International Journal of Disaster Recovery and Business Continuity
Vol.12, No. 1, (2021), pp. 293–309

Understanding pathways form socioeconomic indicators to effect of COVID-19 Lockdown via Structural Equation Modeling (SEM)

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Abstract

Covid-19 pandemic has created unusual and uncertain conditions with massive economic and social changes. The negative association between Covid-19 and Global economic indicators is obvious and started to be documented at macro-level, however, on individual level the mechanism of action between socioeconomic indicators and impact of Covid-19 has not been explored yet. We have hypothesized that due to Covid-19 lockdowns generally people are suffering or will suffer economically, bearing the brunt of global economic crisis originating currently. COVID-19 is marking its impression on mental health, sleep patterns, social capital and financial status of the people. We did pathway analysis using Structural equation modeling (SEM) to understand the direct and indirect impacts on Covid-19 due to socioeconomic indicator (SEI) change. Over the course of 3 months, through purposive sampling technique, a data from 2532 respondents is collected out of which 62% are female and 38% are males. Our results show that the probability of overall impact of Corona (IES-R score) increases 16% of SD (standard deviation) for every one SD decrease in socioeconomic indicators. For the identification of likely interventions we use SEM via four latent variables including, financial stress, sleep quality, mental health and social capital. Covid-19 is a pandemic whose end is unforeseen hitherto. Just like any other natural calamity, there are going to be far reaching social, economic and psychological impacts on a common man. World needs to better understand the mechanism of socioeconomic actions that influence overall negative impact of Covid-19 on the people in order to reduce the burden of these impacts.

Keywords: *Socioeconomic indicators, psychological impacts.*

Introduction

Since January 2020, Covid-19 has become an international emergency (WHO, 2020). Originated from Wuhan China in end of 2019, this mysterious disease spread extensively and exponentially across the world. Economic path way analysis done by Ma et al. (2020) at global level shows that the impact of present pandemic is far greater than all early outbreak from Hong Kong Flu to Zika. So much so that complete lockdowns were the only solution to stop or minimize the spread. Impact of Covid-19 on the global economic indicators is like none of the previous economic shocks (Dutt, 2020). An analysis done on economic indicators of first quarter of 2020 shows strong and unprecedented negative impacts of Covid-19 lockdowns on almost all economic indicators including GDP growth rate, investments, trade, poverty etc.

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ISSN: 2005-4289 IJDRBC

(UNIDO, 2020). Since 1990 Due to Covid-19, for the very first time since 1990's, almost all global development indicators have taken a negative turn, (UNDP, 2020). Despite the realization of negative economic repercussions of Covid-19, there is uncertainty about understanding the pathways of overall impact of Covid-19 at micro-level. Obviously a common man anywhere in the globe is facing this economic meltdown. Covid-19 has created such an uncertain situation form social, economic and psychological point of view that it is creating vast level of negative impacts on the global population. Dealing with a global pandemic with no cure in sight is a very stressful situation. Prolonged stress and uncertainty have amplifying effects on human psychology (Moolchan et al. 2007; Bao et al., 2020). Stress, anxiety, depression etc. are some of these effects (Businelle et al. 2010; Moolchan et al. 2007). This situation may last for some time and this pandemic may not be the last one. Therefore, there is a need for exploratory and investigative research studies to encompass nature, impacts and their interrelationships of Pandemic effects and to introduce interventions to control the arising issues (Yang et al., 2020; Liu et al., 2020a). The gaps existing in the current understanding of Covid-19 need to be filled through research especially the socioeconomic and psychological impacts which are resulting due to prolonged stress and social isolation (Xiao et al., 2020a; Wang et al., 2020; Xiao et al., 2020b). Uncertainty about the mechanism of action, cure and duration of this pandemic; piling death rates and vastness of the disease further intensifies multidimensional impacts of Covid-19, nonetheless research has started exploring mediators and moderators like social capital, economic behavioral patterns, socio-economic status, mental health, gender, age etc. which may help mitigate this impact (Zandifar and Badrfam, 2020; Shigemura et al., 2020; Yang et al., 2020; Tsai and Wilson, 2020; Zhu et al., 2020; Liem et al., 2020; Yao et al., 2020a). In some developed countries efforts to intervene already have already started in the shape of specific emotional trainings, online surveys, medical health awareness, counseling, self-help groups, mental health clinics and public support panels for marginalized populations (Liu et al., 2020a; Duan and Zhu, 2020; Yao et al., 2020b; Xiao, 2020; Zhou et al., 2020; Liu et al., 2020b). All these efforts can be improved if backed by studies done on micro level impact analysis of Covid-19. Current study has done an effort to fill this gap of literature by identifying pathways and building model for impact analysis of Covid-19.

