

Mental Risk Faced During Lockdown in COVID-19: A Grey-TOPSIS Approach – A Case Study of Odisha

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ABSTRACT

The Indian Government has taken broad steps and declared lockdowns to reduce the community transmission of the novel coronavirus. Many people tried to utilize this period by doing online work and household work simultaneously. Many small-scale industries, shops, agencies, school colleges shut their door following government rules and regulations to avoid spreading the virus. People working or engaged in these activities or duties became unemployed. As man is a social animal and feels safe and secure in society, the increase in distance from society from office space and due to financial crises negative thoughts have impacted them. In this study, an attempt was made to prioritize the cause of mental pressure faced by common people. Precautionary measures can be taken for the public health such that appropriate steps can be taken to protect their health from the transmission of this virus by using the grey technique for order of preference by similarity to ideal solution (grey-TOPSIS) method.

KEYWORDS

COVID-19, Grey-TOPSIS, India, Knowledge, Mental Pressure, Public Health

1. INTRODUCTION

Now-a -days everywhere world faces just one health problems that's pandemic Covid-19. Corona virus disease (COVID-19) is that the first pandemic in human history where technology and social media are getting used on a huge scale to keep people safe, productive and connected while being physically apart. Thanks to digitization, which help in connecting people maintaining social distance, Information for Covid -19 and vital health messages are often spread to common peoples mobile ,it helps to save lots of life . By seeing the severity of Pandemic, ITU and WHO turn all telecommunication companies worldwide to hitch this initiative to assist unleash the facility of communication technology to save lots of lives from COVID-19. This initiative builds on current efforts to disseminate health messages through the joint WHO-ITU Be-healthy Be-Mobile initiative. Some of the infectious diseases like Swine flue, attain epidemic-proportion occasionally, albeit many of the diseases are found to be endemic like malaria, flu and tuberculosis, etc. Covid-19 refers to often sudden and increasing number of disease-cases during a community in more than normal expectation during a population. the main causes for Covid-19 still a crucial topic of dialogue but the spread is reported as non-availability of unpolluted & hygienic drinking-water, contamination, of drinking-water sources, lacking in sanitation related awareness, unhygienic-foods, overcrowds,

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biological-conditions also as ecological factors. Moreover, as a consequence of the spread of the Pandemic, many developed and developing countries are affected leading to a high mortality-rate. This pandemic has effected public-health and economy level badly. Therefore, everywhere World try to unravel and mitigate the COVID-19 viruses throughout the planet . Till date just one solution is found lockdown and Social distancing. Those countries by hook or crook followed, they somehow ready to stop the trail of Covid-19 and saved lives of their population. Due to lock down office, industries, shops stop their transaction, so countries started facing financial crises . But still with facing Economic crises also Indian Govt tried lot to safe lifetime of people. Internet has played an important role this point . Internet has saved bread and butter of the many professional during this pandemic. Software professionals can work smoothly in their home, education and teaching professionals and students can use internet facility in their home, doctors can consult by telemedicine facilities. Thus the importance of IT increases within the economy. The increased demand for software and social media platforms like Google Hangouts, WhatsApp Video call, Zoom, and Microsoft Teams is more in different platform. These teleconferencing tools help the people that are in quarantine to remain intuned with their relations also as have conference meetings and work on an equivalent time. The economy also will blossom because, during these crises, people understood the importance of the web and technology as this is often helping us stay safe and helping within the communication between the doctors and therefore the public. Moreover online shopping and door to door delivery has saved tons of peoples life and life style. Professional's of various field have learned, how to complete their work and meetings from home by video conferencing, etc. As there's no production of products or and no services provided, small business firms and household sector unable to supply remuneration to there employees .Few people haven't any options to do their work from home and sit in home ideally. It may be for two reasons ,First case their working industries are small industries and have not developed IT platform to help their employees during this pandemic and secondly physical presence was necessary in their work place to complete job. So the standard of living of household sector also decreases. The loneliness, family burden, financial problem, thought of loosing job, predicted future, fear and most vital distance from society started burden their mind creating mental pressure most of the cases and in some cases work from home created over burden of 24 hours official work as well as family pressure. But still job security somehow helps them to relief. But maximum unemployed mass are found with behavioral changes, anxiety, change in food habits, sleeplessness, loneliness, etc. The industries who were working with old file systems without internet facilities bear tons of loss and every one most pack up ,So their employees without job are in high mental pressure. Some emergency services made their workers compulsory service as they need no online facilities for his or her workers .The workers of these Organizations are always in mental pressure of contamination of Corona in workplace and made to return out of range in fear of losing job. During lockdown physical training, education, even employment interview bogged down .So getting employment or any sort of physical job training is additionally an enormous Challenger for unemployed mass who aren't aware of data technology. For survival also IT plays an important role during pandemic. Starting from financial transactions, for official work ,paying electricity ,water bills, applying for job, education, online shopping, for medicine , to passing and getting information it's helped tons to scale back mental pressure. Thanks to IT people are ready to confine touch to their workplace and outside world . Smart phones, Drone, smart apps also are utilized in many countries to detect Covid patients and help them to urge health services. Not only this it's created many opportunity in job sector also. But persons like less educated ,no education in IT , migrant labors ,unskilled and unemployed mass suffered in depression and mental pressure. Anxiety is common for people handling poverty and unemployment and those with psycho-social issues like violence , sexual assault , etc. Some people that have COVID-19 infection, or have a family or relative one who has tested positive also are susceptible to worry .When people are confined to their homes, voluntarily or compulsorily, and suffers with unemployment and financial crises ,their social and financial loneliness develops , anxiety, fear, sadness, frustration, irritability and anger. But messages and knowledge reached to

