64	56.14
Total	2221	1046	47.10	953	276	28.96



Table 6. below shows that more women were ill compared to men in both gas exposed and unexposed populations.

**Table 6. Females and Males who were ill at the time of the study**

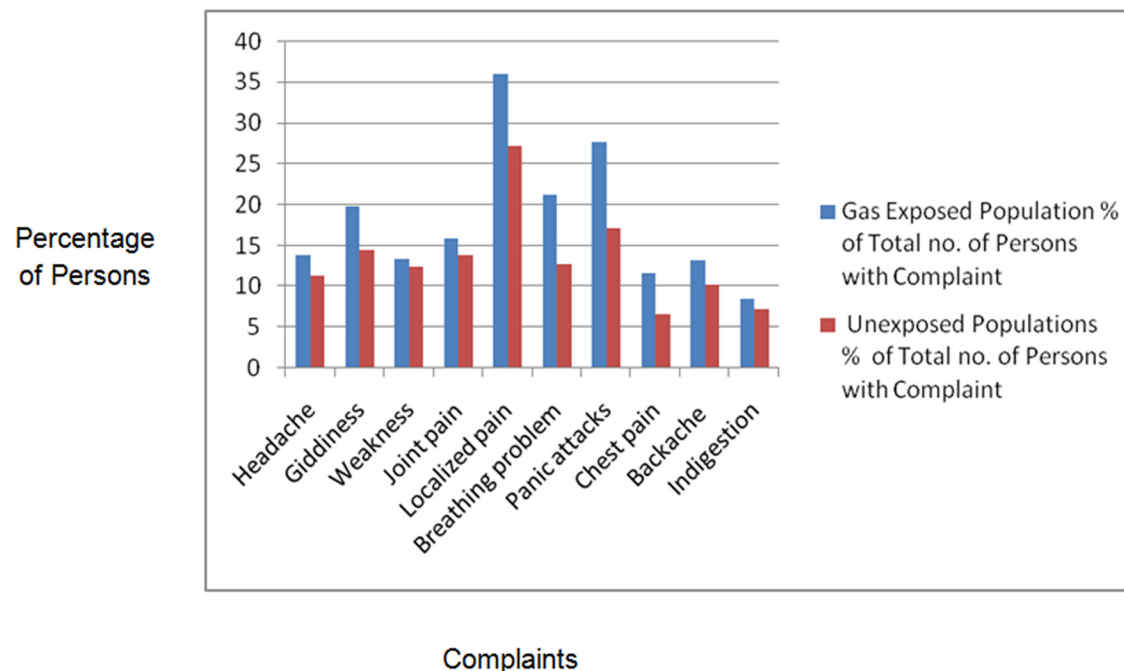
Sex	Gas exposed population			Unexposed population		
	Nos.	No. of Persons with Illness	Percentage of Persons with Illness	Nos.	No. of Persons with Illness	Percentage of Persons with Illness
Female	971	573	59.01	469	168	35.82
Male	1250	473	37.84	484	108	22.31
Total	2221	1046	47.10	953	276	28.96

In Table 7. below we have presented data on the top ten complaints reported by the respondents who were found to be ill. Where possible information on complaints were verified from medical records of the respondents.

**Table 7. Females and males with illness with different complaints**

Complaints	Gas Exposed Population				Unexposed Populations			
	Total no. of Persons with Complaint	% of Total no. of Persons with Complaint	% of Females with Complaint	% of Males with Complaint	Total no. of Persons with Complaint	% of Total no. of Persons with Complaint	% of Females with Complaint	% of Males with Complaint
Headache	145	13.88	19.41	7.17	31	11.23	15.48	4.63
Giddiness	206	19.71	25.35	12.87	40	14.49	16.07	12.04
Weakness	140	13.40	12.76	14.14	34	12.32	11.90	12.96
Joint pain	166	15.89	19.76	11.18	38	13.77	16.67	9.26
Localized pain	376	35.98	40.73	30.17	75	27.17	26.19	28.70
Breathing problem	222	21.24	19.06	23.84	35	12.68	11.90	13.89
Panic attacks	289	27.66	31.99	22.36	47	17.03	18.45	14.81
Chest pain	122	11.67	10.84	12.66	18	6.52	5.95	7.41
Backache	138	13.21	18.36	6.96	28	10.14	11.31	8.33
Indigestion	89	8.52	6.82	10.55	20	7.25	5.95	9.26

