

An Inclusive Appraisal of Community Awareness and Preparedness in Chandigarh to Combat a Biological Disaster

Authors

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Abstract: - *Disasters are the constant companions of mankind. Mostly, any talk of disasters centres only around natural disasters with anthropogenically caused disasters not being given adequate credence. Utilising an exploratory approach this study examines the community awareness and preparedness in Chandigarh to combat incidents of Biological Disasters.*

Responses were collated from 263 respondents for a total of 16 questions covering 25 different variables related to the respondent's knowledge/awareness about their perceptions about the cities level of preparedness for disaster management of a biological event. All responses less the demographic details were logged using a five-point Likert Scale.

The dataset was appraised using the PCA technique with Varimax Kaiser Normalisation as the rotation method whereby a total of eight Principle Components were extracted. Out of the 25 variables tested three were discarded and only 22 loaded individually on the eight extracted Factors. The specific details about the eight Principle Extracted components and the variables which loaded on to each of them were evaluated on a three-tier scale to arrive at a set of thoroughly deliberated deductions regarding the level of community awareness and preparedness in Chandigarh for combating a Biological Disaster.

Keywords: - *Disaster Management; CBRN City Preparedness; Biological Agent; Biological Warfare; Bioterrorism; Local Government.*

1. Introduction

The extensive degree of geopolitical vulnerability and socio-economic susceptibility of India coupled with its diverse climatic conditions, probably give it the dubious distinction of being one of the most substantially disaster-prone nations in the world polity (Atmanand, 2003; Madan, 2006; Government of India, 2011; National Disaster Management Authority, 2012; National Disaster Management Authority, 2013).

As per the World Economic Forum, Weapons of Mass Destruction (WMD) continue to be

the top threat in terms of impact, both in 2017 and 2018 (World Economic Forum, 2017, 2018). Moreover, the likelihood of terrorist attacks, man-made environmental disasters and WMD -figure in the top right quadrant of the Global Risk Matrix – 2018 (World Economic Forum, 2018), thus amply bringing out the importance and topical nature of the current study (Appendix A – refers). All the aforementioned three aspects are deeply intertwined in the contours of the current study.

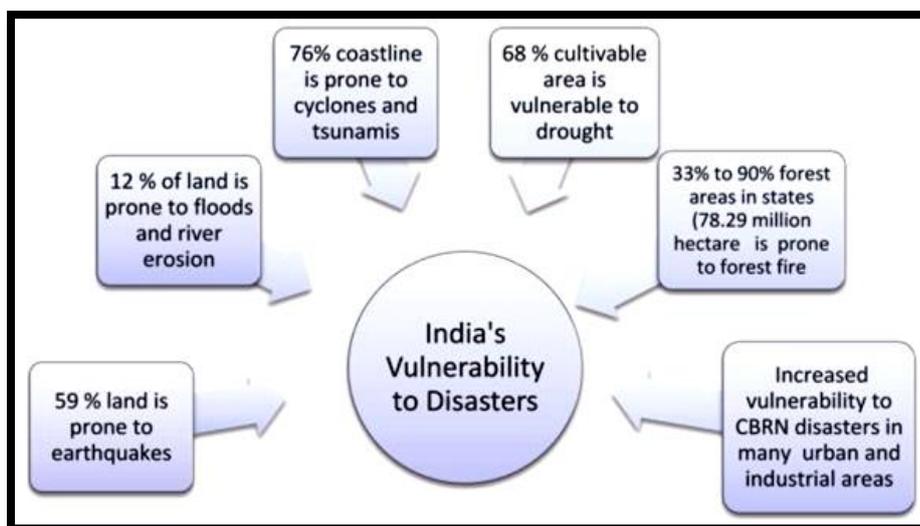


Figure 1 – Vulnerability Profile of India (Ministry of Home Affairs, 2013) (Red highlighting by Author)

However, despite the importance given to WMD's as indicated above, the impact of anthropogenically induced disasters - specifically the Chemical, Biological, Radiological and Nuclear (CBRN) suite of events - are usually pushed to the back of our sensibilities, possibly because of the rather low probability of occurrence in the entire threat spectrum. This may be partly true, but the threat assessment graph for the likelihood of use of CBRN weapons vis a vis. conventional explosive – on the twin variables of Achievable Impact vs Degree of Difficulty of use (Appendix B – refers) shows an ever-increasing likelihood of use of CBRN weapons.

Substantially deviating from the beaten path of how the subject of disaster is usually tackled, a deliberately focused look was attempted in this study on the Community awareness and preparedness for a deliberate or accidental release of a biological agent in Chandigarh.

2. The significance of Choosing Chandigarh for the Study

The city of Chandigarh (Longitude -76° 47' 14" E; Latitude - 30° 44' 14" N) was considered suitable for the study due to it being the common capital of the states of Punjab and Haryana. The city is a lucrative target for any inimical terrorist organisation to perpetrate a biological disaster to adversely affect the

population and environment of the city. It has to its credit many singular distinctions, which made it the ideal choice for the conduct of this study. The following issues are pertinent.

- By virtue of being the common capital of the states of Haryana and Punjab, the entire state administrative machinery, including both State secretariats are located in the heart of the city.
- The city by virtue of being a twin capital, cannot be governed by either of the state governments and has hence been designated as a Union Territory (UT) – administered by the central government of India.
- Chandigarh has numerous medical establishments, administrative institutions, and educational institutes of higher learning, tourist attractions, and also some organisations of national importance.
- The UT's importance is further inflated due to its convenient location and proximity to the national capital and the three states of Punjab, Haryana and Himachal Pradesh.
- Progressively heightening levels of cross-border terrorism.
- Pesky neighbour, intent on fomenting trouble in the hinterland.
- The city presents an appropriate target close to the border. Any untoward incident

in and around this area is bound to generate adequate media attention – which is usually the basic intent of any terrorist episode.

- Poor overall awareness & lack of risk sensitivity towards disaster management in general and for a CBRN event in particular.
- A large number of local chemical, pharmaceutical industries – providing a readily available source for a Chemical or Biological related event.
- Ineffective solid and biomedical waste disposal mechanism.
- Inadequate preparedness & response mechanism at the UT/city level – especially for anthropogenically generated disasters.
- The strategic /military importance of Chandigarh is amplified because it is the rail and air head for many military headquarters, establishments located on the Northern borders of the country. The city also houses Chandimandir – a major army cantonment where the Western Command is located. Also, in the city is a major concentration of the Indian Air Force (IAF), Central Reserve Police Force (CRPF) and Indo Tibetan Border Police (ITBP).

