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ANALYTICAL HIERARCHY PROCESS TECHNIQUE TO MINIMIZE THE COVID-19 RISK IN VARIOUS DAY-TO-DAY ACTIVITIES

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ABSTRACT

Life-threatened novel coronavirus disease 2019 (COVID-19) is getting international attention and has transformed into a pandemic that leads to the consequence of a high number of contaminated cases and casualties. Saliva-droplets or nasal discharge produced by coughing and sneezing of an infected person is the primary cause of the COVID-19 contamination spread. There are certain activities where the risk of this virus spread is very high, although many day-to-day activities have comparatively less risk. An attempt has been made in this research to pinpoint these activities in two segments: main activities and sub-activities. Analytical Hierarchy Process has been used to rank these activities to assess the risk and the virus spread. The results clearly show the level of risk, whether it is low, moderately low, moderate, moderately high, or high, according to the rank based on calculated weights. It is essential to follow the guidelines given by the WHO, CDC, and local administration. This paper provides a list of daily activities and sub-activities, and the risk level ranking has been calculated. It will guide the people to restrict themselves by knowing the severity of the risks associated with the activities and alert them to take precautions.

Keywords: Covid-19, Analytical Hierarchy Process, MCDM, Ranking of daily activities.

1. INTRODUCTION

COVID-19 (Coronavirus disease 2019) is a transferrable infection, and it became an ongoing global pandemic. It is triggered by the SARS-CoV-2 virus (Severe Acute Respiratory Syndrome Coronavirus 2) and spreads from one person to another by droplets and direct touch. Wuhan, in China, was the place where this virus outbreak was first identified in December 2019. On January 30, 2020, the World Health Organization (WHO) claimed the pandemic a Public Health Emergent of International Concern, and later on March 29, 2020, it was declared pandemic. As of July 2, 2021, more than 182 million cases have been registered across 220 countries and territories with more than 3,950,876 fatalities, and total registered vaccine doses were 2,950,104,812 (WHO, 2021). WHO acknowledged it as a significant global health concern (WHO, 2020). The number of infected cases from China imported into other countries is rising, and the epidemiologic picture changing daily (World Health Organization, 2020). COVID‑19 is a new disease, and many of the specifics of its spread are under investigation. It would not be wrong to say that it is the biggest challenge before the world since the Second World -War. Since its appearance in Asia in 2019, The virus has reached all continents apart from Antarctica. However, COVID-19 is not just a health catastrophe, it is also a socioeconomic disaster. Stressing the whole world, COVID-19 can create disturbance in geopolitics and the world economy. It will lead to economic and social effects and will put severe and long-lasting scars (WHO, 2020).

Several things should be understood that may increase the chances of getting infected with COVID-19, like joining small or large gatherings, interacting with people who avoid social distancing norms and not wearing masks properly, contacting the person who has no symptoms but may have an infection. Chances of getting virus infection increase with closeness with others. Indoor activity domains like offices and party halls are more hazardous than outdoor activity domains.

A long-term lockdown to stop the spread of the coronavirus could do more damage than good. Indeed, to enforce complete lockdown by shutting down almost all activities except some of the necessary commercial activities could stop the virus chain. To keep the COVID-19 in check, many countries have adopted strict new rules with social distancing in place worldwide. The consequence of these measures ends up with a debilitating effect on the country's economy. Countries that were looking forward to an increase in the economy are now facing downturn in their

economy. COVID-19 has greatly impacted, negatively the daily lives of people. The everyday living pattern of communities, on the other hand, have change due to the virous. Individuals and institutions are forced to put more money into risk, health, and safety concerns.

Following social distancing, washing hands frequently, isolating yourself after getting infected, covering coughing so that it does not infect anyone else, and avoiding touching your own face by hand are among the recommended measures to prevent COVID-19 infection. (Mayr et al., 2020). Some vaccines that the WHO and several countries approved for emergency use have been adopted for use and treatment, but still, there is no 100-percentage surety that a vaccinated person will never be affected by COVID-19. It will take more than a year, the administrative bodies to vaccinate all their citizens. COVID-19 is mainly spreading through verbal, eatables, and contacting the contaminated person. Quarantine is a situation to isolate a suspected case of COVID-19 so that a person can distinguish himself from others to disconnect from our world as contamination from one person to others is considered seriously. Worldwide, governments declared educational institutions closed to avoid gathering and advised citizens to stay safe at home (Majumder, 2020).

