

Students Collaboration Objective for Research  
Enhancement (SCORE) through International Partnerships



2020

SCORE

2020 SCORE  
Report: COVID-19

2020

TD Global Student  
Research Team



R&B TD Research Institute

Collaborating countries: Azerbaijan; Brazil; Canada; China; France;  
Georgia; Mexico; Portugal; Puerto Rico; Romania; Russia; Sweden;  
Switzerland; Turkey; Uganda; UK; USA



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## **2020 R&B Research Report: COVID-19**

### *Collaborating Countries*

**Azerbaijan, Brazil**

**Canada, China**

**France, Georgia**

**Mexico, Portugal**

**Romania, Russia**

**Sweden, Switzerland**

**Turkey, Uganda**

**UK, and USA**

*RB Transdisciplinary Research Institutes*

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## **R&B 2020 International Research Report**



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## **Preface**

The present report is the outcome of the research of COVID-19 crisis and its impact around the world. Sixteen collaborating countries participated with their student research team to identify the impact of COVID-19 on their countries such as social, environmental, or economical. It should be noted that the results of this report are mainly from 2020. It is known that the impact of COVID-19 will change over the years and will change the world permanently.

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# PART **1**

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## **R&B TD Research Institute 2020 Distinguished Lecturer**

*Roderick J. Lawrence, Geneva School of Social Sciences (G3S),  
the University of Geneva, Switzerland*

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**A**bout the speaker: Dr. Roderick J. Lawrence graduated from the Faculty of Architecture and Town Planning at the University of Adelaide (Australia) with First Class Honours. He has a Master Degree from the University of Cambridge (England) and a Doctorate of Science from the Ecole Polytechnique Fédérale, Lausanne, (Switzerland). In 1999 he was nominated Professor in the Faculty of Economic and Social Sciences at the University of Geneva. He was promoted to Honorary Professor in October 2015. He was also Honorary Adjunct Professor at the University of Adelaide (2017-2020), and Adjunct Professor at the Institute for Environment and Development (LESTARI) at the National University of Malaysia (UKM) from 2011 to 2019. He was Visiting Professor at the Institute for Global Health at the United Nations University (UNU-IIGH) from 2014 to 2016. He was founding Director of the Certificate for Advanced Studies in Sustainable Development at the University of Geneva from 2003 until 2016, and Director of the Global Environmental Policy Program (GEPP) from 2010 until 2016. Since 2017 he has been Invited Professor at the Swiss Universities Doctoral School on Inter- and Trans-disciplinary Research.

### **Talk title: Complexity of COVID-19: Transdisciplinary Responses**

The propagation of the coronavirus SARS-CoV-2 and the health, economic and social impacts of Covid-19 are complex, emergent and unpredictable. This pandemic should be considered as a societal challenge that is a test for systemic thinking and

concerted actions in the context of uncertainty. Here we describe the virtuous relations between three prerequisite conditions - multilevel governance; knowledge and types of resources; and individual and collective behaviors - that should be combined in transdisciplinary responses by concerted action at local and national levels. Please see Dr Lawrence's presentation slides at: [www.rb-tdinstitute.org](http://www.rb-tdinstitute.org).

### **Key references**

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# PART **2**

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## Intergenerative Transdisciplinarity in “Glocal” Learning and Collaboration

*Peter J. Whitehouse, Kristin Bodiford, Patrik Standar, Arthur Namara Aarali, Sylvia Asiimwe, Vanessa Vegter, Wenyue Xi, and Paloma Torres-Dávila*

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*In this report, authors from North America, Africa, Europe, and Asia share commonalities and differences in the lessons we are learning from COVID-19, especially about scholarship and collaboration. We represent different ages and disciplines hence our focus on intergenerational perspectives and transdisciplinary considerations. Our work is intergenerative—that is going “between to go beyond” by connecting creative sources of culture and focusing on the emergent, that is responding to changes in the context in which we work. And importantly in our view, we will point beyond whatever the next phase of COVID or even the next pandemic brings to a more hopeful, sustainable, and flourishing future, even as we face mounting social, health, and environmental challenges.*

### 2.1 Introduction

Students Collaboration Objective for Research Enhancement (SCORE) through International Partnerships is an innovative transdisciplinary effort to encourage research on COVID-19. In this paper, we intend to both celebrate and expand the intellectual and value space surrounding the SCORE program. Specifically, we wish to highlight the importance of *intergenerative* relationships (across ages, communities, disciplines, art forms, nations, and species) to social change. We will do this by sharing examples of communities of practices that co-create stories and deepen relationships. In this space-time field of possibilities and probabilities, we have the opportunity to imagine new visions of our individual and collective humanity, as well as our connections to the planet, in order to transform our civilization. Intergenerativity, as a concept and practice, can help the emergence of what we call cosmopolitanism with greater attention to social and environmental justice for today and tomorrow. Transdisciplinarity is a concept and methodology that helps us to explore boundaries among human fields of endeavor and hence innovate for social

change.

In this paper we first briefly describe the context of COVID-19 that complicates our responses to the pandemic, share in more detail what we mean by intergenerativity, and illustrate our ideas with examples of on-the-ground projects in individual communities and countries. Our illustrative projects cover four continents and various multi-age learning relationships.