Due to the aspects delineated above – the subject of study is contemporary, has real-world, real-time implications and would be of immense interest to Disaster Management organisations, executives and practitioners.

3. Use of Biological Agents

Consequential to recent world events, increased accessibility and proliferation of CBRN agents plus the potential of terrorist incidents using unconventional WMD is a matter of grave concern for everyone (World Economic Forum, 2017, 2018). The Anthrax cases in the US (Grunow & Finke, 2002; Jindal & Roy, 2014) and other radiological scares have been a rude shock to countries across the world. An open

society like India is most vulnerable to WMD terrorism. Gen Bipin Rawat, the Chief of Army Staff, has gone on record to state that the CBRN threat was very much in existence. He exhorted the scientific community to work on products and modern defence technologies relevant to combating the CBRN threats, both from state and non-state actors (IndraStra Global, 2018). It is just a matter of time when we may see terrorist attacks occurring in India involving WMD.

Biological agents have been used since times immemorial as surreptitious weapons which have the unique dual capacity of instilling a sense of dread and doom amongst any community while simultaneously achieving the desired social, economic and political goals of the perpetrators. The major reasons for their preference as a favourite weapon by terrorists and inimical forces are primarily because of their “arduous detection, as well as postponed appearance – hours and days after the terrorist’s attack”. The fact that there is almost always a strong probability of secondary dissemination of the biological agent used – makes them a “go to” option for the empowered terrorist. In addition to the significant characteristics of biological agents (lethality, virulence, infectivity, stability, incubation period and transmissibility/contagiousness) the under mentioned important salient’s have transformed them into the terrorists’ favourite weapon (Tonev, Kanev, & Dishovsky, 2010).

In comparison with chemical and atomic weapons, biological weapons are vastly less expensive and eminently more easily obtainable. According to the National Disaster Management Authority, India biological agents are often referred to as “the poor man’s atomic bomb”; since for near similar levels of mass casualty on unprotected community population, the comparable costs would be \$ 2,000 per square Km with conventional weapons, \$ 800 with nuclear weapons, \$ 600 with nerve gas weapons and just \$ 1 with biological weapons (National Disaster Management Authority, 2008).

Biological agents could be used in minuscule quantities to achieve the same level of destruction as other conventional means, e.g. to cause mass casualty event in an area of one square Km about 1800 pounds of conventional explosive would be required, but the equivalent mass casualty could be achieved by spreading only ¼ ounce Anthrax spores. Detection of biological agents is usually a herculean task, especially prior to their usage.

The varied “incubation times” for diverse biological agents may result in the symptoms/consequences of the spread of the biological agent being visible from hours to days to weeks – after the actual dissemination. The actual process whereby any biological agent could be converted for use as a virulent agent of mass destruction is easily available off the Internet.

4. Literature Review

A deliberate study and research of the subject were undertaken from Sep 2015 onwards by the author and a host of reference material and existing literature reviewed to understand the various facets of the issue under assessment.

Various important international conventions, protocols and major national policy framework documents, guidelines were referred to and these formed the bedrock of the understanding of the institutional framework of Disaster Management (DM) in India. These are listed hereunder, with alphabetical seniority: —

- International Conventions and Protocols.
- Hyogo Framework Protocol for Action, 2005 – 2015.
- Sendai Declaration, 2015 – 2030.
- Sendai Framework: Disaster Risk Reduction.
- Policies, Guidelines and Plans: India and States.
- Community-Based Disaster Management (CBDM) – National Policy Guidelines (Draft).
- Disaster Management Act – 2005

- Disaster Management in India – Emerging Issues and Responses.
- Disaster Management in India.
- Disaster Management Plan – Chandigarh.
- Disaster Management Profile – Haryana.
- Disaster Management Profile – Punjab.
- Disaster Management Terminology.
- Disaster Response in India.
- Disaster Risk Management and Role of Corporate Sector.
- Disaster Risk Reduction and Disaster Management Toolkit for Urban Planning.
- Disaster Trends in India.
- Harnessing Technology for Disaster Risk Reduction and Capacity Building.
- High Powered Committee Report – 2001.
- India Disaster Report – 2011, 2012, 2013.
- Introduction to CBRNe – A Primer.
- National Disaster Management Policy – 2009.
- Role of NGO’s in Disaster Management – Guidelines (Draft).
- State Disaster Management Plan Preparation – Guidelines.
- Understanding Disasters.
- Working Group Report on Disaster Management – 12th Five Year Plan (2012-17).

4.1 Search Strategy

The Literature Review was conducted under the following heads for ease of assimilation: —

- Disaster –Prevention, Mitigation and Preparedness.
- Bioterrorism.
- Biological Studies.
- Biological Weapons Program.
- Planning for a Biological Attack.
- Impact of a Biological Attack.
- Preparedness Level of a City.

A methodical review of many scientific databases was undertaken using varied combinations of keywords such as disaster management, CBRN, CBRN city preparedness, biological agent, biological agent detection,

biological warfare, bioterrorism, local government and WMD, Mass Casualty Incident (MCI) etc.

This search resulted in allowing the author to conduct a macro level review of study material on the subject available in the digital and print format. A total of over 400 books, journal articles, and weblogs and newspaper items were scrutinised. A focused and deliberate attempt was made to specially review available literature which dealt with the subject of biological terrorism, so as to get a deeper insight into this facet of disaster management.

One aspect that was very evident during the process of the literature review – was that despite there is an overabundance of study material available on the internet about “terrorism” – specifically after the gruesome “9/11” episode – the aspect of bioterrorism, was however not given the same amount of exposure as had been provided to other forms of terrorism.

5. Research Methodology and Analysis

5.1 Research Methodology

Since the study dealt with a sensitive subject of the complementary aspects of preparedness, response, mitigation, awareness and level of preparedness of the Community for a Biological disaster in the city of Chandigarh, the methodology adopted catered to the requirements of time criticality, the economy of effort and exactitude. To get the questionnaires filled from respondents, assistance was sought from the Interns associated with the National Vector Borne Disease Control Programme (NVBDCP) at Chandigarh. Dr Gaurav Aggarwal, Public Health Specialist & Anti Malaria Officer, UT Chandigarh, head of this programme was kind enough to allow the Interns to be associated with the task of getting the questionnaires filled for the study by addressing the relevant category of persons as specified in the Research Design. Convenience Non-Probability Sampling method was utilised while administering the questionnaires to the

identified categories, namely - Students (142); Academicians (44); Service Class (46); Business Owners (30).