As can be seen above persons in the gas exposed population had more complaints compared to the unexposed population. For some of these complaints such as Breathing problem, Panic attacks and Chest pain the difference was very high. This is better illustrated in the chart below.



It is interesting to see that the proportion of persons with illness who are taking treatment is higher among the gas affected population in comparison to the unexposed population. As can be seen in Table 8. below, the proportion of people with illness undergoing treatment is 22.59 % less in the unexposed population. This can be ascribed to larger number of health care facilities available to gas exposed persons and of course to the undiminished efforts of the gas exposed persons to recover from their illness.

**Table 8. Females and Males with Illness who are taking Treatment**

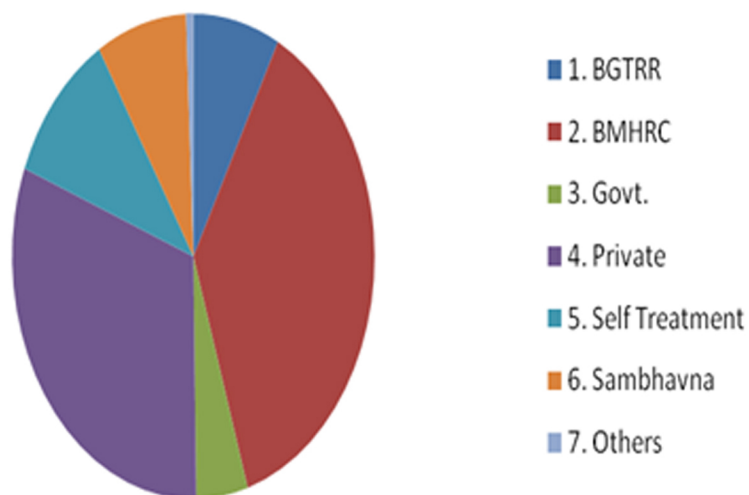
	Gas exposed population			Unexposed population		
	ill	Taking treatment	% taking treatment	ill	Taking treatment	% taking treatment
Female	572	346	60.48	168	74	44.04
Male	474	261	55.06	108	50	46.29
Total	1046	607	58.03	276	124	44.92

Table 9. below presents information on the different healthcare facilities visited by the persons in the gas exposed and unexposed populations. While the figures are not comparable for some of the facilities that are exclusively for the gas exposed population, the proportion of persons visiting private clinics and hospitals in both populations is remarkably large. While this is understandable for unexposed population, public services being what they are, the high proportion of gas exposed persons visiting private clinic and hospitals points to the inadequacy of the government system of healthcare.

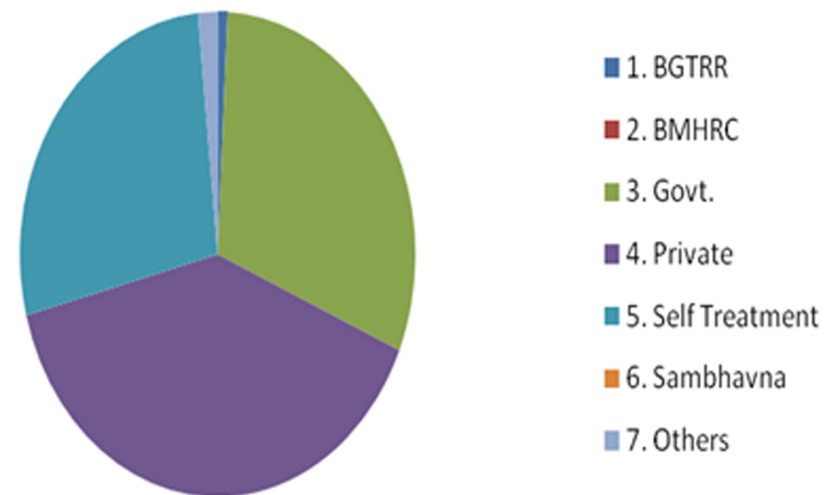
**Table 9. Persons with Illness who are taking Treatment at Different Healthcare Centres**