The Analytical Hierarchy Process (AHP) has been applied in a variety of real-world scenarios. This is a structured technique to organize and analyze decisions, which are complex in nature. Mathematics and psychology are combined in this technique. It refers to a method for computing the weights of assessment criteria that is quite accurate. Expert opinions of individuals are used for assessing the relative weights of factors by making pairwise comparisons.

AHP has been successfully used to investigate and model in decision situations that are complex in nature. It is used in a large number of real applications in the domain of Health care systems (Shirazi et al., 2020, Pirouz et al., 2020, Albahri et al., 2020, Maqbool et al., 2020, Elavarasan et al., 2020, Abdel et al., 2020, Mardani et al., 2020), Transport Mode (Moslem et al., 2020), Location Selection (Hashemkhani et al., 2020), Supply Chain Management (Govindan et al., 2020), Evaluation and benchmarking (Albahri et al., 2020), Preventive Activities (Singh et al., 2020), Performance evaluation (Varmazyar et al., 2016). The purpose of this paper is to assess risk and list day-to-day activities and sub-activities of the impact of COVID-19. The AHP technique is used for ranking list of activities and sub-activities. For the data collection, expert's opinions from different categories have been incorporated. This paper is organized in five sections. Sections 2 includes the literature review. Section 3 includes Methodology. In the same section the AHP technique is used for ranking these identified activities. In section 4, results are discussed and finally in section 5 conclusion of the work is written.

2. LITERATURE REVIEW

The exploration of related literature has been summarized on COVID-19, multi-criteria decision-making (MCDM) techniques. However, some researchers focused on employing MCDM techniques like AHP to solve problems based on the ongoing worldwide COVID-19 pandemic. AHP technique has been utilized to help decision-makers in the healthcare sector.

Moslem et al. (2020) considered the transportation sector with a particular focus on the issue of commuting mode choice, proposed a MCDM technique for the recently formed best-worst method (BWM), and utilized it to assess mobility choices after COVID-19. Hashemkhani et al. (2020) applied a GRA-based decision support structure employing CRITIC (criteria importance through inter-criteria correlation) for his analysis. Pirouz et al. (2020) worked on a critical challenge of sustainable advancement that was examined using the GMDH algorithm and regression analysis.

Maqbool et al. (2020) carried out a systematic literature review to identify the impediments to executing public health and social measures to prevent the spread of COVID-19. Such conditions are classified by using the DEMATEL (Decision Making Trial and Evaluation Laboratory) method. Albahri et al. (2020) presented the technique (based on the intersection of assessment criteria of each categorization of tasks and AI classification methods) to construct four decision matrices: multi-class, binary, multi-labeled, and hierarchical. Secondly, an integrated AHP-VIKOR method was provided for benchmarking AI classification methods to develop the MCDA approach.

Elavarasan et al. (2020) identified and investigated the many applied technologies that help the healthcare systems and administrative bodies, and community in diverse aspects to fight against COVID-19. Sharma et al. (2020) proposed a framework to enhance the survivability of Sustainable Supply Chains for surviving during and after COVID-19. SWARA (Stepwise Weight and Assessment Ratio Analysis) technique has been used in this study to identify important factors to enhance the survivability of Sustainable Supply Chains to focus on the pandemic condition. The research uncovered that Supply Chain Network sustainability is the most critical measure to manage consumer and dealer relationships. Varmazyar et al. (2016) proposed a new cohesive methodology based on the MCDM and BSC (Balanced Scorecard) methods to estimate the performance of research hubs in Iran.

Singh et al. (2020) performed a survey and used MCDM, AHP approach to prioritize preventative activities and suggested several social methods, including a face mask, social distancing, avoiding unnecessary traveling around, maintaining basic hygiene, and proper nutrition. Majumder et al. (2020) developed the Technique in Order of Preference by Similarity to Ideal Solution (TOPSIS) and MCDM approaches to decide on the significant risk factor and constant fatality monitoring due to Covid-19. Mohammed et al. (2020) employed a multi-criteria decision-making (MCDM) technique to assess and benchmark the various diagnostic models for COVID19. Abdel et al. (2020) used BWM (best-worst method) and TOPSIS (Technique in Order of Preference by Similarity to Ideal Solution) to develop a framework to differentiate between four viral chest diseases and COVID-19. Hartanto et al., (2021) used AHP for determining suitable material to make an ecologically responsive non-medical mask.