- The target respondents of the first category (students and academicians) were chosen from various departments of Punjab University, Chandigarh. The maximum number of students were from the Under and Postgraduate classes belonging to the Law, Social Sciences and Humanities (Geo-graphy) streams. The academicians who responded to the questionnaires, all had extensive exposure in their respective subjects of expertise and belonged to either of the aforementioned departments of Punjab University, Chandigarh. The Service class category of respondents was chosen randomly from various government departments and a few private organisations – both at the operational and managerial levels. In all cases, a brief background of the study, its intent and purpose were revealed with the respondents before administering the questionnaires to them.
- The Business class category of respondents was the most challenging since they required the maximum amount of elaboration and clarifications with respect to the reason for the study before they agreed to answer the questionnaires. This took a fair amount of time in obtaining these responses.

6. Sampling Design

To assess Chandigarh’s level of community preparedness, to effectively combat a hypothetically calamitous situation of a deliberate or accidental biological agent release, would totally depend upon the precise knowledge of available organic/inorganic resources including trained personnel vis a vis the requirement extrapolated to confront the evolving situation. The data pertaining to the availability status of resources, personnel was gleaned from the existing Disaster Management

Plans for Chandigarh and the India Disaster Resource Network (IDRN) website maintained by the central government. Further details about the level of preparedness of Chandigarh were garnered by analysis of the primary data generated by administration of the pre-prepared questionnaire (Appendix C – refers) and follow up questions during personal semi-structured interviews. In order to ensure that the questionnaires were comprehensive, covered all dimensions of the intended study, and were appropriate to the task at hand, the questionnaires were whetted by the academic faculty at the National Institute of Disaster Management, New Delhi and Dr Achyanta K Sarmah, Assistant Professor, IIM, Shillong.

The main intent of studying the Community was to understand, examine and evaluate the level of general awareness about the subject of the deliberate or accidental release of biological agents, biological terrorism and associated mitigation measures—amongst the general population of Chandigarh.

- Sample Size.
- The population of Chandigarh as per the 2011 Census (Government of India, 2011a), which is specified as 1,054,686 (Males – 580,282 and Females – 474,404), has been instrumental to derive the sample size for this study.
- Use is made of the undermentioned formula (Krejcie & Morgan, 1970) the target population of 1,054,686 to arrive at the recommended sample size.

$$X^2 * N * P * (1 - P)$$

$$n = \frac{X^2 * N * P * (1 - P)}{(ME^2 * (N-1) + (X^2 * P * (1 - P)))}$$

Where

n = sample size

X² = Chi-square for the specified confidence level at 1 degree of freedom

N = Population Size

P = population proportion (.50 in this table)

ME = desired Margin of error (expressed as a proportion)

- The recommended sample size for a population of 1,054,686 with a confidence level of 95% is 267.
- In order to ensure that the sample selected adequately represents the demographic profile of Chandigarh and provides a holistic assessment of the study variables at hand, Convenience Non-Probability Sampling Technique (Teddlie & Yu, 2007) was resorted to – as per the under mentioned segregation of the target population—
- Students- Colleges/Panjab University, Chandigarh. (142)
- Academicians - Colleges/Panjab University, Chandigarh. (44)
- Business Owners. (30)
- Service Class. (46)
- Accordingly, as per the recommended sample size calculated above pre-prepared questionnaires were responded to by the selected sample of 263 respondents.

7. Community Involvement in the Study

A fair amount of thought, contemplation and debate was engendered while considering the involvement of the community in the collection of primary data for the study. In order to ensure that the study addressed all aspects which might impinge on the preparedness of the city, a conscious decision was taken to include four separate categories from the general public of Chandigarh – students, academicians, service class and business class people.

The methodology of Convenience Non-Probability Sampling was chosen for collecting primary data pertaining to the public, wherein a pre-prepared questionnaire was administered to the chosen categories from Chandigarh city. While a decision to include the public in the contours of the study had already been taken, during further scrutiny and review of existing literature on the subject, the author was pleasantly surprised to find that that the thought

of inclusion of community in health and environment research had already found favour with other researchers and had been formally termed as Community Based Participatory Research (CBPR) (Viswanathan et al., 2004).

CBPR is an alternative paradigm in research approach that “combines systematic inquiry, participation, and action to address urban health problems”. This approach has been found to “increase the value of studies for both researchers and the community being studied” (Minkler, 2005).

There is evidence available which state that CBPR has been known to be beneficial to various studies – not only to the researcher but also to the community participants, and the healthcare practitioner’s alike, through the use of shared knowledge and valuable experiences. CBPR creates bridges between scientists and communities, thus making projects more effective and efficient (Mieko & E Summerson, 2002).

8. Factor Analysis: Community

Convenience Non-Probability Sampling Technique was utilised for data collection. The samples were chosen from four different segments (Students, Academicians, Service Class and Business Owners,) – so as to cover the major spectrum of the Community. A total of 263 respondents from all categories was asked to respond to the questionnaires.

Since the subject was quite specific and technical, it often necessitated some amount of elaboration and background building before the respondents could comprehend the subject of the study, its intent and content. Most of the respondents from the Community, were very diffident in sharing their personal details, fearing repeated comebacks with reference to

following up on the questionnaires. This appeared atypical and anomalous, but the author had no option but to permit the respondents to keep their responses anonymous.

Responses were collated for a total of 16 questions covering 25 different variables related to the respondent’s knowledge/awareness about their perceptions about the cities level of preparedness for disaster management of a biological event. Their responses about the standard and quantum of coordination existing between the various “Essential Services” were also recorded. All responses less the demographic details were logged using a five-point Likert Scale.

9. Data Analysis

Despite ensuring all possible care during the administration of the questionnaire personally to all respondents, by the author, there were still a few respondents who chose not to respond to certain questions in the questionnaire. In order to ensure that the responses to a particular item were not insufficient (<10%) so as to subsequently undermine the quality of inferences and analysis, a Missing Value analysis was undertaken using the IBM SPSS (Version 24) statistical software. This value for the current dataset varied from zero to 26 items for different variables (0% to 9.9%) and hence none of the 263 cases was ignored for the analysis. The missing values were imputed using the IBM SPSS (Version 24) statistical software automatic method, with linear regression as the model for scale variables. The imputation was conducted such as to ignore cases which had more than 10% of the variables missing, which as indicated earlier did not result in any case being ignored. Hence, the dataset continued to have 263 cleansed cases with a few missing values imputed.