Literature Review

Realization of the scale and intensity of Covid-19 pandemic shifted the focus of global research towards different aspects of this pandemic and its effects. Most of the post graduate research has gone on hold because previous non-Covid topics have become less important and all funds of research have been channelized towards Covid-19 (Alsafi, Abbas, Hassan and Ali 2020; DHSC, 2020; NIH, 2020). This has resulted in the much needed information about the pandemic, its nature, effects and intervention strategies. Along with desperate research in medical fields in order to find a cure, multiple social-scientists have also joined in to help reduce uncertainty currently linked with Covid-19. This pandemic is impacting psychologically to all and sundry, therefore, this aspect has been explored by many (Rajkumar, 2020). These studies are observational, exploratory, general or specific to certain groups. Observational studies (Wang et al, 2020; Li et al, 2020) have pointed out effects on Covid-19 on people like anxiety, depression, stress and mental health issues. Scope of the studies varies from general population (Zandifar and Badrfam, 2020; Shigemura, 2020) to specific groups like medical health workers (Kang et al., 2020; Chen et al., 2020; Liu et al., 2020b) adults (Yang et al., 2020), women (Rashidi Fakari and Simbar, 2020) Sick (Yao et al., 2020) homeless (Tsai and Wilson, 2020) and foreigners (Liem et al., 2020; Zhai and Du, 2020). Some studies have focused on interventions and health protocols of dealing with Covid-19 (Wang et al., 2020; Duan and Zhu, 2020; Liu, eta l., 2020; Xiao, 2020 and Yao et al., 2020). These studies have highlighted a

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vast variety of Covid-19 interventions to mitigate the psychological or overall effects from minor actions like washing hands to more advanced strategies like psychological and psycho-social trainings etc. All most all of these studies stressed on the importance of data gathering via online surveys for collecting as much information and record of Covid-19 impacts around the globe (Rajkumar, 2020). Current study is an effort to play a part in this global data and information pool building for understanding Covid-19 impact and its explanatory variables. Main purpose of the study is to develop a model of socio-economic indicator change and its impact on Covid-19 overall effect via mediators like financial stress, social capital, mental-health and sleep quality.

Background of variables

Social isolation and Sleep quality

There is repeated research documentation of the fact that disrupted sleep patterns, raised BP and spikes in level of cortisol are the results of social isolation (Baumeister, Twenge and Nuss, 2002). According to Seeman (2000) even when social isolation is only temporary it still reduces cognitive performance. So much so that after cardiovascular causes, social isolation is a leading cause of heart attacks (Cacioppo and Hawkley, 2003).

Social isolation and mental health

When comes to mental health impacts of Covid-19 we need to realize that even during normal circumstances those who face mental issues already have limited social capital, and in situations like these, they feel more secluded (Mummery, 2004; Borgeet al. 1999; Clinton et al., 1998; Lauder, et al., 2015; Andersson, 1998). Social isolation leads to many evils including despair (Luanaigh and Lawlor, 2008; Cacioppo et al., 2006), development of behavior syndromes (Richman and Sokolove, 1992), psychoses (DeNiro, 1995) and even suicidal tendencies (Goldsmith, Pellmar, Kleinman and Bunney, 2002). These conditions increase hospitalization (Mgutshini, 2010), mental fuzziness (White et al., 2000) and create psychological aberrations (Garety et al., 2001). Despite discussions about all these outcomes of social isolation the mechanism of their happenings and extent is still not known. Moreover, Covid-19 has brought about social isolation on such vast scale and for uncertain prolonged time period that many more are bound to face these mental health issues due to social isolation. Current research derives its importance from the very need of understanding this mechanism to implement effective interventions.

Quality of Sleep and Financial stress

Hall et al, (2008) discusses that financial stress has significant negative impact on sleep quality. When they adjusted for effects of variables like physical and mental health, age and gender, they found that onset of sleep, its latency and efficiency all are reduced due to financial stress.