3. METHODOLOGY

3.1 Analytical Hierarchy Process

Multi-criteria decision-making (MCDM) techniques are widely used in modeling complex real-life problems almost in all areas of life, including disaster management. It refers to the best option out of all the achievable alternatives in complex and conflicting decision criteria. One of the unique aspects of the MCDM approaches is the Analytic Hierarchy Process which obtain the relative weights among the multi-level criteria. The AHP technique is most utilized in MCDM and has been effectively applied to a variety of practical decision-making issues (Saaty, 1980, Saaty, 1990). MCDM framework can enable better decision-making, especially in disaster situations like the COVID-19 pandemic. However, a limited number of studies have worked on ranking of daily activities in a pandemic and disaster situations using MCDM. This approach contributes to our motivation to study daily activities in detail and to do ranking according to the weights obtained by using AHP.

The Analytical Hierarchy Process (AHP), a unique aspect of the Multi-Criteria Decision-Making technique, was first presented and used by Saaty (1980). It is a strong mathematical approach for studying complicated decision-making issues. It has been thoroughly researched over time and improved upon as a technique for ranking. It is a precise approach for developing a reasonable structure for issues and quantifying their assessment criteria. The AHP is a three-layer Hierarchy structure, as shown in Figure 1.

The procedure of the AHP methodology is depicted in Figure 1.

According to Figure 2, the AHP process involved in this study consists of 8 steps:
Step 1: Defining the problem
Step 2: Identification of daily main activities and sub-activities that are selected based on the expert (Table 4)
Step 3: Preparation of questionnaire and floating for collecting data for constructing pairwise comparison matrix
Step 4: Construction of pairwise comparison matrix based on Saaty's scale of relative importance (Table 1)
Step 5: Normalization
Step 6: To calculate the consistency index (CI), use suitable RI corresponding to the number of criteria with the help of Saaty's scale (Table 2)

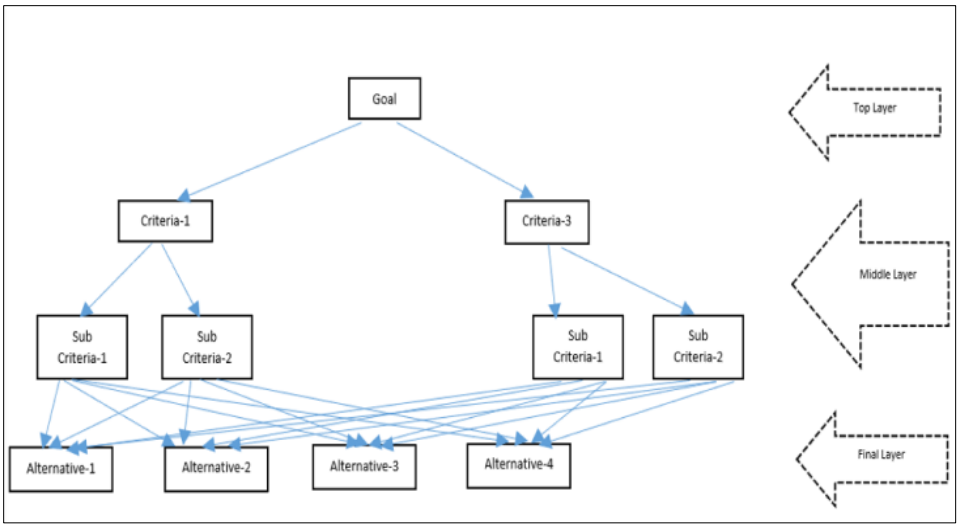

Figure 1: AHP Hierarchy Structure

Table 1: Saaty's scale of relative importance		
Scale	Rating	Reciprocal
Equally importance	1	1
Equally to moderately importance	2	1/2
Moderately importance	3	1/3
Moderately to strongly the importance	4	1/4
Strongly importance	5	1/5
Strongly to very strongly importance	6	1/6
Very strongly importance	7	1/7
Very to extremely strongly importance	8	1/8
Extremely importance	9	1/9

