Scale of COVID-19 Infection, Deaths and Recoveries in Relation to Volume of Inbound Tourism, Prevailing Health Conditions, Average Age and Performance of Health Systems: Case of 33 Countries.

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Abstract

This study was focussed on finding the relationship between Scale of COVID-19 Infection, Deaths and Recoveries to the volume of inbound tourism, prevailing health conditions, average age and performance of health systems. Secondary data of 33 countries on these variables was analyzed by Pearson correlation, partial correlation and process analysis on SPSS V.21. It was found that average age and prevailing health conditions were significant moderators when number of infected cases was independent and number of associated deaths was dependent variable. Process model no.4 was adopted for the analysis of assessing conditional direct effects of independent variable on dependent variable via moderation of average age and prevailing health conditions. The analysis revealed that the countries with highest influx of inbound tourism were having highest number of infections and deaths. Prevailing health condition and average age were significant moderators and their lower values helped in lowering the number of deaths effectively. Some combinations of moderators were significantly helpful in lowering deaths. Performance of health systems was found to be effective if average age, prevailing health conditions and volume of inbound tourism were controlled. Data was analyzed at .05 level of significance.

Keywords- COVID-19, Pandemic, Inbound Tourism, Performance of health systems, process analysis.

1. Introduction

The spread of COVID-19 virus has been declared as a pandemic by WHO and has posed one of the most significant threats before the survival of the human race. Responding to the needs of accelerated research efforts, WHO released a research roadmap on February 12 2020. This roadmap consists of eight thematic areas – Virus: natural history, animal-human interface,

epidemiological studies, clinical characterization and management, infection prevention and control,Candidate therapeutics R&D, the need of vaccine development, ethical aspects in research, and social science's response in the outbreak. Present study falls under the category of epidemiological studies under the subcategory of understanding the susceptibility of populations. Most of the studies on the outbreak are focused on clinical aspects and reproduction numbers. This study takes a macro perspective and tries to explore the factors responsible for the circulation of virus and associated factors for worsening the situation in Europe, U.S.A., and other parts of the world. In this study relationship between prevailing health condition of the country, the average age of the country, inbound tourism influx, the number of COVID-19 cases and deaths are analyzed. Prevailing health condition is defined as "Percentageprobability of dying between exact ages 30 and 70 from any of cardiovascular disease, cancer, diabetes, or chronic respiratory"according to World Health Statistics 2017 (WHO) for each country. Inbound tourism is defined as per UNWTO standards and volume of inbound tourists in 2019 is taken as a variable for indicating the susceptibility of populations for the tourist destination country. The rationale behind selecting this variable was the fact that the pandemic worst hits most preferred tourist destinations. The population of the study is comprised of 33 countries for which secondary data by WHO, UNWTO, and worldhealthmeter.org was available. These countries were the most affected by the pandemic till April 5 2020. Process analysis based on model 2 in SPSS was performed for understanding the mechanism of how prevailing health conditions and average age interact with no of infected individuals (no of cases) in predicting no of deaths in the countries.

2. Literature Review

Deteriorating environmental conditions are linked with the prevalence of cardiovascular disease and chronic respiratory disease around the world. Bhatnagar (2017) found overall evidence that CVD is primarily associated with deteriorating environmental conditions. A report by the World Health Organisation (2020) estimates that air pollution is accountable for 7 million premature deaths around the world. Based on the mortality data of the year 2012, the agency estimated that 12.5% of global deaths are associated with air pollution. Air pollution is significantly linked with heart disease, respiratory infections and disease, cardiovascular disease and stroke. Burroughs & Rollins (2017) experienced increased evidence about the exposure of air pollution and its association with multiple cardiovascular disease, hypertension, coronary heart disease, stroke and cardiovascular mortality.