by Information technology helps them counsel and to scale back their mental pressure .So during this paper an attempt is taken to survey and prioritize the cause /parameters of mental pressure during Covid-19 lockdown due to lack of knowledge of IT and suggests the way to reduce mental pressure.

2. LITERATURE REVIEW

In the wake of this global health crisis, stringent public health measures are implemented to curtail the spread of COVID-19 (Adhikari et al., 2020). Widespread outbreaks of communicable disease, like COVID-19, are related to psychological distress and symptoms of mental disease (Bao et al., 2020). (Yang et al., 2020) and (Liu et al., 2020a) have suggested the precautionary measures necessary to contain the spread of COVID-19. (Zandifar and Badrfam, 2020) have highlighted the role of unpredictability, uncertainty, seriousness of the disease, misinformation and social isolation in contributing to worry and mental morbidity. The authors highlighted the necessity for both psychological state services, particularly for vulnerable populations, and therefore the strengthening of social capital to scale back the adverse psychological impact of the outbreak. (Shigemura et al., 2020) have emphasized the economic impact of COVID-19 and its effects on well-being, also because the likely high levels of fear and panic behaviour, like hoarding and stockpiling of resources, within the general population. This paper also identified populations at higher risk of adverse psychological state outcomes, including patients with COVID-19 and their families, individuals with existing physical or psychiatric morbidity, and health care workers. Banerjee, 2020 have explained six important roles for the psychiatrist: a) education of the public about the common psychological affects of an epidemic , b) motivating the general public to adopt strategies for disease prevention and health promotion, c) integrating their services with available health care, d) teaching problem-solving strategies to deal with the present crisis, e) empowering patients with COVID-19 and their caregivers, and f) provision of psychological state care to healthcare workers (Banerjee, 2020). (Duan and Zhu, 2020) have suggested the training of community health personnel in basic aspects of psychological state care is very essential. Liu et al., 2020b) have explained about the utilization of online surveys to assess the scope of psychological state problems and the event of online materials for psychological state education (Liu et al., 2020a). (Liu et al., 2020b) have explored the supply of online counselling and self-help services and (Xiao, 2020) has suggested the utilization of structured letters as a sort of asynchronous psychiatric consultation. (Zhou et al., 2020) have explained about the event of synchronous telemedicine services for diagnostic purposes and (Yao et al., 2020b) have found counselling as important tool and therefore they suggest to make online psychological state services accessible to individuals from lower socioeconomic strata . Such strategies offer the hope of providing psychological state services in an easily accessible manner with none increase in infection risk. So to assist in get obviate mental pressure related diseases IT plays an important role by providing on line counselling and e mental services .So before suggesting mental services the explanation for mental pressure must be found and therefore the most vital cause must be prioritized by MCDM(multi-criteria decision making) methods.