Table 2: Saaty's Scale of random index												
RI (Random Index)	n	1	2	3	4	5	6	7	8	9	10	11
	RI	0	0	0.58	0.9	1.12	1.24	1.32	1.41	1.45	1.49	1.51

Lambda max (eigenvalue) is the average of criteria weights. If n is the number of criteria, then the consistency index (CI) is calculated using the formula presented below in Equation 3.1.

$$CI = \frac{\lambda_{max} - n}{n - 1} \tag{3.1}$$

Step 7: We compute the consistency ratio (CR) by using Equation 3.2.

$$CR = \frac{CI}{RI} \tag{3.2}$$

Step 8: The CR is checked to see whether it is less than 0.1 or not. If it is less than 0.1, then do a ranking of criteria and sub-criteria using weights calculated using AHP. If not, then reconsider data by requesting participants to rethink and repeat and get CR until you get the CR < 0.1.

3.2 Problem Definition

The coronavirus SARS-CoV-2 (COVID-19) has affected 220 countries and territories. One hundred forty-eight million, one hundred ninety thousand and three hundred eighty-seven people (148,190,387) have been affected, and 3,126,361 confirmed deaths. The second spike of the COVID-19, the Delta, is more dangerous as the new variant of

the virus infects all age groups. To prevent another catastrophe, it is essential to follow the guidelines provided by the CDC, WHO and local administration. Generally, more proximity or interaction with others puts you at a higher risk of COVID-19 virus spread (Varmazyar, 2016). Suppose you are engaged in social events and wish to care for yourself, you would need to observe all protocols and practice preventive actions like covering your mouth and nose with a mask, keeping social distancing, avoiding unnecessary touching of surfaces and own body parts, and frequently sanitization of hands. As businesses and organizations are open, to avoid increased spread of virous, we may need to seek ways to continue certain daily routines while maintaining as much safety as possible in the presence of a pandemic crisis all around us. There is no available method to guarantee zero risks of virus infection; it is critical to comprehend likely risks and how to receive various kinds of avoidance measures to secure our self and help diminish the spread of COVID-19. Centers for Decease Control and Prevention (CDC) and The World Health Organization is unable to assign a risk rating for each activity in each locality. Individuals need to consider their situation and the risk for themselves and their families, and the society before going out for an activity. This is the time to evaluate our day-to-day activities, check which activities are essential and more important, and understand the severity of the virus risk attached to activities and sub-activities.