Studies around the world are confirming the prevalence of cardiovascular disease in patients diagnosed with COVID 19 infected patients. Prevalence of Cardiovascular disease was found in SARS and MERS. Researchers later analyzed these comorbidities, and it was found that in 8% of cases, CVD was prevalent in SARS. For MERS, the ratio was 50%.A similar trend was observed when the National Health Commission of China confirmed that 8% of diagnosed patients had prevalent CVD conditions, while 35% of patients had hypertension. (Clerikin et.al,2020). A meta-analysis by Zheng et..al(2020) indicated the same trend. Driggin et al. (2020) summarised that prevalent CVD might be a predictor of COVID-19 prognosis. He reviewed nine studies in China and found the prevalence of CVD, diabetes, hypertension, smoking, coronary artery disease and cerebrovascular disease in more than 50% cases.

Madsbad (2020) found diabetes as one of the most critical factors for getting COVID-19 infection. He quoted two studies with populations of 173 and 140 patients and found that

diabetes was prevalent in 16.2% and 12% cases respectively.Heymann&Shindo (2020) also indicated the role of diabetes in getting COVID-19 infection. In a study by Zhou et al. (2020), it was found that in 191 patients, 19% had comorbidity related to diabetes. Ondor and Rezza(2020) referred to a population of 335 patients in Italy who died by COVID-19 infection, of which 35.5% had diabetes. Basile (2020), concludes that diabetes can increase the chance of getting infected with diabetes.

Medical professional around the world has observed that persons with any kind of prevailing lung disease, chronic respiratory disease or lung cancer have a high risk of contracting the virus and fatality. The world's air pollution level and associated disease are already risking the lives of people as air pollution is one of the most significant causes of deaths every year. In this context, chances of contracting COVID-19 and Corona disease have posed even much higher risk for the lives of patients with prevailing lung-related disease, or chronic respiratory disease. Science Daily (March 30 2020), reports a study with Artificial Intelligence in which chronic respiratory disease was found to be one of the prevailing conditions in COVID-19 contracted patients. Kelland (2020) cited a reference of a pooled study which indicates that shortness of breath (Dysponea) is the symptom that is found in most severe patients and that is associated with prevalent respiratory or lung-related complications. Patients with Chronic obstructive pulmonary disease (COPD) were at the highest risk of contracting COVID-19 infection and required intensive care.

Verity et al. (2020) reported that age could be a factor in the chance of contracting infection, the severity of case and chances of recovery or fatality. Report of the WHO-China Joint Mission on Coronavirus Disease 2019 (COVID-19) states that

"Among 55,924 laboratory-confirmed cases reported as of February 20 2020, the median age is 51 years (range 2 days-100 years old; IQR 39-63 years old) with the majority of cases (77.8%) aged between 30–69 years. Among reported cases, 51.1% are male, 77.0% are from Hubei, and 21.6% are farmers or labourers by occupation."

Agarwala et al. (2020) for Database resources of the National Center for Biotechnology Information in the U.S.A. indicated the higher risk of contracting COVID-19 infection in the country because 55% of the population is older than 65 years. Studies across the world have reported a similar trend and average age of a country's population remains a crucial factor for the survival in this pandemic.

WHO has been collecting and disseminating data on "Probability of dying between exact ages 30 and 70 from any of cardiovascular disease, cancer, diabetes, or chronic respiratory (%)". Country-wise percentage probability is periodically calculated and disseminated in every 2-3 years of span. The latest data released by the agency as "World Health Statistics 2017" provides estimates on this indicator. The definition of this indicator provided by WHO is as following

"Per cent of 30-year-old-people who would die before their 70th birthday from any of cardiovascular disease, cancer, diabetes, or chronic respiratory disease, assuming that s/he would experience current mortality rates at every age and s/he would not die from any other cause of death (e.g., injuries or HIV/AIDS)."

If taken into consideration, this probabilistic estimate can be a predictor of no of cases, fatalities and recoveries in different countries. This is considered as an indicator of **Prevalent Health Condition (P.H.C.)** of each country. It takes account of all relevant prevalent health

conditions in corona pandemic – Cardiovascular disease, diabetes, chronic respiratory disease, cancer and any other non-communicable diseases.

3. Research Questions& Methodology

Several countries imposed a ban on international travels after the outbreak of a pandemic. An intuitive question arises whether there is any association among volumes of inbound tourism, number COVID-19 affected cases and deaths. Research question 1 and 2 are framed to test the same belief and significance of these decisions.