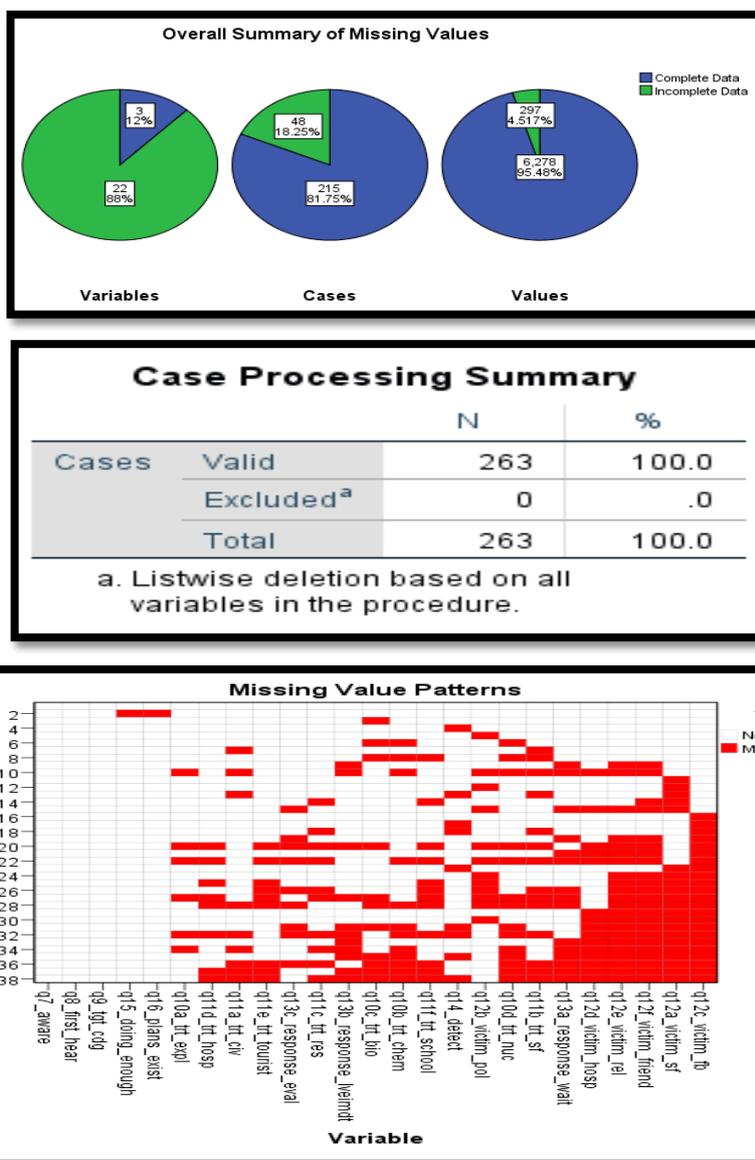


Figure 2 – Community Dataset – Missing Value Analysis (Authors Analysis)

Once the dataset had been verified, cleaned and all the missing item values for variables imputed, specific statistical tests pertaining to Reliability, Sampling Adequacy etc. were conducted on the data collected using specific tools available in IBM SPSS (Version 24) statistical software.

- The Kaiser-Meyer-Olkin measure of sampling adequacy was 0.605, just a little over the universally endorsed value of 0.6 (Norušis, 2008).
- Bartlett’s test of sphericity was significant ($p < .05$)

KMO and Bartlett's Test		
Kaiser-Meyer-Olkin Measure of Sampling Adequacy.		.605
Bartlett's Test of Sphericity	Approx. Chi-Square	1444.486
	df	300
	Sig.	.000

Figure 3 – Community Dataset –KMO and Bartlett Test Values (Authors Analysis)

- The Cronbach Alpha value was 0.620, which is just shy of the minimum recommended value of 0.70 (Norušis, 2008).

Cronbach's Alpha	Cronbach's Alpha Based on Standardized Items	N of Items
.620	.638	25

Figure 4 – Community Dataset – Cronbach Alpha Test (Authors Analysis)

- Further, the Communalities were all above 0.295 (varying from a low of 0.295 and a high of 0.806), confirming that each variable had some common variance with the others.

	Initial	Extraction
q7_aware	1.000	.733
q8_first_hear	1.000	.688
q9_tgt_cdg	1.000	.503
q10a_trt_expl	1.000	.480
q10b_trt_chem	1.000	.616
q10c_trt_bio	1.000	.601
q10d_trt_nuc	1.000	.632
q11a_trt_civ	1.000	.575
q11b_trt_sf	1.000	.415
q11c_trt_res	1.000	.585
q11d_trt_hosp	1.000	.572
q11e_trt_tourist	1.000	.362
q11f_trt_school	1.000	.609
q12a_victim_sf	1.000	.599
q12b_victim_pol	1.000	.572
q12c_victim_fb	1.000	.555
q12d_victim_hosp	1.000	.295
q12e_victim_rel	1.000	.764
q12f_victim_friend	1.000	.806
q13a_response_wait	1.000	.646
q13b_response_lveimdt	1.000	.737
q13c_response_eval	1.000	.483
q14_detect	1.000	.664
q15_doing_enough	1.000	.728
q16_plans_exist	1.000	.689

Extraction Method: Principal Component Analysis.

Figure 5 – Community Dataset – Communalities Values (Authors Analysis)

The Scree Plot drawn indicates two clearly defined inflexion points at Component Number four and 8. This goes on to indicate that as rough yardstick four or eight components could be extracted as a result of the PCA.