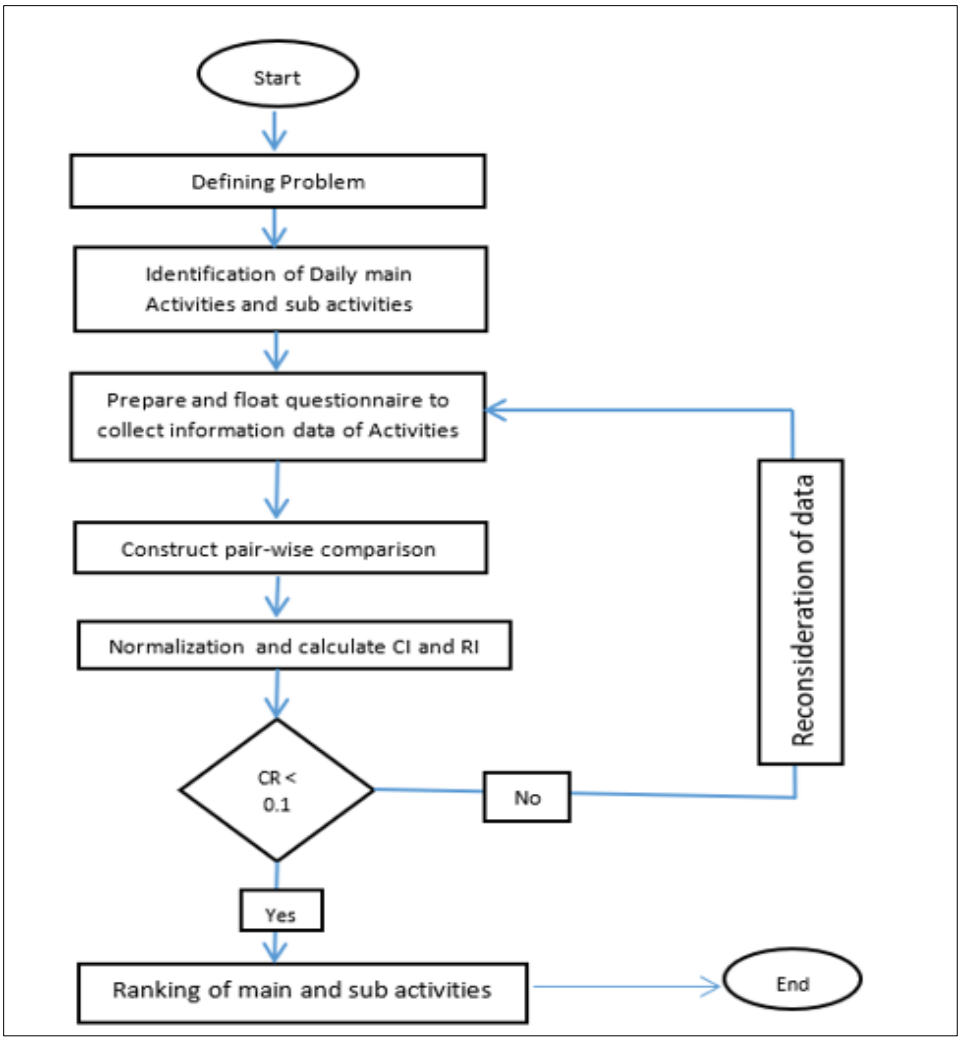

Figure 2: Architecture of proposed decision framework

Data and information provided by the Centers for Decease Control and Prevention (CDC) is summarized in the following Table 3. There are six activity region and 34 sub-activities regions. Activity regions and sub-regions are treated as criteria and sub criteria in the present work.

Table 3: Main criteria and sub-criteria	
Activity Region	Activity Subregion
School and Work (C1)	School (C11), Work (C12)
Going Out (C2)	Banks(C21), Bars and Clubs (C22), Doctor Visits(C23), Gas Stations(C24), Grocery Stores(C25), Gym or Fitness Centers(C26), Libraries(C27), Barber Shops(C28), Playgrounds(C29), Pharmacy/Medical Stores(C210), Restaurants(C211)
Events and Gathering (C3)	Attending Events and Gatherings(C31), Sporting Events(C32), Visiting family and friends(C33), Weddings(D34)
Travel, Recreation and Leisure (C4)	Beaches and Pools(C41), Camping(C42), Hotels(C43), Parks and Recreation Facilities(C44), Playing Sports(C45), Travel(C46)
At Home (C5)	Deliveries or Takeout(C51), Home Assistant(C52), In-Home Services or Repairs(C53)
Transportation (C6)	Public Transportation (Bus, Subway, Trains, etc.) (C61), Taxis(C62), Rideshare Services(C63), Personal Vehicles(C64), Personal bikes(C65), walking(C66), wheelchair rolling(C67), Shared bikes(C68)

Data collection for study – The questionnaires were collected from 90 respondents, and the average of each entry in comparison matrices was calculated. Respondents' classification is shown in Table 4. The questionnaire was prepared in the google form and then circulated among them. Data analysis was done in a Microsoft Excel sheet.

Table 4: Classification of respondents	
Category	Number of respondents
Students (age 18-25)	30
Academicians Medical practitioner	30 10
Self-employed	20
Male	46
Female	44
Countries	India, USA, Oman, Saudi Arabia, UAE, Philippine

The experts are grouped into four categories: students among age 18-25, academicians of various countries (India, USA, Oman, Saudi Arabia, UAE, and the Philippines), Medical practitioners, self-employed. Gender equality was tried to maintain balance between genders by taking the response of 23 males and 22 females. Total of 90 respondents filled the questionnaire and provided their feedback.

3.3 Pairwise Comparison Matrices

Following the pairwise comparison, tables have been constructed based on the data collected from respondents. For the calculations, Microsoft excel sheets have been used by applying the formula to check the consistency. In all tables, CR is less than 0.1, which is a threshold value. (Saaty, 1980). That is why associated weights in all pairwise comparison tables have been accepted to decide local ranks.