The literature review indicates that age and prevalent health conditions (P.H.C.) are associated with the chance of getting infected and resulting deaths. Research Question 3 tests the mechanism of how the number of infected cases affects the number of deaths when moderated by average age and prevailing health conditions and what are the significant interaction effects. Process analysis in SPSS V.21 is performed, and model no two are taken for explaining the mechanism.

To know about how the best health systems of the world respond in recovery if other factors remain the same, question no four was framed. Prevailing health conditions, inbound tourism, average age and total cases per one million population were controlled to know the relationship between health system performance of country and recovery.

The literature review indicates the lack of scientific evidence on the mechanism of how inbound tourism is related to the outbreak of COVID-19 infection. The associations between "Prevalent Health Conditions" of country and outbreak of COVID-19 infection is still an unanswered question. The factors responsible for the number of infected cases and deaths need to be analyzed, and the interplay of these variables is still a dark area.

Following research questions were framed after considering the knowledge gap for systematic inquiry.

1. How is Inbound Tourism related to the Number of COVID-19 Cases?
2. How is Inbound Tourism related to the Number of COVID-19 Deaths?
3. What is the mechanism of between Total Cases 1 Million Population (TC1MPOP) and Deaths in 1 Million Population (D1MPOP) when Prevailing Health Condition (P.H.C.) and Average Age of country population are taken as two moderators?
    - 3.1.1 How the interaction effects of the independent variable (**TC1MPOP)** with moderators(**P.H.C.** and **Average Age)** affect the dependent variable (**D1MPOP)** in this model?
    - 3.1.2 What is the conditional direct effect of the independent variable(**TC1MPOP)** on the dependent variable(**D1MPOP)** for different values of moderators (**P.H.C.** and **Average Age)**
4. How is Health System Performance related tothe number of recoveries?

The population of the study: All the countries of the world who are affected by Corona pandemic consist of the population of this study

Sample of the study: Those countries were identified which had the manifestations of variables of interest of this study. Countries with complete information on these variables were selected. 33 countries qualified on these criteria and consisted of the sample of this study (Table 1)

	Table No. 1: Sample of the Study and Variables' information.									
1.	Country	IN	No of	AV_	PH	PH	No.	Deat	D1MP	TC1MP

		BT	Cases	Age	C	S	Recv	hs	OP	OP
2.	USA	79.7	310233	37	13.6	82	14741	8444	26	937
3.	Italy	61.6	124632	45.9	9.4	90	20996	15362	254	2061
4.	Spain	82.8	126168	43.2	10.0	95	34219	11947	7593	2699
5.	China	62.9	81639	37	18.1	98	26400	3326	2	57
6.	Germany	38.9	96092	45.9	12.0	99	26400	1444	10962	1147
7.	France	89.4	89953	41.2	10.9	89	15438	7560	3436	1378
8.	Iran	7.3	55743	29.5	14.8	99	78	3452	41	664
9.	UK	36.3	41903	40	11.0	73	229	4313	64	617
10	Switzerland	11.7	20505	42.2	8.7	92	6415	666	77	2369
11	Turkey	45.8	23934	29.9	16.8	78	786	501	1913	284
12	Belgium	9.1	18431	41.3	11.6	82	3247	1283	111	1590
13	Canada	21.1	13912	40.5	9.8	100	2595	231	6	369
14	Portugal	22.8	10524	43.9	11.3	93	75	266	26	1032
15	Brazil	6.6	10360	31.3	16.9	97	127	445	2	49
16	Sweden	7.4	6443	40.9	9.1	93	205	373	37	638
17	Czech Republic	14	4472	41.4	15.6	93	78	59	6926	418
18	Ireland	10.9	4604	36.9	10.3	78	25	137	28	932
19	Denmark	12.7	4077	41.6	11.6	89	1283	161	28	704
20	Malaysia	25.8	3483	27.7	17.1	100	915	57	2	108
21	Russia	24.6	4731	38.7	29.3	77	333	43	0.3	32
22	Poland	19.6	3627	39.7	18.4	74	116	79	2	96