Socio-economic impacts of Covid-19

Dutt (2020) did an analysis showing that the economic impacts of Covid-19 are already much severer than all previous International economic shocks. An analysis done on economic indicators of first quarter of 2020 has shown strong and negative impacts of Covid 19 lockdowns on almost all economic indicators including GDP growth rate, investments, trade, poverty etc. (UNIDO, 2020). Human development has taken a negative turn since 1990s (UNDP, 2020). Many businesses have suffered economic losses due to lockdowns during Covid-19 pandemic. Educational institutions closure has resulted

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in major losses of income for commercial school owners. According to Keogh Brown (2010) during influenza epidemic some ten years ago, the estimated loss for 12 week closure of only New York City caused USA a loss of USA 1% of her GDP. If projections are made on the same estimates, current pandemic is an economy killer. On the other hand there are people like Wren-Lewis (2020) who considers this a temporary phase that will pass and the global economy will recover.

Socioeconomic changes and mental health

People who have low socioeconomic status are more at risk of falling into mental health issues because of various inequalities and exclusions they face in the society. Reiss et al. (2019) conclude that in order to protect such people; socio-economic inequalities need to be reduced. This is a major concern during Covid-19 because this global level economic meltdown is resulting in widespread socio-economic breakdown.

Social Capital

Social Capital was defined for the very first time in 1980's Portes (1998). According to him social capital is actually a combination of various emotional support constructs like sense of belonging, inclusion, social trust and mutual recognition. Lynch and Kaplan (1997) further advanced social capital as the desire to participate in community activities and trust the fellow humans. However, one needs to differentiate between social support and social capital, where social support includes both social networks and material resources that can help a human (Khazaeian et al, 2017) social capital consists of more emotional constructs like belonging, participation and trust etc. (Harpham, Grant and Rodriguez, 2004).

Theoretical lenses of interrelationships

Stress process model links **resources** as moderator and mediator of **stress** for an individual. It talks about the value of social support and strategies to cope with stress due to control over resources (Milkie, 2010). This sociological theory provides a lens for understanding that poor socioeconomic resource indicators lead to higher financial stress level for both individuals and their families. Reverse is also true.

Fundamental cause theory connects higher level of socioeconomic status to better health outcomes in all respects via ability to put resources to optimal use for this purpose. This theoretical lens helps see the connection between SEI and Mental health (Dudley, Phelps and Riordan, 2019).

Rydgren (2009) points out two theories as perspective pointers for linkage between social isolation and disruptive behaviors. He states that **theory of social capital** and **mass society theory** both point towards the need of having social support systems and voluntary organizations for reducing the risks of intolerance at social level due to people who suffer from too much social isolation.

Hudson, (2005) discusses the role of stresses as the cause of poor mental health under the lens of **social causation theory.** This poor mental health according to **social drift theory**, he discusses can lead to losing jobs and in the long run financial stresses, resulting in a vicious cycle of negative outcomes.

Material and Methods

Study population

A survey questionnaire was created and shared with 289k members of Facebook group named Corona Recovered Warriors. These are the people from all around the world whose family members or they

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themselves have suffered or are suffering from COVID-19 and they have joined hands to help each other with information sharing about recovery process, medical facilities in their areas, medicine availability or plasma donation etc. These people were requested to fill in the questionnaire. 2532 responses were received. 960 respondents are males and remaining are females. Mean age of the participants is 38.5 years.

Operationalization of Variables

Socio economic indicators

Adaptation form (Darin-Mattsson, Fors, and Kåreholt, 2017) was used to measure SEI of socioeconomic indicator. Two variables including family income class and personal income were used to measure SEI. This is a pure subjective index, based on self-assessment of the respondents. Scale from best to worst (1-3) was used in both latent variables.

Overall Covid-19 impact (IES-R)

Adaptation of Weiss and Marmar (1997) IES-R overall impact scale was used to measure overall effect of Covid-19. 0-4 Likert scale response from 0 = Not at all to 4 = extremely was used.

Mental health (DASS-21)

Adapted DASS-21 (Lovibond & Lovibond, 1995) scale was used with 0-4 Likert scale response from 0 = does not apply to me to 4 = mostly applies to me for the past week responses.