Table 5: Pairwise comparison matrix for day-to-day activities									
Criteria	C1	C2	C3	C4	C5	C6	Weight	Rank	Key indicators
C1	1	3	1/3	2	5	3	0.1937	2	λ_{max} =6.507
C2	1/3	1	1/7	½	6	1/2	0.0836	5	
C3	3	7	1	7	9	4	0.4691	1	C.I. = 0.1014
C4	1/2	2	1/7	1	5	3	0.1361	3	R.I.=1.24
C5	1/5	1/6	1/9	1/5	1	1/2	0.0333	6	C.R.= 0.0818
C6	1/3	2	1/4	1/3	2	1	0.0842	4	Associated weights are acceptable

Table 6: Pairwise comparison matrix for C1(School and work)				
Sub Criteria C1	C11	C12	Weight	Rank
C11	1	5	0.8333	1
C12	1/5	1	0.1667	2

Table 7: Pairwise comparison matrix for day-to-day activities C2 (Going out)													
Criteria C2	C21	C22	C23	C24	C25	C26	C27	C28	C29	C2,10	C2,11	Weights	Rank
C21	1	1/5	1/5	2	1/3	1/3	2	1/6	1	1/3	1/6	0.0327	10
C22	5	1	3	5	3	4	5	1	5	3	1/2	0.1632	2
C23	5	1/3	1	3	3	2	3	1/3	1/2	1/2	1/5	0.0772	4
C24	1/2	1/5	1/3	1	1/6	1/5	1/3	1/5	1/3	1/6	1/7	0.0192	11
C25	3	1/3	1/3	6	1	1/2	2	1/3	3	2	1/6	0.0698	6
C26	3	¼	1/2	5	2	1	2	1/3	2	3	1/6	0.0750	5
C27	1/2	1/5	1/3	3	1/2	1/2	1	1/3	2	1/2	1/5	0.0397	9
C28	6	1	3	5	3	3	3	1	5	5	1/3	0.1585	3
C29	1	1/5	2	3	1/3	1/2	1/2	1/5	1	2	1/3	0.0515	8
C2,10	3	1/3	2	6	1/2	1/3	2	1/5	1/2	1	1/3	0.0636	7
C2,11	6	2	5	7	6	6	5	3	3	3	1	0.2495	1

Key indicators of pairwise comparison matrix for criteria C2 are λ_{max} = 6.507, C.I. = 0.1014, R.I. = 1.24 and C.R.= 0.0818. Associated weights are acceptable because C.R value is less than 0.1.

Table 8: Pairwise Comparison Matrix for C3 (Events and Gathering)							
Criteria C3	C31	C32	C33	C34	Weight	Rank	Key indicators
C31	1	5	2	1/2	0.2735	2	λ_{max} =4.05
C32	1/5	1	1/3	1/7	0.0585	4	C.I. = 0.0167, R.I =0.9
C33	1/2	3	1	1/5	0.1378	3	C.R.= 0.0186
C34	2	7	5	1	0.5302	1	Associated weights are acceptable

Table 9: Pairwise Comparison Matrix for C4 (Travel, recreation, and leisure activities)									
Criteria C4	C41	C42	C43	C44	C45	C46	Weight	Rank	Key indicators
C41	1	2	1/3	1/4	1/2	1/7	0.0641	5	λ_{max} =6.349
C42	½	1	1/2	1/3	1/2	1/5	0.0576	6	
C43	3	2	1	1/4	1//2	1/5	0.0963	4	C.I. = 0.699
C44	4	3	4	1	3	1/3	0.2344	2	R.I.=1.24
C45	2	2	2	1/3	1	1/4	0.1151	3	C.R.= 0.0564
C46	7	5	5	3	4	1	0.4325	1	Associated weights are acceptable

Table 10: Pairwise Comparison Matrix for C5 (At home activities)						
Criteria C5	C51	C52	C53	Weight	Rank	Key indicators
C51	1	5	2	0.5813	1	λ_{max} =3.004
C52	1/5	1	1/3	0.1096	3	C.I. =0.0018, R.I =0.58
C53	1/2	3	1	0.3092	2	C.R.= 0.0032
						Associated weights are acceptable