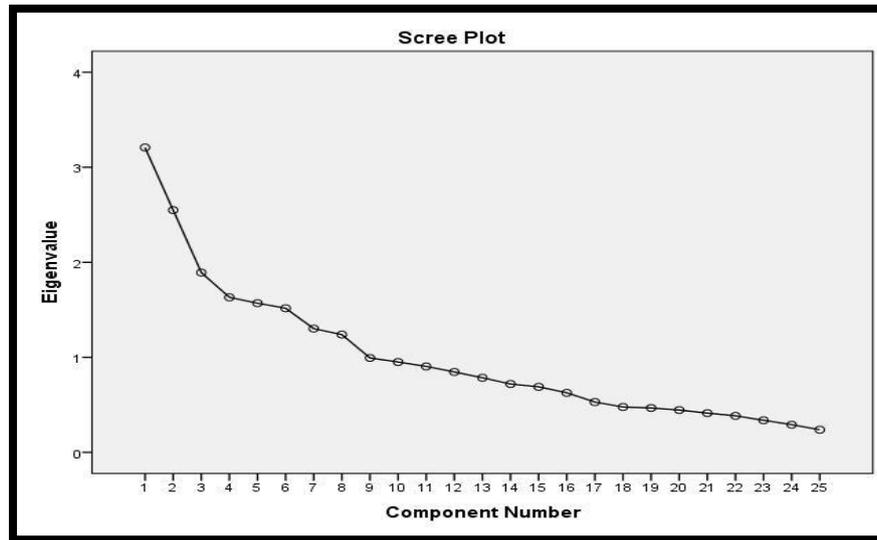


Figure 6 – Community Dataset – Scree Plot (Authors Analysis)

Given the aforementioned overall indicators, factor analysis was deemed to be suitable for all 25 variables. Data reduction is at the very core of using the method of Principle Components Analysis (PCA). PCA as a method was considered appropriate to be used in this case since it provides an efficient method to transform a set of observations of conceivably correlated variables to a probably smaller set of linearly uncorrelated variables called Principle Components or Factor. Accordingly, the data set was appraised using the PCA technique with

Varimax Kaiser Normalisation as the rotation method.

A total of eight Principle Components were extracted using the Varimax Kaiser Normalisation. The rotation converged in six iterations. Out of the 25 variables tested three were discarded and only 22 loaded individually on the eight extracted Factors. The specific details about the eight Principle Extracted components and the variables which loaded on to each of them are tabulated hereunder.

Component	Total Variance Explained										
	Total	Initial Eigenvalues			Extraction Sums of Squared Loadings			Rotation Sums of Squared Loadings			
		% of Variance	Cumulative %		Total	% of Variance	Cumulative %	Total	% of Variance	Cumulative %	
1	3.208	12.832	12.832	3.208	12.832	12.832	2.095	8.382	8.382		
2	2.549	10.197	23.029	2.549	10.197	23.029	1.995	7.981	16.363		
3	1.891	7.566	30.595	1.891	7.566	30.595	1.986	7.945	24.308		
4	1.631	6.525	37.120	1.631	6.525	37.120	1.982	7.928	32.237		
5	1.569	6.278	43.398	1.569	6.278	43.398	1.802	7.208	39.444		
6	1.516	6.065	49.463	1.516	6.065	49.463	1.720	6.879	46.323		
7	1.302	5.208	54.671	1.302	5.208	54.671	1.685	6.742	53.065		
8	1.239	4.956	59.628	1.239	4.956	59.628	1.641	6.563	59.628		
9	.993	3.973	63.601								
10	.950	3.801	67.402								
11	.904	3.615	71.017								
12	.846	3.383	74.400								
13	.785	3.140	77.540								
14	.719	2.876	80.416								
15	.689	2.756	83.172								
16	.626	2.503	85.675								
17	.529	2.117	87.792								
18	.477	1.909	89.701								
19	.467	1.869	91.571								
20	.445	1.781	93.351								
21	.413	1.650	95.001								
22	.384	1.535	96.537								
23	.337	1.347	97.884								
24	.291	1.164	99.048								
25	.238	.952	100.000								

Extraction Method: Principal Component Analysis.

Univariate Statistics								
	N	Mean	Std. Deviation	Missing		No. of Extremes ^a		
				Count	Percent	Low	High	
q7_aware	263	1.32	.467	0	.0	0	0	
q8_first_hear	263	3.45	1.724	0	.0	0	0	
q9_tgt_cdg	263	3.36	1.035	0	.0	0	0	
q10a_trt_expl	257	3.92	1.067	6	2.3	0	0	
q10b_trt_chem	250	3.36	1.097	13	4.9	13	0	
q10c_trt_bio	251	3.43	1.109	12	4.6	11	0	
q10d_trt_nuc	248	2.90	1.251	15	5.7	0	0	
q11a_trt_civ	253	3.85	.948	10	3.8	4	0	
q11b_trt_sf	248	3.71	1.043	15	5.7	7	0	
q11c_trt_res	252	3.80	1.035	11	4.2	0	0	
q11d_trt_hosp	255	3.86	1.025	8	3.0	0	0	
q11e_trt_tourist	253	3.72	.978	10	3.8	2	0	
q11f_trt_school	250	3.85	.997	13	4.9	0	0	
q12a_victim_sf	237	3.77	1.065	26	9.9	0	0	
q12b_victim_pol	249	3.81	1.094	14	5.3	0	0	
q12c_victim_fb	237	3.08	1.204	26	9.9	0	0	
q12d_victim_hosp	246	4.07	1.012	17	6.5	22	0	
q12e_victim_rel	239	3.77	1.147	24	9.1	0	0	
q12f_victim_friend	238	3.78	1.149	25	9.5	0	0	
q13a_response_wait	247	3.97	1.096	16	6.1	0	0	
q13b_response_lveimdt	252	3.39	1.312	11	4.2	0	0	
q13c_response_eval	253	3.94	1.122	10	3.8	0	0	
q14_detect	250	3.12	1.100	13	4.9	0	0	
q15_doing_enough	262	2.87	1.026	1	.4	0	0	
q16_plans_exist	262	2.83	1.014	1	.4	0	11	

a. Number of cases outside the range (Q1 - 1.5*IQR, Q3 + 1.5*IQR).

Rotated Component Matrix ^a								
	Component							
	1	2	3	4	5	6	7	8
q7_aware			.843					
q8_first_hear			.817					
q9_tgt_cdg		.620						
q10a_trt_expl								
q10b_trt_chem		.774						
q10c_trt_bio		.723						
q10d_trt_nuc		.595						
q11a_trt_civ								.737
q11b_trt_sf				.557				
q11c_trt_res								.732
q11d_trt_hosp						.743		
q11e_trt_tourist								
q11f_trt_school						.748		
q12a_victim_sf				.719				
q12b_victim_pol				.620				
q12c_victim_fb				.657				
q12d_victim_hosp								
q12e_victim_rel					.856			
q12f_victim_friend					.888			
q13a_response_wait							.753	
q13b_response_lveimdt							-.842	
q13c_response_eval							.550	
q14_detect	.806							
q15_doing_enough	.835							
q16_plans_exist	.815							

Extraction Method: Principal Component Analysis.
Rotation Method: Varimax with Kaiser Normalization.

a. Rotation converged in 6 iterations.