Sleep Quality (PSQI)

Sleep loss is a direct effect of increased stress and anxiety (Xiao et al., 2020). Adaptation of Pittsburg Sleep Quality Index (PSQI) (Buysse et al., 1989) was used to measure sleep quality which has four significant items. Each question was scored on 0-3 Likert scale.

Social Capital (PSCI-16)

Adapted PSCI-16 scale (McCallister and Fischer 1978; Van Sonderen et al. 1990) was used with 5 significant items as per CFA. 1-5 Likert scale response. All questions asked the respondent to quantify social capital indicators.

Financial Stress

Financial stress was measured by asking three questions about: current financial crisis, ability to pay bills and monthly finance availability (Lantz, House, Mero, Williams, 2005). For these responses 0 – 1 scoring is used. Deprivation is scored as 1 and none deprivation as 0. For financial crisis inverse scoring is used 1 for facing financial crisis and 0 for not facing financial crisis.

Table 1: Latent variables and items with significant factor loadings

Variables	Items	Factor loadings
SEI	Item 2: Personal income	.97
Social Capital	Item 1: How many friends do you have?	1.00
	Item 3: How do you rate the number of governmental, political, economic, and social groups and organizations in your community?	.99
Mental Health	Item 1: I was aware of dryness of my mouth	.78
	Item 2: I couldn't seem to experience any positive feeling at all	.93

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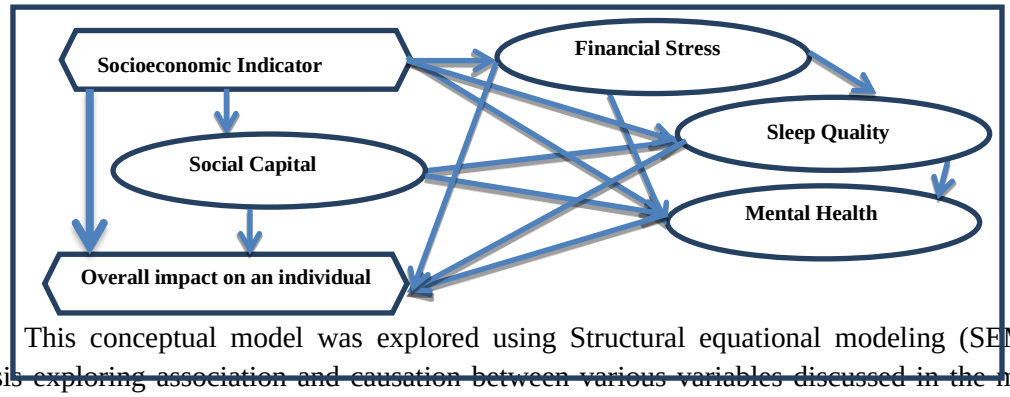
	Item 3: I experienced breathing difficulty (e.g. excessively rapid breathing, breathlessness in the absence of physical exertion)	.73
	Item 4: I felt that I had nothing to look forward to	.90
	Item 5: I felt scared without any good reason	.80
Financial Stress	Item 2: financial crisis	.83
Sleep Quality	Item 1: How often have you had trouble sleeping?	.95
	Item 2: Cannot get to sleep within 30 minutes	1.00
	Item 3: Have bad dreams	.97
Over All Corona Effect (OACE)	Item1: Other things kept making me think about Covid-19.	.68
	Item2: I thought about Covid-19 when I didn't mean to	.64
	Item3: I was jumpy and easily startled	.64
	Item4: I had trouble concentrating	.69
	Item5: I felt watchful or on-guard	.84

Development of conceptual model

Literature explored points out to various linkages weak and strong, direct and indirect between the above described variables. According to the literature and theoretical lenses describing the connectivity of these latent variables to each other and observed variables, following model has been hypothesized. A hypothetical chain is shown in Figure1.

Figure 1: Hypothesized Linkages within different variables.



This conceptual model was explored using Structural equational modeling (SEM). Statistical analysis exploring association and causation between various variables discussed in the model follows. Resultant association diagram generated by SEM is shown in Results section which partially differs from this proposed web of interrelationships.

Statistical analysis

Statistical analysis has been done by Structural equation modeling (SEM). SEM combines Confirmatory factor analysis (CFA), which checks associations between observed indicators, latent variables and latent mediators; and multiple regression analysis where hypotheses were checked. Weighted least squares with robust standard errors (WLSMV) were used to adjust for categorical indicators. That is why for parameters of continuous variables linear regression was used but for categorical variable parameters probit regression was used as per recommendations of (Muthen and Muthen, 2010).