Moreover, a number of multicriteria decision making (MCDM) methods have been employed in diverse significant areas. Some of the MCDM methods include “preference-ranking organization-method for enrichment-evaluations (PROMETHEE)”, “analytic hierarchy process (AHP)”, “data envelopment analysis (DEA)”, “decision-making trial and evaluation laboratory (DEMATEL)”, “technique for order of preference by similarity to ideal solution (TOPSIS)”, etc. (Chaharsooghi & Ashrafi, 2014; Wu, 2007). The judgments by decision-makers are often uncertain and remain undefined with certainty. Thus it becomes very complicated to make the decision-making process. Many researchers have recently integrated different methodologies for solving vague problems in non-deterministic social, environmental and economical areas (Kuo et al., 2008; Li et al., 2007; Zhang et al., 2005). The Grey theory has been reported to be superior in uncertain information situations and is used in order to study human judgments with uncertainties and ambiguities (Li et

al., 2007). The extension of TOPSIS was investigated for a group-decision environment in the tea industry and a grey based TOPSIS method was developed in a study (Shih et al., 2007). In order to select the best supplier in MCDM, an integrated model of grey theory and TOPSIS has been proposed (Jadidi et al., 2008). Mishra et al. (2013) have suggested a MCDM method based on Grey theory and fuzzy-TOPSIS to select the suitable flexible-system in implementing mass customization-strategies. Fuzzy AHP and TOPSIS were applied for evaluating the performances as well as ranking the bank's branches (Aliakbarzadeh and Tabriz, 2014). In a study fuzzy-TOPSIS was proposed to improve the supply-chain management process of the food-industries (Roghianian et al., 2014). Nyaoga et al. (2016) have used "Grey-TOPSIS" approach in order to measure and rank the value-chain performances of the tea processing firms. Srivastawa et al. (2017) have considered ten Gear materials to evaluate their performance based on four selective criteria by the use of "Grey-TOPSIS" method and then validated the result by "Grey-Complex proportional assessment (COPRAS-G)" method. Chen (2019) has explained the problems of the existing coordinated-TOPSIS and has proposed a novel coordinated-TOPSIS in view of the co-efficient of variation in order to avoid the limitations in the existing coordinated-to Topsis. The primary aim of this study was to prioritize the preventive measures against mental pressure of people due to effect of COVID-19 viruses' infectious diseases under "Grey-TOPSIS" Multi-criteria environment.

3. METHODOLOGY

In this study, a total of 150 individuals were considered to find their cause of mental pressure in the recent epidemic corona virus in Indian context. The participants were chosen randomly between the age group of 30 to 60 years from the state of Odisha in India of different income levels (monthly in come up to 20,000), more than 20,000-1,00,000 and ,more than 1,00,000. Further, on the basis of the opinions of five numbers of experts from the health-care field and academicians, a standard question is designed and circulated among daily labors, house sector workers, university professor, industry workers, small scale workers, software processionals, shopkeepers etc. These workers /persons are basically categorized under Private company workers, Govt/public sector workers, and Self service/ Business sector then, the "Grey-TOPSIS" model was developed for evaluating as well as ranking of the cause of mental pressure during lockdown for COVID-19 viruses in view of the general public in India.