23	Japan	31.2	3139	46.3	8.8	100	514	77	0.6	25
24	Philippines	7.2	3094	24.1	28.6	87	57	144	1	28
25	Thailand	38.2	2067	37.8	16.2	98	674	20	0.3	30
26	India	17.4	3588	26.7	23.3	98	229	86	84	3
27	Saudi Arabia	15.4	2179	29.8	16.4	97	420	29	0.8	63
28	Indonesia	13.4	2092	28	26.6	99	150	191	0.7	8
29	South Africa	10.5	1585	26.1	26.5	100	95	9	0.2	27
30	Greece	30.1	1673	43.3	12.3	76	78	68	7	161
31	Mexico	41.1	1688	27.5	15.2	97	633	60	0.5	13
32	Singapore	14.7	1189	40	10.1	99	297	6	1	203
33	Ukraine	14.2	1225	40.3	28.9	99	25	32	0.7	28

Data Collection Procedure: This study is based on secondary data. World Health Statistics 2017 (WHO) was used as a secondary source for collection on data for Prevalent Health Condition of Country (P.H.C.) and Health System Performance. Data on the volume of inbound tourism was collected from the United Nations World Tourism Organization's (UNWTO) website. Pandemic related secondary data was collected from https://www.worldometers.info/ as on April 5 2020.

4. Functional Definition of Terms Used

Prevalent Health Condition of Country (P.H.C.)

Probability of dying between exact ages 30 and 70 from any of cardiovascular disease, cancer, diabetes, or chronic respiratory (%)". Country-wise percentage probability is periodically calculated and disseminated in every 2-3 years of span. The variable is measured and defined as per "World Health Statistics 2017". This definition is as per the World Health Organization's standards. This indicator is named as Prevalent Health Condition (P.H.C.) for the convenience of analysis.

Inbound Tourism (INBT)

As per the World Tourism Organization

"Inbound tourism comprises the activities of a non-resident visitor within the country of reference on an inbound tourism trip. Inbound tourism is the activities of the visitor travelling to a place outside his usual environment for not more than one consecutive year

*and not less than 24 hours. The travel is for leisure, business and not for permanent work and gaining money (*UNWTO,2020).*"*

In this study, Inbound Tourism is measured as no of Tourist Visited in 2019-20 in Millions. This is taken as an indicator in the analysis.

Health System Performance

Health System Performance (HSP) is defined by the World Health Organization's parameters as

"Percentage of attributes of 13 core capacities that have been attained at a specific point in time. The 13 core capacities are (1) National legislation, policy and financing; (2) Coordination and National Focal Point communications; (3) Surveillance; (4) Response; (5) Preparedness; (6) Risk communication; (7) Human resources; (8) Laboratory; (9) Points of entry; (10) Zoonotic events; (11) Food safety; (12) Chemical events; (13) Radio nuclear emergencies."

This definition is taken from WHO's Indicator Metadata Registry Details. (2020) Furthermore, data is taken from World Health Statistics 2017 (The latest release available). In the data provided by WHO, the variable is named "Average of 13 International Health Regulations core capacity scores"

Number of Deaths and Number of Deaths per 1 Million Population-

This data was collected from https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/ and based on world Health Organization's statistics as on April 6 2020

Number of Cases and Number of Cases per 1 Million Population-

This data was collected from https://www.worldometers.info/coronavirus/coronavirus-age-sex-demographics/ and based on world Health Organization's statistics as on April 6 2020.

Statistical Methods

As per the need of research questions, correlational analysis- Pearson correlation, partial correlation and Process Analysis were performed on SPSS V.21. For research question 3, process analysis on model 2 was performed where the model includes one independent variable (Total Cases 1 Million Population), First moderator (Prevailing Health Condition), second moderator as Average Age of the country, and a dependent variable (Deaths in 1 Million Population). The rationale for selecting this model of analysis was based on the literature review and insights from the trends of the pandemic. The analysis was performed ona .05 level of significance.

5. Data Analysis& Interpretations

The descriptive statistics of the variables are depicted in table 2.