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Results

Demographic summary

Table 2 displays demographic characteristics of 2532 respondents. The population had an average age of 38.5 years and consisted of nearly 62.1% females and 37.9% males. More than half of the respondents belonged to middle aged group. Socioeconomic indicators show that around half of the total sample population belonged to average income class with education around graduation (bachelors). A quarter of the population reported to be unemployed and around 22% were financially stressed.

Table 2: Demographic Summary of Selected Sample.

Characteristic	Demographic distribution Percentage
Gender	
Male	37.9
Female	62.1
Age	
< 25	23.3
25-50	56.9
>50	19.8
Socioeconomic Indicator	
Family income class	
Well-off	31.6
Average	45.7
Not too Well-off	22.7
Education	
Post-graduate (≥Masters)	25.4
Graduate (till bachelors)	60.8
< Graduate	13.8
Employment Status	
Self-employed	28.7
Employed	45.3
Unemployed	26
Personal Income	
Lavish	8.7
Moderate	44.8
Struggling	23.1
Nil	23.4

Correlations

Figure 2 represents CFA results for our hypothesized model. Six manifest variables (education, employment status, bills, wake-up, monthly expenditure and lack of enthusiasm) were removed from the analysis on the basis of CFA results. RMSEA (0.036), CFI (0.991) and TLI (0.988) showed pretty good fit (Lei and Wu, 2007). All latent variable standardized factor loadings were significant (> 0.60) except one (jumps = 0.59). Furthermore, correlations between main model variables show that these variables were interrelated as expected except for sleep quality which did not show any correlation with social capital. The

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associations among the observed constructs were weaker as compared to variables with their respective indicators. **Socioeconomic indicator** (pi) was significantly and positively associated with **social capital** (.65). Other strong associations were between **SEI** and **OACE** (-.54) were observed. Strongest associations were seen between **SEI** and **Financial crisis** (-0.68). S**ocial capital** and **financial crisis** were also significantly associated (-.49). Surprisingly there were negative but negligibly small associations between SEI and Sleep quality and financial crisis and Sleep quality may be due to missing latent variables. Future research may add the other indicators of PSCI scale for more elaborate analysis. Nevertheless the association between sleep quality and mental health and financial stress was positive as per expectation. Associations between mental health and financial crisis plus social capital and OACE were also negative as per expectation. In economic circumstances where both large and small types of business have suffered massively due to lockdowns and boarder sealing, many have faced unforeseen economic shocks. Their dependency on their social support system is inevitable. In this unusual and unprecedented situation of a global pandemic, results of the study show negligible impact of education and employment status on socio-economic status. Strongest associations as per factor loadings in CFA therefore existed between SEI and Financial crisis (-0.68), SEI and social capital (0.65), SEI and OACE (-0.54), social capital and financial crisis (-0.49), financial crisis and OACE (0.40), social capital and OACE (-0.36).