Figure 7 – Community Dataset – PCA (Authors Analysis)

Table 1 – Community Dataset – Principle Components Extracted (Authors Analysis)

Principle Component Number	Number of Factors Loaded on the Individual Extracted Principle Component	Names of Factors Loaded on to Individual Extracted Principle component	Commonality	Loading	Identity assigned to Principle Extracted Component
1	3	q14_detect	0.664	0.806	Early Warning and Reaction Mechanism
		q15_doing_enough	0.728	0.835	
		q16_plans_exist	0.689	0.815	
2	4	q9_tgt_chd	0.503	0.620	Risk Perception
		q10b_trt_chem	0.616	0.774	
		q10c_trt_bio	0.601	0.723	
		q10d_trt_nuc	0.632	0.595	
3	2	q7_aware	0.733	0.843	Prior Awareness
		q8_first_hear	0.689	0.817	
4	4	q11b_trt_sf	0.415	0.557	Initial Response_a
		q12a_victim_sf	0.599	0.719	
		q12b_victim_pol	0.572	0.620	
		q12c_victim_fb	0.555	0.657	
5	2	q12e_victim_rel	0.764	0.856	Initial Response_b
		q12f_victim_friend	0.806	0.888	
6	2	q11d_tr_hosp	0.572	0.743	Vulnerability Assessment_a
		q11f_trt_school	0.609	0.748	
7	3	q13a_response_wait	0.646	0.753	Self-Preservation & Resilience
		q13b_response_lveimdt	0.737	- 0.842	
		q13c_response_eval	0.483	0.550	
8	2	q11a_trt_civ	0.575	0.737	Vulnerability Assessment_b
		q11c_trt_res	0.585	0.732	

10. Results and Discussion

10.1 Findings

The 263 responses collected across 25 different variables were condensed to a set of 8 factors extracted as a result of PCA. A detailed description of the methodology and technique utilised for the same has already been enumerated in the previous paragraphs. What is of essence is that firstly, the extracted components broadly match the overall aspects which were being gauged in the first place about the community and general population of Chandigarh. Moreover, this evaluation also allowed us to broadly comprehend all those issues which help in attaining an understanding of the level of awareness about biological disasters existing amongst the general population in Chandigarh. Furthermore, the analysis also provided the communities perception of how well the civil administration and the emergency services were geared up to tackle any biological disaster.

While researching about the role of the community in a disaster event – the concept of Zero responders (Cole, Walters, & Lynch, 2011)– appeared very thought-provoking. It examines the role and actions of competent, spontaneous persons from the general public, who voluntarily take charge of a deteriorating disastrous situation before the actual first responders arrive at the incident site. The initial actions of these zero responders, and the manner in which they are able to explain the circumstances, which lead to the occurrence of the incident, are key for the first responders to react in an efficient and effective manner, to reduce or control the manifestations of the

incident. The data collected about the variables which condensed to the Principle component of Self Preservation and Resilience (of the community) amplifies this facet. In addition, a large number of respondents provided very encouraging Initial Response options as their preliminary reactions to a biological disaster event.

The interplay of the twin concept of vulnerability vis a vis resilience

(Drury, Novelli, & Stott, 2013), with respect to the reactions of the community, is also quite intriguing. The general public when faced with a critical fight or flight circumstance, exhibit two vastly diverse demeanours. The portion of the public which is feeling vulnerable displays an inherently weak and dysfunctional reaction. On the other hand, is the portion of the community, which reacts with surprising resilience, are able to constructively support and further the efforts of the first responders. The population of Chandigarh was found to be split in the ratio of 4:6 when examined on the factor of Initial Response to a CBRN event in general and a biological disaster in particular.

The extracted components when seen in conjunction with the data collated for the variables, consolidating to respective factors, allow us to make a reasonable assumption about the level of awareness which exists in the general public as well as their perceptions about the quantum of inter-service coordination between the various emergency services and the civil administration. The major inferences drawn from the data analysis coupled with the PCA is presented in a tabular format for ease of assimilation.

Table 2 – Community Dataset – Inferences Drawn (Authors Analysis)

Principle Component Number	The identity of Principle Extracted Component	Inferences Drawn	Evaluated Grading (Mean of Loadings)		
			-1 < 0.6	0 0.6 to 0.7	+1 > 0.7
1	Early Warning and Reaction Mechanism	Maximum respondents acknowledged a lack of knowledge about any mechanism existing in Chandigarh to detect the accidental or deliberate release of a biological agent. They also weren't aware of any initiatives undertaken by the civil administration to upgrade their capabilities of being able to provide early warning about an impending biological disaster. Lastly, the respondents indicated that though plans and SOP's may be existing they had no idea if they would be able to collectively contain an event of a biological agent release.	-	-	✓
2	Risk Perception	The respondents viewed the likelihood of a terrorist attack on Chandigarh being occasioned due to a C, B, N agent as being quite possible. The likelihood of a biological agent related event was rated as being "Very Likely" – more than a chemical or nuclear event. This is in line with the worldview which also follows this trend(Beyza & Aghlani, 2016).	-	✓	-
3	Prior Awareness	Considering that the respondents were all general public with varied levels of education ranging from non-matriculates, Post Graduates and even some with Doctorates, it was a foregone conclusion that most of the respondents would have previously heard of the term Biological warfare, Bioterrorism. This expectation was found true in the data collated. A large proportion of the respondents had been exposed to the terms from exposure to Internet/ TV / Books and Newspapers respectively.	-	-	✓
4 5	Initial Response_a Initial Response_b	A total of six factors which separately condensed onto two Principle components were assigned similar names. There were two distinct categories of responses which were collated for seeking reaction when a respondent was faced with a biological disaster situation. One set of respondents indicated that they would first inform their friends/relatives. On the other hand, the other set opined that they would prefer to inform about such an event first to the Security Forces (including PMF) and some averred that they would rather inform the Police / Fire Brigade – only because they did not know how to contact the Security Forces(including PMF) setup.	-	-	✓