Table No. 2Descriptive Statistics

	N	Minimum	Maximum	Mean	Std. Deviation
INBT	32	6.6	89.4	28.888	23.3976
Pop_Den	32	1.452	1460.136	123.70281	255.723223
Cases	3	1189	310233	33718.28	62763.296

	2				
AV_Age	32	24.100000	46.299999	37.05000031	6.675617866
PHC	32	9	29	15.60	6.409
HSP	32	73	100	91.28	8.952
NoRecv	32	25	34219	4933.53	9411.234
Deaths	32	6	15362	1902.22	3758.839
D1MPOP	32	.2	10962.0	988.534	2603.2475
T1MPOP	32	0	17729	3225.00	4036.115
TC1MPOP	32	3	2699	586.56	738.512
Valid N (listwise)	32				

5.1 Inbound Tourism and the Number of COVID-19 Cases

Research Question 1: How Inbound Tourism is related to the Number of COVID-19 Cases?

RH1:Volume of Inbound Tourism is significantly correlated to the number of COVID-19 Positive cases in selected countries under study.

H01: There is no any significant relationship between the Volume of Inbound Tourism and Number of COVID-19 cases.

Table No.3 presents a Correlations between INBT (Volume of Inbound Tourists) and Number of Deaths by COVID-19 infections.

Table No.3
Correlations between INBT(Volume of Inbound Tourists) and Number of Deaths by COVID-19 infections.

		INBT	Cases
INBT	Pearson Correlation	1	.738**
	Sig. (2-tailed)		.000
	N	32	32
Cases	Pearson Correlation	.738**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

The Correlational analysis from 32 countries on the number of COVID-19 infections and Inbound Tourism (Measured by No of Visitors) is presented in Table 1. The analysis confirms that there is a significant and positive correlation betweenthe volume of Inbound Tourism and number of Cases r=.738,p=.000. Thus the null hypothesis H01 is rejected.

5.2 Inbound Tourism and the Number of COVID-19 Deaths

Research Question 2: How Inbound Tourism is related to the Number of COVID-19 Deaths?

RH2: Volume of Inbound Tourism is significantly correlated to the number of deaths in selected countries under study.

H02: Volume of Inbound Tourism is not significantly correlated to the number of deaths in selected countries under study.

Table No.4 depicted a Correlations between INBT (Volume of Inbound Tourists) and Number of Deaths by COVID-19 infections.

Table No.4
Correlations between INBT (Volume of Inbound Tourists) and Number of Deaths by COVID-19 infections.

		INBT	Deaths
INBT	Pearson Correlation	1	.754**
	Sig. (2-tailed)		.000
	N	32	32
Deaths	Pearson Correlation	.754**	1
	Sig. (2-tailed)	.000	
	N	32	32

**. Correlation is significant at the 0.01 level (2-tailed).

The Correlational analysis from 32 countries on number of COVID-19 infections and Inbound Tourism (Measured by No of Visitors) is presented in Table No.4. The analysis confirms that there is a significant and positive correlation betweenthe volume of Inbound Tourism to the country and the number of deaths in the country, r=.754,p=.000. This is a highly significant and strong positive correlation.Thus the null hypothesis H02 is rejected.

5.3 Total Cases 1 Million Population (TC1MPOP) and Deaths in 1 Million Population (D1MPOP)

Research Question 3: What is the mechanism of between Total Cases 1 Million Population (TC1MPOP) and Deaths in 1 Million Population (D1MPOP) when Prevailing Health Condition is taken as Mediator, and Average Age of country population is taken as Moderator?

RH3: A linear Regression Model (Process Model no.2 in process analysis) comprising Total Cases per Million Population as an Independent Variable and Number of Deaths Per 1 million Population as a criterion variable with Prevailing Health Condition of country and Average Age in the country as two moderators provide a significant explanation of variance in criterion variable.

H03: A linear Regression Model (Process Model no.2 in process analysis) comprising Total Cases per Million Population as an Independent Variable and Number of Deaths Per 1 million Population as a criterion variable with Prevailing Health Condition of country and Average Age in the country as two moderators does not provide a significant explanation of variance in criterion variable.

Analysis:Table No.5 and 6 are outputs of process analysis and its evident from the output that for the above model, F=4.3819, p=.005. Thus null hypothesis H03 is rejected.