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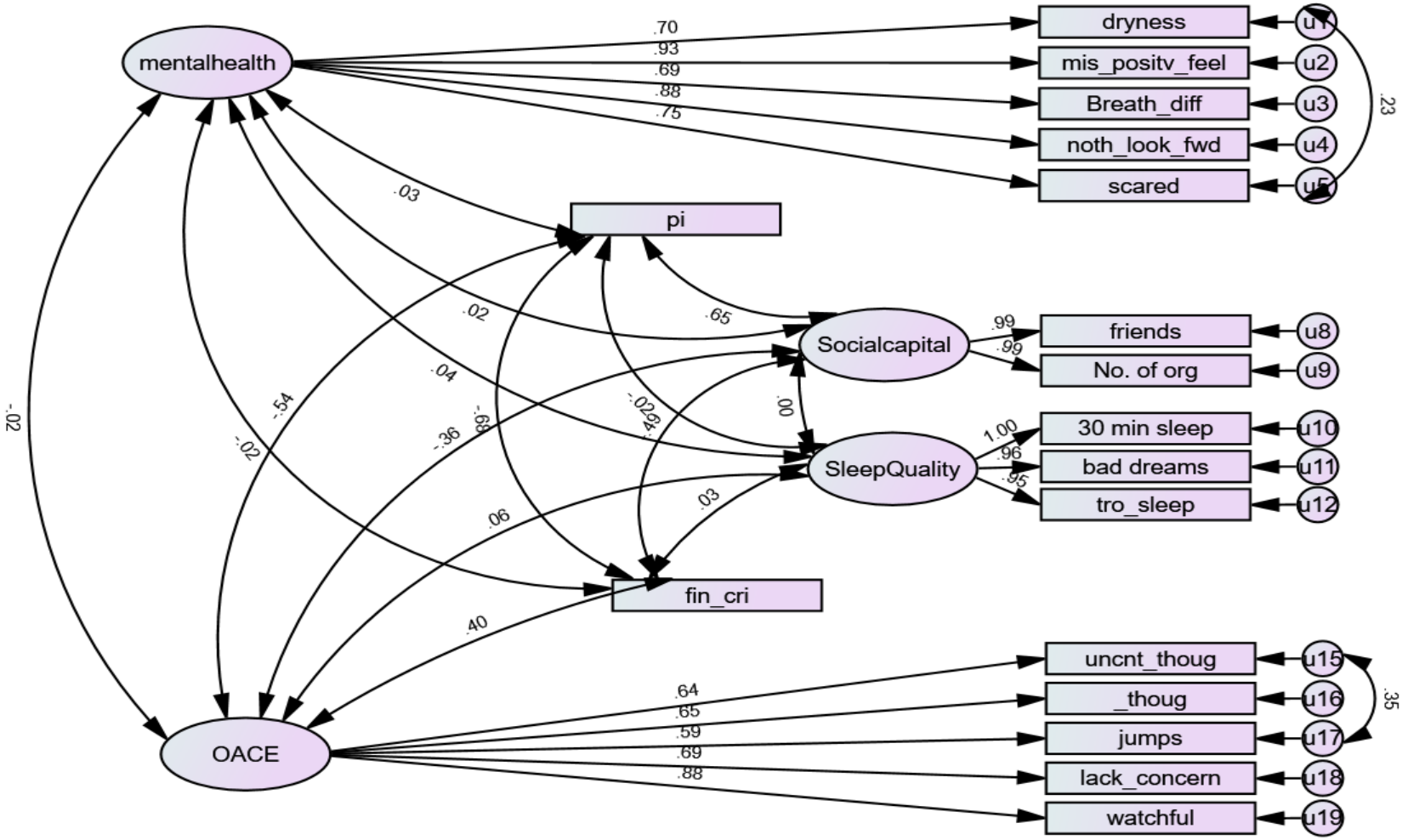
Figure 2: CFA Factor-loadings and Standardized results.



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Results of SEM models

Model fits for all four alternate models are shown in Table 3. There are few variations in good fit acceptance of SEM values but generally for any model to have a good fit RMSEA should be < 0.06 and both CFI and TLI should be > 0.90 (Lei and Wu, 2007). Fourth model with social capital, financial stress, sleep quality and sleep disturbance as mediators was the best fit with RMSEA (0.036), CFI (0.991), and TLI (0.988).

Table 3: Alternate model fits for Socioeconomic Indicators to Overall Covid-19 Impact.

Models	**RMSEA**	**CFI**	**TLI**
Social capital, financial stress	0.065	0.846	0.815
Mental health, financial stress	0.051	0.843	0.813
Social capital, mental health, financial stress	0.049	0.942	0.933
Social capital, mental health, sleep quality, financial stress	0.036	0.991	0.988

In model 4, latent variables as mediators were social capital, financial stress, mental health issues and sleep quality; socioeconomic indicators had a significant impact on over all Covid-19 impact from psychological point of view. Better socioeconomic status was related to lessor financial stress during Covid-19, which was linked with better sleep quality and better mental health, this in turn, reduced the overall impact of Covid-19. Higher financial stress led to low sleep quality and poor mental health (MH). There was no impact of social capital (SC) on sleep quality, which was actually surprising, whereas, social capital decreased financial stress (FC) and improved mental health. Improved mental health resulted in better sleep quality (SQ). Decomposition of this significant impact into direct, indirect and total effects was (-0.33), (0.17) and (-0.16) respectively. This overall effect -0.16 shows that every unit decrease in socioeconomic status leads to 16% increase in OACE faced by an individual. Results very strongly point towards negative overall impacts faced by people of low socioeconomic status during Covid-19 pandemic. Financial Stress and Social Capital proved to be two significant mediators in the analysis.