7	Self-Preservation & Resilience	Maximum respondents when faced with a biological disaster and the response options of waiting, leaving the area immediately or evaluating their situation and then reacting – opined that they would leave the area immediately rather than wait, evaluate the situation and then react.	✓	-	-
6	Vulnerability Assessment_a	There were two distinct categories of responses collated with respect to the likelihood of a particular type of facility being targeted by a biological agent. One set of respondents indicated that the civilian office buildings and civilian residential areas were more vulnerable, while the other set opined that it is the hospitals and schools which are most vulnerable to a biological agent related the terrorist incident.	-	-	✓
8	Vulnerability Assessment_a				

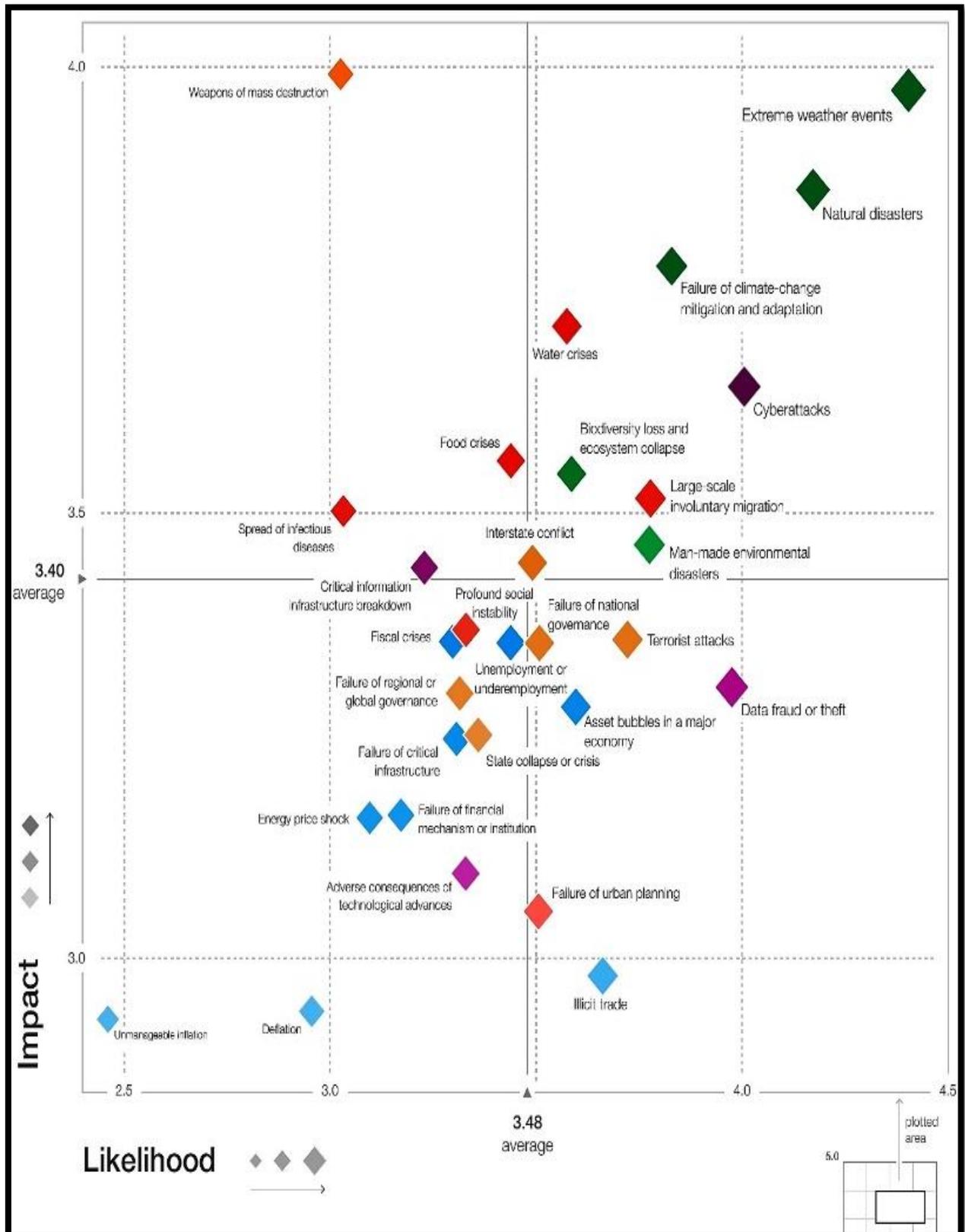
11. Conclusion

The above mentioned Inference Table along with the Evaluated Gradings drawn based on the Means of Loadings of the extracted components, when seen in its entirety, provides a summated mean of 0.66 which decodes to an overall grading of zero (0) which when deciphered implies that the Community component of Chandigarh presently possesses a fair amount of awareness about biological disasters/bioterrorism but no corresponding action is presently being undertaken by the civil administration on mainstreaming Disaster Management and other related training activities. Substantial quantum of further improvement is warranted in this realm.

During the course of this study, there were some issues – specific to the officious bureaucratic environment existing in Chandigarh – which need to be highlighted here, since it is quite obvious, that without finding a resolution of these concerns, we may never be able to make real progress in ensuring a resilient city-wide infrastructure to effectively tackle a bioterrorist incident of any magnitude. Some of these are fundamental to any and every problem that plagues our society. These are—

- Falling standards of national/city/individual self-pride.