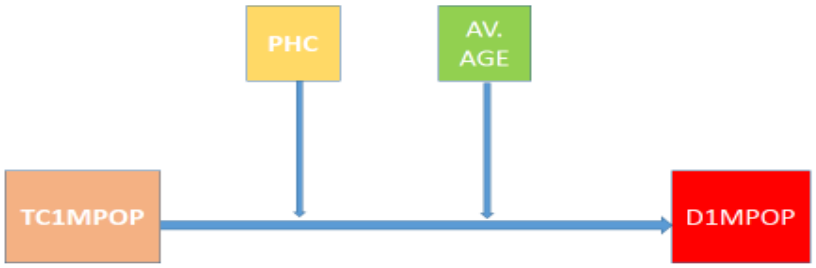

Figure 1: Diagram of Process ModeNo: 2(www.guilford.com/p/hayes3)

Model = 2
Y = D1MPOP
X = TC1MPOP
M = PHC
W = AV_Age
Sample size: 32

Table No.5: Process Model

Outcome: D1MPOP						
Model Summary						
R	R-sq	MSE	F	df1	df2	p
.6762	.4573	4384994.99	4.3819	5.0000	26.0000	.0050

Table No.6 Model					
coeff	se	t	p	LLCI	ULCI
constant	333.8608	4098.3712	.0815	.9357	-8090.7362 8758.4578
PHC	-10.2824	86.3036	-.1191	.9061	-187.6879 167.1231
TC1MPOP	-31.2807	10.2504	-3.0517	.0052	-52.3514 -10.2101
int_1	1.1769	.3485	3.3772	.0023	.4606 1.8932
AV_Age	-10.7144	85.0363	-.1260	.9007	-185.5147 164.0859
int_2	.4907	.1893	2.5913	.0155	.1014 .8799

Interactions:

int_1	TC1MPOP	X	PHC
int_2	TC1MPOP	X	AV_Age

Research Question 3.1:How the interaction effects of the independent variable (TC1MPOP)withthe mediator (P.H.C.) and moderator (Average Age) affect the dependent variable (D1MPOP) in this model

RH3.1.1: The interaction effect between Total Cases per 1 Million Population and Prevailing Health Conditions is significant.

H03.1.1: The interaction effect between Total Cases per 1 Million Population and Prevailing Health Conditions is not significant

Table-7: R-square increase due to interaction(s):

	R2-chng	F	df1	df2	p
int_1	.2381	11.4057	1.0000	26.0000	.0023
int_2	.1402	6.7150	1.0000	26.0000	.0155
Both	.2631	6.3021	2.0000	26.0000	.0059

Based on the information provided in table no. 7,it is evident that first interaction effect (int_1) between Total Cases per 1 Million PopulationPrevailing Health Conditions is highly significant at F=11.4057, p=.0023. Thus nullhypothesis is rejected (table-5)

RH3.1.2: The interaction effect between Total Cases per 1 Million Population and Average Age is significant.

H03.1.2: The interaction effect between Total Cases per 1 Million Population and Average Age is not significant.

Based on the information provided in table no. 7, the second interaction effect (int_2) between Total Cases per 1 Million Population and Average Age is highly significant at F= 6.7150, p=.0155 (table-5)

RH3.1.3: The combined interaction effect is significant

H03.1.3: The combined interaction effect is not significant

Analysis- Based on the information provided in table no. 7, the combined effect of both interaction effects is highly significant and contribute a 26.31% change in R2 at F=6.3021, p= .0059

Research Question 3.2: What is the conditional direct effect of the independent variable (TC1MPOP) on the dependent variable (D1MPOP) for different values of moderators (P.H.C. and Average Age)?

RH3.2 Conditional direct effects of the independent variable (TC1MPOP) on dependent

variable (D1MPOP) for different values of moderators (P.H.C. and Average Age) are significant.

H03.2 Conditional direct effects of independent variable (TC1MPOP) on the dependent variable (D1MPOP) for different values of moderators (P.H.C. and Average Age) are not significant

Analysis: Table No.8 presents 9 combinations of two moderators (each taking three values, mean, mean plus and minus one S.D.) between X and Y.