Table 11: Pairwise Comparison Matrix for C6 (Transportation activities)											
Criteria C6	C61	C62	C63	C64	C65	C66	C67	C68	Weight	Rank	Key indicators
C61	1	2	3	6	5	7	5	2	0.2842	1	λ_{max} =8.699
C62	1/2	1	½	6	5	7	5	2	0.1903	3	
C63	1/3	2	1	6	5	6	3	2	0.1976	2	C.I. = 0.09999
C64	1/6	1/6	1/6	1	1/2	1//3	1/3	1/6	0.0261	8	R.I.= 1.41
C65	1/5	1/5	1/5	2	1	1/3	½	1/5	0.0365	7	C.R.= 0.0708
C66	1/7	1/7	1/6	3	3	1	1/3	1/5	0.0473	6	Associated
C67	1/5	1/5	1/3	3	2	3	1	1/5	0.0622	5	weights are
C68	1/2	1/2	½	6	5	5	5	1	0.1557	4	acceptable

4. RESULTS

The comparison matrices calculated and mentioned in Tables 5 – Table 11 are summarized and collectively revealed in Table 3.12 according to the calculated weights for local and global ranking.

Table 12: Calculated local and global weights

Criteria	Weight	Ranking	Sub criteria	Local Weight	Local Ranking	Global Weights	Global Ranking
C1	0.1937	2	C11	0.8333	1	0.16141	2
			C12	0.1667	2	0.03229	6
C2	0.0836	5	C21	0.0327	10	0.00273	32
			C22	0.1632	2	0.01364	15
			C23	0.0772	4	0.00645	22
			C24	0.0192	11	0.00161	34
			C25	0.0698	6	0.00584	24
			C26	0.075	5	0.00627	23
			C27	0.0397	9	0.00332	30
			C28	0.1585	3	0.01325	16
			C29	0.0515	8	0.00431	27
			C2,10	0.0636	7	0.00532	25
			C2,11	0.2495	1	0.02086	10
C3	0.4691	1	C31	0.2735	2	0.12830	3
			C32	0.0585	4	0.02744	8
			C33	0.1378	3	0.06464	4
			C34	0.5302	1	0.24872	1
C4	0.1361	3	C41	0.0641	5	0.00872	20
			C42	0.0576	6	0.00784	21
			C43	0.0963	4	0.01311	18
			C44	0.2344	2	0.03190	7
			C45	0.1151	3	0.01567	14
			C46	0.4325	1	0.05886	5
C5	0.0333	6	C51	0.5813	1	0.01936	11
			C52	0.1096	3	0.00365	29
			C53	0.3092	2	0.01030	19
C6	0.0842	4	C61	0.2842	1	0.02393	9
			C62	0.1903	3	0.01602	13
			C63	0.1976	2	0.01664	12
			C64	0.0261	8	0.00220	33
			C65	0.0365	7	0.00307	31
			C66	0.0473	6	0.00398	28
			C67	0.0622	5	0.00524	26
			C68	0.1557	4	0.01311	17

In the following table (Table 13), sub-activities are sorted in ascending order according to the global ranking, and the risk level is also indicated.

Table 13: Ordered Ranking of Activities and Sub-Activities			
Sub activity region	Sub criteria	Global Ranking	Risk Level
Weddings	C34	1	High
School	C11	2	
Attending events/gathering	C31	3	
Visiting family and friends	C33	4	Moderately High
Travel	C46	5	
Work	C12	6	
Parks and recreation facility	C44	7	
Sporting events	C32	8	
Public transportation	C61	9	
Restaurants	C2,11	10	
Deliveries or takeout	C51	11	Moderately
Rideshare service	C63	12	
Taxis	C62	13	
Playing sports	C45	14	
Bars and clubs	C22	15	
Barber shops	C28	16	
Shared bikes	C68	17	
Hotels	C43	18	
Maintenance work	C53	19	
Beaches and pools	C41	20	
Camping	C42	21	
Doctors' visits	C23	22	
Gym or fitness centers	C26	23	
Grocery Stores	C25	24	Moderately Low
Pharmacy stores	C2,10	25	
Wheelchairs rolling	C67	26	
Playgrounds	C29	27	
Walking	C66	28	
Home Assistance/ Maid	C52	29	
Libraries	C27	30	
Personal bikes	C65	31	Low
Banks	C21	32	
Personal vehicles	C64	33	
Gas Station	C24	34	