Healthcare Centre	Gas exposed Population		Unexposed population	
	No. of persons	%	No. of Persons	%
1. BGTRR	47	7.74	1	0.81
2. BMHRC	227	37.40	0	0.00
3. Govt.	28	4.61	38	30.65
4. Private	189	31.14	49	39.52
5. Self Treatment	63	10.38	34	27.42
6. Sambhavna Clinic	49	8.07	0	0.00
7. Others	4	0.66	2	1.61
TOTAL	607	100.00	124	100.00

**Gas exposed Population taking treatment at different Centres**



**Unexposed population taking treatment at different Centres**



The information presented above is based on preliminary analysis and detailed statistical analysis will be carried out before sending the research for publication.

## Conclusions and Recommendations

1. The government must set up a system of registration of deaths of persons with direct or indirect exposure to Union Carbide's toxic gases.
2. In view of the significantly higher rates of deaths due to cancer in the present study, and the fact that well over 5000 gas exposed cancer patients have been paid ex-gratia by the government there is an urgent need for review of the work of the Population Based Cancer Registry in Bhopal that claims that there is no association between gas exposure and cancer.
3. Significantly higher rates of illness among the gas exposed despite the passage of over three decades should propel the government to review the system of health care and in particular pulmonary healthcare and make improvements without delay.
4. Significantly higher rates of diseases of the kidneys among the gas exposed could well be associated with prolonged use of painkillers along with toxic exposure. While the government is already paying ex-gratia to gas exposed with kidney diseases, there is need to urgently review drug utilization in the care of gas exposed persons to avoid kidney damage.

## References

1. Health Effects of the Toxic Gas Leak from the Union Carbide Methyl Isocyanate Plant in Bhopal TECHNICAL REPORT on Population Based Long Term Epidemiological Studies (1985 - 1994) Bhopal Gas Disaster Research Centre Gandhi Medical College Bhopal (M.P.), India, 2004  
<http://www.nireh.org/assets/pdf/technical%20reports/TR-Epid.pdf>
2. Akanksha S. Kashikar Statistical Modeling of Mortality and Morbidity among the Victims of Bhopal Gas Disaster, Proceedings of the Regional Statistics conference, International Statistical Institute, Bali, March 20 – 24, 2017.
3. Technical Report on Population Based Long Term Epidemiological Studies Part-II (1996--2010), National Institute of Research on Environmental Health, ICMR, Bhopal, 2013  
<http://www.nireh.org/publication.php>
4. Dinesh C Sharma, Bhopal study represents “missed opportunity”, The Lancet, Volume 382, Issue 9908, Page 1870, 7 December 2013
5. Ranjan, N., Sarangi, S., Padmanabhan, V.T., Holleran, S., Ramakrishnan, R., and Varma, D.R. (2003). Methyl isocyanate exposure and growth patterns of adolescents in Bhopal. JAMA 290, 1856-1857
6. Daya R Varma, Ritesh Pal, Diana Katgara, Satinath Sarangi, Tasneem Zaidi, Steven Holleran, Rajashekhar Ramakrishnan and Shree Mulay. Catch-up growth in males affected by the Union Carbide disaster of 1984 in Bhopal, India. The Journal of the Federation of American Societies for Experimental Biology 22:1137.1, 2008
7. S. Sarangi, T. Zaidi, R.K. Pal, D. Katgara, V. G. Gadag,, S. Mulay, and D.R. Varma, Effects of Exposure of Parents to Toxic Gases in Bhopal on the Offspring. American Journal of Industrial Medicine;53(8):836-41, 2010