From the table it is evident that for 9 out of 6 combinations of two selected moderators, the independent variable has a significant effect on dependent variable. In combination no 2, 4 and 7 the effects are not significant.

Table No.8: Conditional effect of X on Y at values of the moderator(s):

	AV_Age	PHC	Effect	se	t	p	LLCI	ULCI
1	30.3744	9.1908	-5.5607	2.5750	-2.1595	.0402	-10.8539	-.2675
2	30.3744	15.6000	1.9821	2.3591	.8402	.4085	-2.8672	6.8314
3	30.3744	22.0092	9.5249	3.8048	2.5034	.0189	1.7038	17.3459
4	37.0500	9.1908	-2.2852	1.3931	-1.6403	.1130	-5.1489	.5785
5	37.0500	15.6000	5.2576	1.8989	2.7688	.0102	1.3543	9.1609
6	37.0500	22.0092	12.8004	3.9047	3.2782	.0030	4.7738	20.8269
7	43.7256	9.1908	.9903	.6682	1.4820	.1503	-.3832	2.3639
8	43.7256	15.6000	8.5331	2.2004	3.8780	.0006	4.0100	13.0562
9	43.7256	22.0092	16.0759	4.3833	3.6675	.0011	7.0656	25.0861

When average age is 30.3744, and prevailing health condition is 9.1908 (both values are at their lowest, i.e. mean minus one S.D.), they interact together to lower the death rates significantly. The effect of this combination is -5.5607, t=-2.1595, p=.0402.

With an increase in the value of both moderators, they leave a positive and significant effect on the number of deaths, except combinations mentioned above of moderators (2^{nd}, 4^{th} and 7^{th}).

5.4 Health System Performance and number of recoveries for Prevailing Health Conditions

Research Question 4: How Health System Performance is related to the number of recoveries if controlled for Prevailing Health Conditions, Average Age and Volume of Inbound tourism?

RH4: Health System Performance is significantly correlated with no of recoveries if controlled for Prevailing Health Conditions, Average Age and Volume of Inbound tourism.

H04: Health System Performance is not significantly correlated with no of recoveriesif controlled for Prevailing Health Conditions, Average Age and Volume of Inbound tourism.

The partial correlation coefficient is r=.381, p=.041, demonstrates that correlation is positive and significant which is presented in table 9.

Table No.9: Partial Correlations

Control Variables			NoRecv	HSP
PHC &AV_Age& INBT	NoRecv	Correlation	1.000	.381

		Significance (2-tailed)	.	.041
		df	0	27
	HSP	Correlation	.381	1.000
		Significance (2-tailed)	.041	.
		df	27	0

There is a significant positive correlation between Performance of Health system of country and number of recoveries if, Prevailing Health Conditions, Average Age and Volume of Inbound tourism are controlled.

6. Findings and Discussion.

There was significant and positive correlation between the volume of Inbound Tourism with number of COVID-19 infected Cases and deaths. Interestingly the countries with the highest amount of inbound tourism are found to reported highest cases of COVID-19 infections and deaths.The result confirms this trend. Italy, France, Spain, U.S.A., Switzerland, China, Mexico, Turkey, Germany are the countries struggling with the highest number of infections and associated deaths.

Average Age and Prevailing Health Conditions were found to be important moderators between the number of cases and number of deaths. For lower values of these two, it was found that number of infected cases lead to significantly lower number of deaths.When average age was 30.3744, and prevailing health condition score was 9.1908 (% Probability of dying by non-communicable diseases as defined by WHO world health Statistics 2017), the Number of Deaths per Million Population was lowest the effect of number of cases on number of deaths was negative for the first time. This is the most unique manifestation. It indicates that the countries with younger population are in better condition to stand the pandemic if other factors remain the same. Interestingly with an increase in average age and Prevailing Health Condition worsening (with higher PHC Score i.e. prior probability of dying by non communicable diseases), the interaction of these two moderator variables with the total number of infected cases per 1 million population (independent variable) contributes positively and significantly to the number of deaths per 1 million population(dependent variable). Although these interaction pattern and effects are to be interpreted with caution because they become insignificant forfor three combinations of ofAverage Age and Prevailing Health Conditions - (30.3744, 15.6000-combination no 2), (37.0500,9.1908,-combination no 4) and (43.7256 , 9.1908,-combination no 7). Table no.8 provide clear details. For these three combinatinos, effect of number of COVID-19 infected cases on number of associated deaths becomes insignificant. It means these combinations of Average age and PHC scores are helpful in fighting the pandemic. Although they are unmanipulable, they give us prior probabilities and insights if any similar pattern emerge in anywhere in any natural setting.