Although it is a scientifically approved strategy for reducing virus transmission from one person to another and allowing the already overburdened healthcare system to cope for any government, it is difficult to impose lockdown in the long run because it harms the economy, and experts warn that it will destroy livelihoods and squeeze the country's economy. In early 2021, people assumed that the pandemic situation is under control. However, because of the negligence of precautions, greater mobility, and mingling, the COVID-19 virus got an additional chance to surge through. To balance economic activities and the public health crisis, situations should be managed in closed

workspaces, and as much as possible people should be allowed to work from home and where it is unavoidable, people should stagger workdays and timings. It is the greater responsibility of the people to be self-guided, regulated, and control their daily activities by knowing the virus risk. As the results clearly indicate, attending or organizing a wedding ceremony (C34) is on top rank in risk level. It is almost impossible to gather relatives and friends in a wedding ceremony to follow the local government and WHO guidelines. While drinking or eating, they will remove masks in a closed circle. In this study, the calculated global weightage associated with gathering at a wedding is 0.24872.

Calculated weightage associated with sub-activity of schools and other institutions (0.16141) is also at a high risk. They are attending events/gatherings (C31), has great virus spreader with the weight of 0.12831, and falls at an increased risk of coronavirus spreading. Visiting families and friends (C33), Travelling (C46), Workplace (C12), Park and recreation facility (C44), Sporting events (C32), Use of Public transportation (C61), and Eating in Restaurants (C2,11) showed moderate to high-risk level of virus infection with associated weights 0.06464, 0.05886, 0.03229, 0.03190, 0.02744, 0.02393 and 0.02086, respectively. The result of the analysis shows that Deliveries or Takeout (C51), Rideshare service (C52), Taxis (C62), Playing sports (C45), Bars and Clubs (C22), Barber shops (C28), Shared bikes (C68), Hotels (C43), Maintenance work (C53) either in-home or in-office, outside enjoyment at Beaches and pools (C41), Camping (C42), Doctors' visit with a patient (C32) and going Gym or fitness centers (C26) are in moderate risk level with calculated weights 0.01936, 0.01664, 0.01602, 0.01567, 0.01364, 0.01325, 0.01311, 0.01311, 0.01030, 0.00872, 0.00784, 0.00645 and 0.00627 respectively using AHP.

In moderate-low level of virus risk sub-criteria include Grocery stores (C2,10), Wheelchairs rolling (C67), Playgrounds (C29), Walking (C66), Home assistance/maid (C52) and going to Libraries for reading (C27) where the calculated weights are 0.00584, 0.00532, 0.00524, 0.00431, 0.00398, 0.00365, 0.00332, respectively. Furthermore, Personal bikes for movements (C65), going Banks (C21), using Personal vehicles (C64) for commuting, and going Gas stations for refueling are having a low risk of virus infection as the calculated value of weights are 0.00307, 0.00273, 0.00220, 0.00161respectively.

5. CONCLUSION

The second spike of COVID-19 is much more dangerous as the new variants of the virus is infecting all age groups. To protect everyone, it is essential that people follow the guidelines given by the WHO, CDC, and the local administrations. All people should be encouraged to get vaccinated against the virus. At present, no Government is in favor of complete lockdown, and it is the greater responsibility of the individual citizen to make a behavioral change during pandemic-like situations. In simple words, they should apply the approach of self-motivated lockdown by curbing their day-to-day activities. Most of the researchers' works are not focused on this dimension to deal with the unprecedented pandemic situation. In this paper, an attempt has been made successfully to identify daily activities in two segments: one is main activities, and the second is in the sub-activities. Analytic Hierarchy Process (AHP), which is one of the MCDM approaches, has been used to rank these activities to identify the risk of virus spread. This method helps provide a list of activities that should be considered as high risk and alert people to control or avoid the activities that fall under high risk. They must avoid excessive roaming in high-risk criteria or sub-criteria domains. This paper provides a detailed list of daily activities with a ranking of risk levels. With this, people would have a better understanding on how many levels of virus risk they may face, and they can seriously follow the guidelines issued by the official and competent authorities.

This work can be enhanced by including more categories and incorporate their opinion in pairwise comparison matrices. A decision support system in the form of an app can be designed and provided to support people for self-motivated lockdown in place of complete lockdown and enforced by the government administration. This approach could work to help avoid the type of a big dent due to lockdown in the country's economy and livelihood.

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