3.1 Steps in "Grey-TOPSIS" Method

At first, the linguistic-values expressed in Grey-numbers were applied for the assessment of weights as well as ratings of performance evaluation-criteria. Secondly, the Grey-numbers criteria importance-weights were de-greyed and then, normalized. And finally, TOPSIS multi model based on fuzzy-set theory was expressed, and fuzzy positive as well as negative ideal-solutions were used for determining the closeness ideal-solution for each performance and then, they were ranked accordingly.

This method has been reported to be very suitable to solve the 'group decision-making problems' in an environment with uncertainty. It was assumed that $P = P_1, P_2, \dots, P_m$ were a discrete-set of 'm' possible-alternatives as cause of mental pressure for COVID-19, and $C_R = C_{R1}, C_{R2}, \dots, C_{Rn}$ as a set of 'n' criterion. The criterion's were additional-independent, and $\otimes w = \otimes w_1, \otimes w_2, \dots, \otimes w_n$ was the vector of criteria-weights. In this study, the criteria-weights as well as ratings of alternatives were considered as linguistic-variables (Li et al., 2006; 2007).

The linguistic-variables can be expressed in Grey-numbers by "1 to 7 scale" as illustrated in Table 1. Moreover, the criteria-ratings $\otimes G$ can also be expressed in Grey-numbers by "1 to 7 scale" as illustrated in Table 2.

Table 1. The scale of criteria-weights ($\otimes w$)

Scale	$\otimes w$
Very-low (VL)	[0.0, 0.1]
Low (VL)	[0.1, 0.3]
Medium-low (ML)	[0.3, 0.4]
Medium (M)	[0.4, 0.5]
Medium-high (MH)	[0.5, 0.6]
High (H)	[0.6, 0.9]
Very-high (VH)	[0.9, 1.0]

Table 2. The scale of criteria-ratings ($\otimes G$)

Scale	$\otimes G$
Very-poor (VP)	[0, 1]
Poor (P)	[1, 3]
Medium-poor (MP)	[3, 4]
Fair (F)	[4, 5]
Medium-good (MG)	[5, 6]
Good (G)	[6, 9]
Very-good (VG)	[9, 10]

The steps followed for the “Grey-TOPSIS” method were as following:

Step 1: Forming a committee of decision-makers and identifying the criteria-weights of alternatives. By assuming of a decision-group having K persons, the criteria-weight of criteria C_{Rj} can be calculated as:

$$W_j = \frac{1}{k} [W_j^1 + W_j^2 + w_j^3 + \dots + w_j^K] \quad (1)$$

where, $\otimes w_j^k$ ($j= 1, 2, \dots, n$) represents the criteria-weight of K^{th} decision-makers.

Step 2: Using the linguistic-variables for the ratings to make the criteria rating-value. Then, the rating-values can be calculated as:

$$\otimes G_{ij} = \frac{1}{K} (\otimes G_{ij}^1 + \otimes G_{ij}^2 + \dots + \otimes G_{ij}^K) \quad (2)$$

where, $\otimes G_{ij}^K$ ($i=1, 2, \dots, m; j=1, 2, \dots, n$) was the criteria rating-value of K^{th} decision-makers.

Step 3: Establishing the grey decision-matrix as:

$$D = \begin{bmatrix} \otimes G_{11} & \otimes G_{12} & \dots & \otimes G_{1n} \\ \otimes G_{21} & \otimes G_{22} & \dots & \otimes G_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \otimes G_{m1} & \otimes G_{m2} & \dots & \otimes G_{mn} \end{bmatrix} \quad (3)$$

where, $\otimes G_{ij}$ were linguistic-variables based on the grey-number.