Table 4: Total, direct and indirect effects from SEI to OACE (3-levels).

	SC, FC, SQ, MH	
Total (SEI to OACE)	**-0.54**	*******
Total Indirect (SEI to OACE)	**-0.04**	*******
Direct (SEI to OACE)	**-0.50**	*******
Specific direct		
SE1 to Social capital	0.58	***
SE1 to financial stress	-0.68	***
SE1 to mental health	0.03	***
SE1 to sleep quality	--------	---------
Social capital to OACE	-0.01	***

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financial stress to OACE	0.05	***
mental health issues to OACE	-0.01	***
sleep quality to OACE	0.06	**
Specific indirect		
SEI to Social capital to OACE	-0.0058	***
SEI to Financial stress to OACE	-0.034	***
SEI to Mental health issues to OACE	-0.0003	***
SEI to Sleep quality to OCAE	--------	--------
SEI to Social capital to Financial stress to OACE	-0.0029	***
SEI to Social capital to Sleep Quality to OACE	-0.0007	**
SEI to Social capital to Mental Health to OACE	0.0002	**
SEI to Financial stress to Mental health to OACE	--------	--------
SEI to Financial stress to Sleep quality to OACE	--------	--------
SEI to Mental Health to Sleep quality to OACE	0.0001	**
SEI to Social capital to Financial stress to Mental health to OACE	--------	--------
SEI to Social capital to Financial stress to Sleep quality to OACE	--------	--------
SEI to Social capital to Mental health to Sleep quality to OACE	0.00004	***

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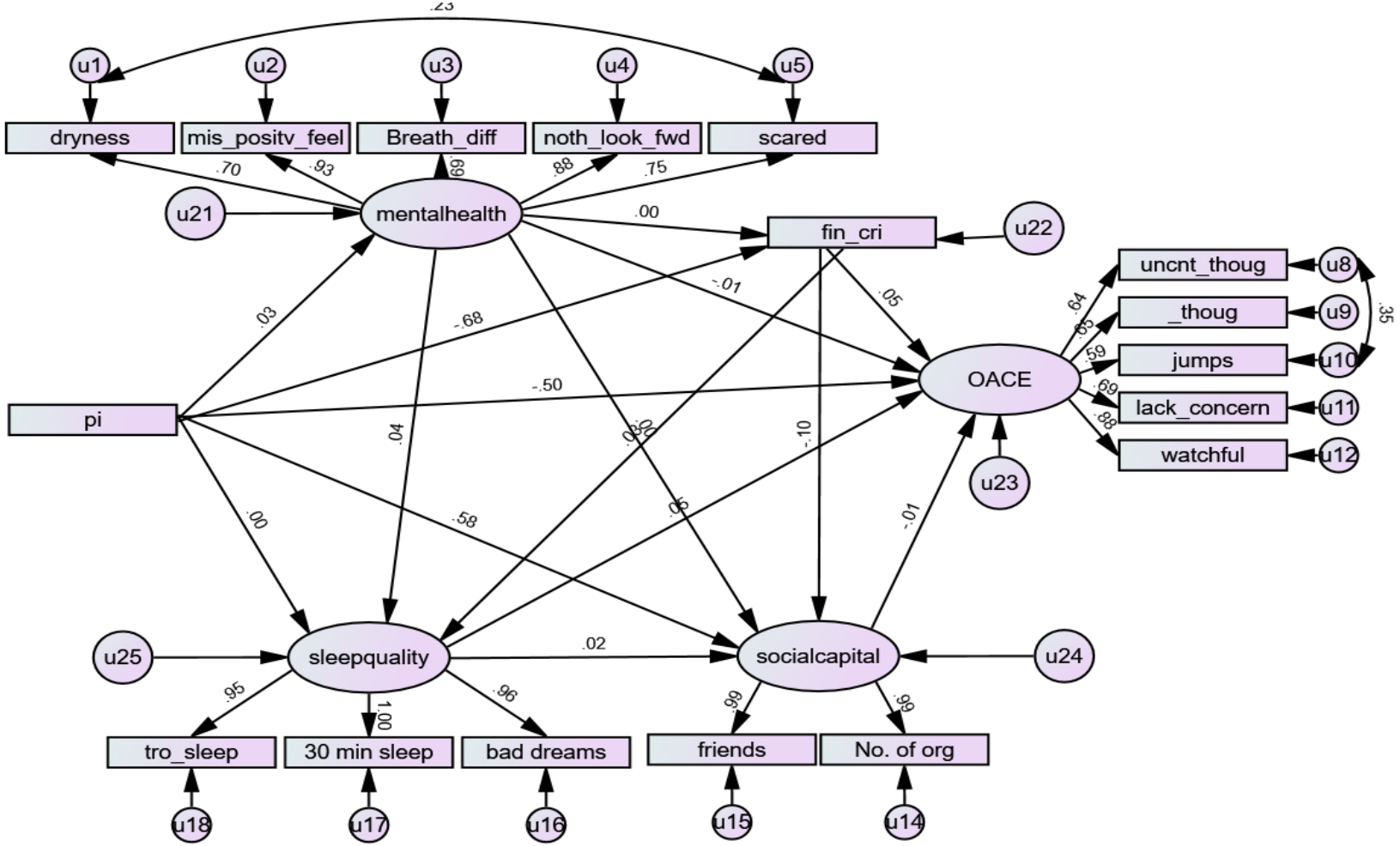
Figure 3: SEM model 4 standardized results-pathways to overall Covid-91 impact (3-levels) via social capital, mental health, financial stress and sleep quality.