Research Questions	**Corresponding Null Hypothesis**	**Method of Analysis**	**Result**	**Decision (p=.005)**
1.How is Inbound Tourism related to the Number of COVID-19 Cases?	H01: There is no any significant relationship between the Volume of Inbound Tourism and Number of COVID-19 cases.	Pearson Correlation	r =.738, p=.000	Rejected
2.How is Inbound Tourism related to the Number of COVID-19 Deaths?	H02: Volume of Inbound Tourism is not significantly correlated to the number of deaths in selected countries under study.	Pearson Correlation	r =.754, p=.000	Rejected
3.What is the mechanism of between Total Cases 1 Million Population (TC1MPOP) and Deaths in 1 Million Population (D1MPOP) when Prevailing Health Condition (P.H.C.) and Average Age of country population are taken as two moderators?	H03: A linear Regression Model (Process Model no.2 in process analysis) comprising Total Cases per Million Population as an Independent Variable and Number of Deaths Per 1 million Population as a criterion variable with Prevailing Health Condition of country and Average Age in the country as two moderators does not provide a significant explanation of variance in criterion variable.	Process Analysis (Model No.2)	F=4.3819, p=.005.	Rejected
3.1.1 How the interaction effects of the independent variable (**TC1MPOP)** with moderators (**P.H.C.** and **Average Age)** affect the dependent variable (**D1MPOP)** in this model?	H03.1.1: The interaction effect between Total Cases per 1 Million Population and Prevailing Health Conditions is not significant	Process Analysis (Model No.2)	F=11.4057, p=.0023.	Rejected
	H03.1.2: The interaction effect between Total Cases per 1 Million Population and Average Age is not significant.	Process Analysis (Model No.2)	F= 6.7150, p=.0155	Rejected
	H03.1.3: The combined interaction effect is not significant	Process Analysis (Model No.2)	F=6.3021, p= .0059	Rejected
3.1.2 What is the conditional direct effect of the independent variable(**TC1MPOP)** on the dependent variable(**D1MPOP)**	H03.1.2: The interaction effect between Total Cases per 1 Million Population and Average Age is not significant.	Process Analysis (Model No.2)	Refer to table no.8	Refer to table no.8

for different values of moderators (**P.H.C.** and **Average Age)**				
4. How is Health System Performance related to the number of recoveries?	H04: Health System Performance is not significantly correlated with no of recoveries if controlled for Prevailing Health Conditions, Average Age and Volume of Inbound tourism.	Pearson Correlation	r=.381, p=.041	Rejected

Health systems Performance was found to have a positive and significant correlation with recovery if age and prevailing health conditions and the number of cases per million population were controlled. It indicates that countries like Italy, France, U.K, and U.S. A with best health systems are struggling due to higher average age of their populations, prevailing health conditions, and higher cases per 1 million people.

Conclusion :

The scale of COVID-19 infected cases and deaths were significantly and positively correlated with the volume of inbound tourism in 33 countries under this study. Scale of Deaths by COVID-19 infection was dependent on the scale of infection in the country but, Average age and Prevaling Health Conditions were two significant moderators in deciding the number of deaths.Health System Performance of the countries under study was found to be an effective measure, with a significant and positive correlation with number of recoveries, when other relevant variables - Prevailing Health Conditions, Average Age of country and volume of inbound tourism were controlled.

The study provides insights about resource allocation and prioritization criteria for public health systems. Depending on the average age and prior health conditons of the infected community, public health systems can prioritize their actions and accordingly the use of facilities / hopsitals could be planned and assigned. It can help in generating similar insights in situation of accumulating pressure of performance and delivery on public health systems.

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