Step 4: Normalizing the grey decision-matrix as:

$$D^* = \begin{bmatrix} \otimes G_{11}^* & \otimes G_{12}^* & \dots & \otimes G_{1n}^* \\ \otimes G_{21}^* & \otimes G_{22}^* & \dots & \otimes G_{2n}^* \\ \vdots & \vdots & \ddots & \vdots \\ \otimes G_{m1}^* & \otimes G_{m2}^* & \dots & \otimes G_{mn}^* \end{bmatrix} \quad (4)$$

where, for a benefit-criterion, $\otimes G_{ij}^*$ was expressed as:

$$G_{ij}^* = \left[\frac{\underline{G}_{ij}}{G_j^{\max}}, \frac{\bar{G}_{ij}}{G_j^{\max}} \right], G_j^{\max} = \max_{1 \leq i \leq m} (\bar{G}_{ij}) \quad (5)$$

where, for a cost-criterion, $\otimes G_{ij}^*$ was expressed as:

$$G_{ij}^* = \left[\frac{G_j^{\min}}{\bar{G}_{ij}}, \frac{G_j^{\min}}{\underline{G}_{ij}} \right], G_j^{\min} = \min_{1 \leq i \leq m} (\underline{G}_{ij}) \quad (6)$$

The normalization method mentioned above was to preserve the property that the ranges of the normalized grey-number belonged to [0, 1].

Step 5: Establishing the weighted normalized grey decision-matrix. Considering the different importance of each criterion, the weighted normalized grey decision-matrix can be established as:

$$D^* = \begin{bmatrix} \otimes V_{11} & \otimes V_{12} & \dots & \otimes V_{1n} \\ \otimes V_{21} & \otimes V_{22} & \dots & \otimes V_{2n} \\ \vdots & \vdots & \ddots & \vdots \\ \otimes V_{m1} & \otimes V_{m2} & \dots & \otimes V_{mn} \end{bmatrix} \quad (7)$$

$$\otimes V_{ij} = \otimes G_{ij}^* \times \otimes w_j$$

Step 6: Making the ideal alternative as a referential alternative. For ‘m’ possible alternatives set $S = [S_1, S_2, \dots, S_m]$, the ideal referential alternative $S^{\max} = [\otimes G_1^{\max}, \otimes G_2^{\max}, \dots, \otimes G_n^{\max}]$ can be obtained by:

$$s^{\max} = [\{\max_{1 \leq i \leq m} (v_{i1}), \max_{1 \leq i \leq m} (\bar{v}_{i1})\}, \{\max_{1 \leq i \leq m} (v_{i2}), \max_{1 \leq i \leq m} (\bar{v}_{i2})\}, \dots, \{\max_{1 \leq i \leq m} (v_{in}), \max_{1 \leq i \leq m} (\bar{v}_{in})\}] \quad (8)$$

Step 7: Calculation of the grey possibility-degree between compared alternatives set $S = [S_1, S_2, \dots, S_m]$ and ideal referential alternative S^{\max} .

$$P[S_i \leq S^{\max}] = \frac{1}{n} \sum_{j=1}^n P[\otimes V_{ij} \leq G_i^{\max}] \quad (9)$$

Step 8: Ranking of the order of set alternatives. When, $P[S_i \leq S^{\max}]$ will be smaller, the ranking order of S_i will be better. Otherwise, the ranking order will be worse.

According to the above procedures, the ranking order of all alternatives can be determined and the best among the set of feasible alternatives can be selected.

3.2 Selection of Criteria and Alternatives

After survey and expert analysis it is found that the cause of mental pressure during lockdown in COVID-19 viruses and its' transmission to the public were considered as six alternatives i.e. $P_1, P_2, P_3, P_4, P_5,$ and P_6 . and as evaluated by the experts under three-criteria Private company workers(c1), Govt/public sector workers(c2) and Self service/Business sector(c3).

P1= Domestic fight due to lack of supplies

P2= Fear of social stigma

P3= complete isolation

P4= daily news of death & infection

P5= Helplessness and boredom

P6= Fear of loosing job and Unemployment and financial insecurity.

4. RESULTS AND DISCUSSION

After assigning the weight values (W) to different criteria (C) for a sustainable public-health in Indian context, the integrated-matrix was obtained for all the six alternatives as the precautionary measures against COVID-19 (Table 3), which was further followed by the normalized-matrix (Table 4) and weighted normalized-matrix (Table 5), respectively.