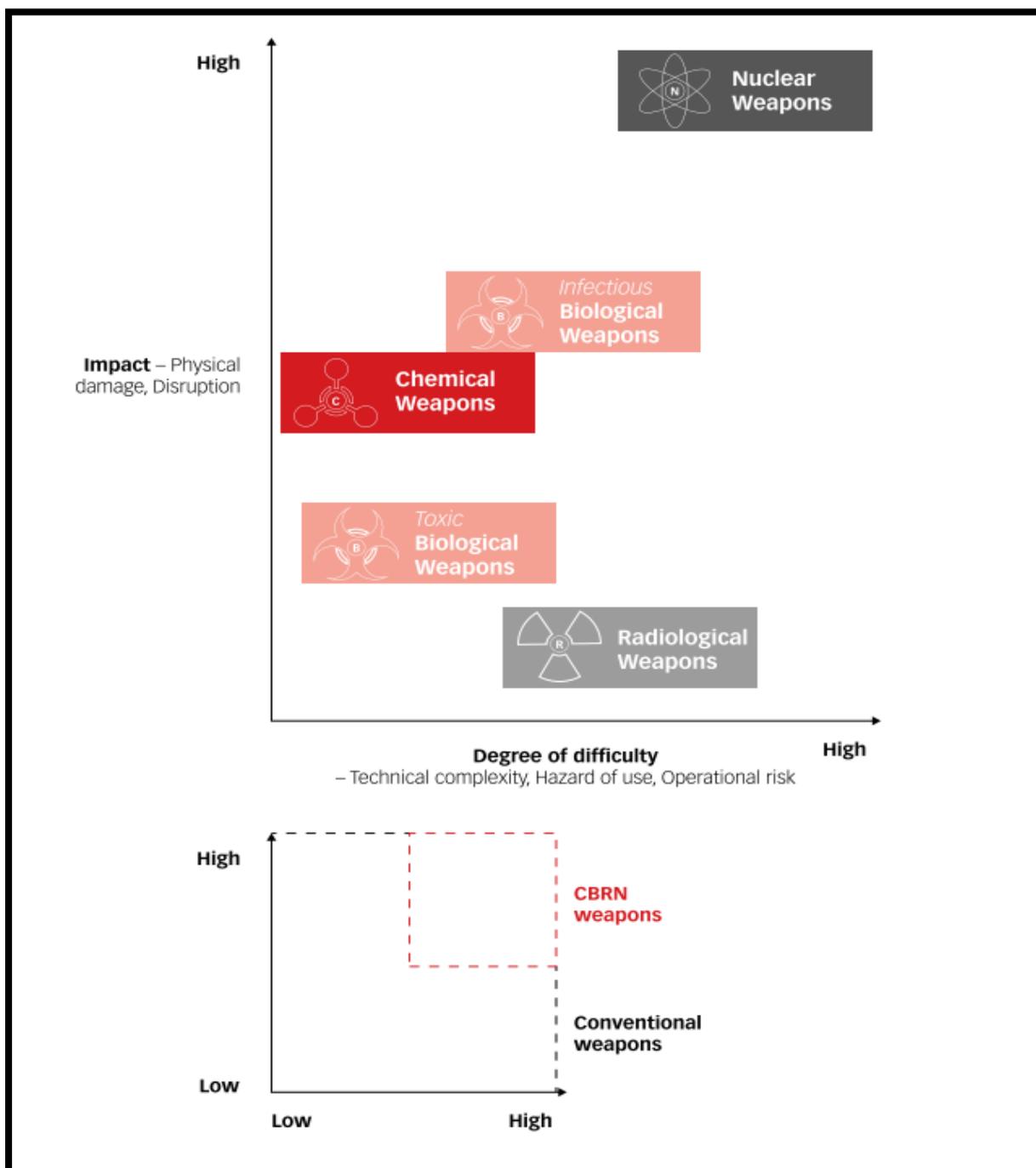
- Apparent affluence vs. increasing poverty. This rapidly widening social chasm needs to be bridged.
- The unabashed lack of awareness on the part of the bureaucracy coupled with their palpable reluctance to step out and find real-world solutions to the actual problems existing in the city.
- The infrastructure and equipment required to combat CBRN events are rather costly. This problem is further compounded by the restriction of repeated purchases and stocking due to the limited shelf life of most of the items required in the inventory. The government will have to find appropriate solutions to overcome these financial constraints.
- Regulatory mechanisms – at all echelons of operations/command are plagued with endemic corruption and political interference. These need to be rooted out with an iron hand.
- Rising levels of population, including the migratory population which has already overburdened the stretched resources of the cities administration.
- A sense of utter apathy with respect to hygiene and sanitation –both within our houses and in the city.



APPENDIX A - GLOBAL RISK MATRIX

(World Economic Forum, 2018)- Red highlighting by Author

APPENDIX B - CONVENTIONAL WEAPONS VS CBRN WEAPONS: THREAT ASSESSMENT



(Beyza & Aghlani, 2016)

APPENDIX C - BIOTERRORISM PREPAREDNESS – COMMUNITY AWARENESS

What is Bio Terrorism? ‘Use of microorganisms or toxins to kill or sicken people, animals or plants intentionally’

Directions: Respond to the following items to the best of your knowledge.

About You – Demographical Data

1. Age

Less than 18 years

- 18– 25years
- 25– 35 years
- 35– 45 years
- More than 45 years

2. Gender

- Male Female

3. Educational Qualification

- Doctorate
- Post Graduate
- Graduate
- Below Class 12

4. Role

- Student
- Academic / Teacher
- Business Owner / Employee
- Executive / Supervisor
- Other – Please specify _____

5. Name of Individual Completing Questionnaire (Optional)

6. Contact Details (Optional)

Email - _____ Mobile - _____

Awareness and Perception

7. Are you aware of the term Bioterrorism or Biological warfare?

- Yes No

8. Where did you first hear about the term – Bioterrorism or Biological warfare?

- Books / Magazine
- TV
- Radio
- Internet
- This questionnaire
- Others

Answer Question Numbers 9 to 16 based on the graded scale given hereunder

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Statement(Tick ✓ the most appropriate response for each from amongst the 5 options available)	Very Likely	Somewhat Likely	Do Not Know	Not Too Likely	Not Likely at All
9. How likely is Chandigarh to be targeted by terrorists?					
10. In your opinion, if Chandigarh is targeted by a terrorist strike, that event is most likely to be a terrorist attack involving					
• Explosives and firearms					
• Chemical weapon					
• Biological weapon					
• Nuclear weapon					
11. In your opinion, if Chandigarh is targeted by a biological agent, that event is most likely to be focused towards					
• Civilian office building					
• Security Forces					
• Residential complex					
• Hospital					
• Recreational / Tourist area					
• School					
12. In case you were a victim of a terrorist incident involving biological agents who would you inform in the first instance					
• Security / Para Military Forces					
• Police / Traffic Police					
• Fire Brigade					
• Hospital					
• Relative					
• Friend					
13. In case you were a victim of a terrorist incident involving biological agents what would be your likely evacuation response					
• Wait for instructions from police or health department officials					
• Immediately leave the area, regardless of any instructions					
• Carefully evaluate available information before deciding					
14. In your opinion will the release of a Bioterrorism agent be able to be detected by the facilities existing / available in the city?					

Statement (Tick ✓ the most appropriate response from amongst the five options available)	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
15. Chandigarh administration is doing enough to make the public aware of the dangers of Bioterrorism?					
16. Chandigarh administration has specific procedures and plans existing to combat a Bioterrorism incident?					

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