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Discussion

Overall impact of Covid-19 was significantly mediated by socioeconomic indicators through sleep quality, financial stress, mental health and social capital. Total direct effect of SEI (pi) was -0.54, which means probability of impact of Corona (IES-R score) increased 54% of SD (standard deviation) for every one SD decrease in socioeconomic indicators. Social capital had no significant impact on mental health and financial status had no significant impact on mental health and sleep quality. However, socioeconomic indicator impacted financial stress, mental health and social capital significantly. And these mediators in turn impacted OACE significantly. All these results highlight the mechanism of action of socioeconomic indicators via mediating variables on controlling the overall impact of Covid-19. Current research was not exhaustive as far as inclusion of mediators is concerned. Future research may add other mediators to enhance the effectiveness of model predictions and understanding. Furthermore data being limited, sample being non-random, study being cross-sectional with no time-effect element and study being subjective and observational limit the outcomes. Therefore future studies may address these limitations for definitive results. Notwithstanding these limitations, current study did an exploratory analysis of multiple hypotheses to check the impact of socioeconomic indicators on overall impact of Covid-19 from psychological aspects via mediators using SEM (Amorim et al. 2010; Vanderweele, 2012). Strengths of this study are the understanding the instruments of socioeconomic indicators and overall Covid-19 effect. Overall impact of Covid-19 was impacted negatively with poor socioeconomic indication, poor mental health, low social capital poor sleep quality and increased financial stress. Three major correlations were seen between socio-economic status, social capital and financial stress. Inverse relationship between socioeconomic status SEI and overall corona effect OACE via social capital and financial crisis shows that already vulnerable groups of the society are at higher risks of negative impacts of Covid-19 lockdowns both from financial and psychological point of views. This enhances the need of vast scale psychological health protocols as well as economic public interventions for the protection of marginalized groups around the globe. Better understanding of the psychological impacts of Covid-19 as a widespread global pandemic will help generate health and psychology protocols which will help general population cope with this international dilemma in far better way. According to a recent HDP report (UNDP, 2020) this global pandemic of Covid-19 has released a mammoth destruction of human development progress so much so that it has taken the world back to 1980's. Death, financial destruction, health deterioration, education stall and many other aspects of Covid-19 makes it an unprecedented multidimensional eradicator of human development. This is no doubt impacting all and sundry, nevertheless, current study shows that socio-economic status and social capital are two insurance against this evil. This means that the part of global population devoid of high socioeconomic status and better social capital are at the mercy of the financial and psychological stressors. Economic and financial recovery is easy after normalcy is attained. History shows that market economies have the tendency to bounce back very quickly, however, poor and marginalized groups need help (Benerjee and Duflo, 2020). Even in normal financial and social conditions socioeconomic indicators via such mediators lead to increased stress and deviant behaviors like (Martinez et al, 2018). Therefore, when it comes to psychological impacts of this pandemic, there is a dire need for vast psychological health recovery protocols to implement. Both psychologists and psychiatrists will have to play their role.

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