Further, based on the grey possibility-degree between compared precautions as alternative set $S = [S_1, S_2, \dots, S_m]$ and ideal referential precautionary measure (alternative) S^{\max} , the ranking of alternatives was done (Table 6).

It was found from the ranking (Table 6) that the main parameter for mental pressure is Fear of loosing job and Unemployment and financial insecurity. So major attention must be focused in this area to reduce the post or lockdown effect due to corona virus .Hence Govt must take necessary steps to focus in this area, such that mental pressure can be reduced and affects of mental pressure like suicidal attempt, anxiety, anger can be reduced among population.

5. CONCLUSION

This study aims to support the adoption and implementation of public-health measures at the individual also as community levels, so as to scale back the mental pressure during lockdown period

Table 3. Integrated-matrix

	W ₁		W ₂		W ₃	
	0.67	0.95	0.75	0.95	0.65	0.75
	C ₁		C ₂		C ₃	
P ₁	4.600	6.600	4.400	6.000	4.400	6.000
P ₂	4.000	5.200	4.400	6.000	4.600	6.600
P ₃	3.800	5.000	2.600	3.600	4.200	5.800
P ₄	3.600	4.400	1.600	2.800	4.400	6.000
P ₅	3.600	4.400	2.000	3.000	3.600	4.400
P ₆	4.200	5.400	1.600	2.800	3.400	4.200
MAX	6.600		6.000		6.600	
MIN	3.600		1.600		3.400	

*W_{so}= Weight values of social criteria, and W_{ec}= Weight values of economic criteria.

Table 4. Normalized-matrix

	W ₁		W ₂		W ₃	
	0.67	0.95	0.75	0.95	0.65	0.75
	C ₁		C ₂		C ₃	
P ₁	0.545	0.783	0.267	0.364	0.567	0.773
P ₂	0.692	0.900	0.267	0.364	0.515	0.739
P ₃	0.720	0.947	0.444	0.615	0.586	0.810
P ₄	0.818	1	0.571	1	0.567	0.773
P ₅	0.818	1	0.533	0.800	0.773	0.944
P ₆	0.667	0.857	0.571	1	0.810	1

Table 5. Weighted normalized-matrix

	C ₁		C ₂		C ₃	
P ₁	0.365	0.743	0.200	0.345	0.368	0.580
P ₂	0.464	0.855	0.200	0.345	0.335	0.554
P ₃	0.482	0.900	0.333	0.585	0.381	0.607
P ₄	0.548	0.950	0.429	0.950	0.368	0.580
P ₅	0.548	0.950	0.400	0.760	0.502	0.708
P ₆	0.447	0.814	0.429	0.950	0.526	0.750
S ⁺	0.548	0.950	0.429	0.950	0.526	0.750

Table 6. P $[S_i \leq S^{\max}]$ **and ranking of precautions (alternatives)**

Precautions	C ₁	C ₂	C ₃	SUM	Grey possibility-degree	Rank
P₁	0.750	1	0.877	2.627	0.657	6
P₂	0.613	1	0.936	2.550	0.637	5
P₃	0.571	0.798	0.820	2.189	0.547	4
P₄	0.500	0.500	0.877	1.877	0.469	3
P₅	0.500	0.624	0.576	1.700	0.425	2
P₆	0.654	0.500	0.500	1.654	0.414	1

in India. It becomes most vital to stop spreading of corona virus which is at a really dangerous speed throughout the planet . When measures like invention of vaccine, shut downs are taken by Govt. It is the sole responsibility of each service-providers, policy-makers, and decision-maker to act proactively to organize an appropriate framework for their employees such that there are going to be no loosing of jobs and no mental pressure. They should modify their Organizations with IT services, such that people can stay healthy physically and mentally. the result of this study will help the individuals, community-group, service-providers, policy-makers, and decision-maker in establishing/creating IT related employment in health sector, mental health sector ,in emergency services and in every job field, which may help to tackle any such Pandemic Situation.

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