## 2.2 Context

COVID-19 is occurring in the context of other wicked problems like political unrest, economic challenges, social injustice, and climate change, all of which are complexly interlinked. COVID-19 has amplified and made more visible social inequities around the world. It has exposed and exacerbated injustice both within and between countries where health systems struggle to care for people fairly, especially those with conditions that make them more vulnerable. These vulnerabilities include not only chronic diseases but structural conditions that marginalize people like ageism, poverty, or racism (International Monetary Fund 2020) [1]. The United Nations Secretary-General has described inequality as the defining challenge of our era, which the COVID-19 crisis has thrown into even greater relief (United Nations DESA 2020) [2].

COVID-19 is also making it more clear how our health and our planet's health are inextricably intertwined. Scientists remind us that pandemics emerge from our damaging ecological footprint and exploitation of the environment. The impact humans are having on the planet is putting us at greater risk of other future pandemic diseases and threats to the health of the public. Human and animal diseases are intimately linked and exacerbated by ecological change with decreasing both habitat and animal diversity (Kessel 2020) [3].

## 2.3 Intergenerativity

The word intergenerative signifies blending and going *between* many different forms of creativity to design a flourishing *beyond*. Intergenerative community building aims to construct a meaningful fusion of conversations and experiences among often disconnected sources of human creativity (e.g., generations, disciplines, or nations) that inspires new possibilities and innovative actions (George et al., 2011 [4]; Whitehouse and Flippin, 2017 [5]; Whitehouse and Whitehouse, 2020 [6]; Bodiford and Whitehouse, 2020, [7]).

An essential aspect of intergenerativity is the recognition that we need to examine our current use of social constructs particularly in our relationships to relationships between humans and nature. Humans are a part of nature, not separate. Intergenerativity itself is a new (eco)social construct. Human culture is part of our response to the natural environment which includes humans and other living creatures. Finally, part of being intergenerative involves critical thinking about what it means to learn more deeply, including evaluating evidence of all kinds and how we use evidence to take action. Each of the following stories from around the world illustrate attitudes and behaviors of being intergenerative.

There are several resources we like to engage with that help to spark intergenerativity.

- ***Attending to relationships*** - Intergenerativity invites a specific focus on the relational space-in-between. When we place an explicit focus on relationships among humans, other species, and the world around, we are able to value and engage the strength of differences and diversity. As we do so, we magnify relational responsibility – in which we are focusing on and responsible to the process of co-creating meaning we are making in each moment, engaging in deeper listening and attunement, and increasing empathy towards each other.
- ***Embedding in community*** - Community and societal change require new, more comprehensive and inclusive approaches. Intergenerativity is thus embedded in community, based upon values of human dignity and equity.
- ***Thinking intergenerationally*** - Intergenerational approaches engage multiple forms of difference such as age, knowledge, wisdom, experiences, skills, perspectives, and connections that create senses of time that extend generations before and ahead (Indigenous Ideas of Seven Generations).
- ***Expanding global connections*** - Intergenerativity recognizes nation state borders as social, political, and historical constructions and seeks to expand our interconnectedness for collective knowledge production and social action.
- ***Finding the spirit of and in global and local collaboration*** - Seeing work and play together as vitalizing.
- ***Valuing of difference*** - With a focus on this between-space, differences can be seen as a relational resource for transformative potential that helps us create new futures. Diversity in all aspects of nature and culture are celebrated.
- ***Encouraging*** the quest for beauty in nature and in our own aesthetic enterprises as human beings. Seeking beautiful relationships in organizations.
- ***Conceptualizing the involved (eco)systems*** - Intergenerativity highlights the interconnectedness of social and ecological systems. A deeply rooted sense of interconnectedness of human and non-human life is a precondition for ecological flourishing.
- ***Considering deeper ethical issues of relationship to nature and responsibility for the future*** - Intergenerativity invites a relational ethic of responsibility and responsiveness that is value-embedded and recognizes the consequences of actions. Each choice is accompanied by a moral responsibility to not cause harm.
- ***Shifting to a multispecies perspective*** - If our relationships and even our own identities are social and dialogically constituted what does this look like in relationship to non-human life? How do we create opportunities to engage in this relationality with nature?
- ***Recognizing death is a part of life*** -Appreciating our mortality is key to spiritual health.
- ***Creating collective wisdom through experiential learning*** – Deeper learning needed for individual and social transformation.
- ***Learning to create and share new inspiring stories of genuine hope*** – Narrative helps system thinking and integrating values.
- ***Critically examining the need and nature of evidence*** - Considering what counts and combining quantitative and qualitative methods.

## 2.4 Collaborating Countries through Their Students and Advisors

### 2.4.1 Africa - Community-based Responses to Build More Resilient Food Systems *(by Arthur Namara Aarali and Sylvia Asimwe)*

During COVID, group meetings by older persons in Uganda have been disrupted. As a result, loneliness, isolation, and neglect increased. The community reported increased deaths among older persons due to a lack of access to health care services, especially those with non-communicable diseases (NCDs) like diabetes and hypertension. Starvation due to lack of food was also reported. Health Nest Uganda (HENU) is a non-governmental organization whose work is firmly embedded in the community. It has a long history of working intergenerationally and in collaboration with older persons groups. In response to the challenges older persons and their families were experiencing, HENU mobilized different stakeholders locally and globally to respond. They worked collaboratively with Entebbe Hospital and the President's representative in the area to deliver NCD drugs to older persons within their community. In addition, HENU is working with a volunteer from the US to build the electronic data capability so that they do not face the challenge of lack of information in the future and to empower community volunteers who are retired health workers to participate in refills for the drugs.

HENU also combined resources with the Lions Club of Entebbe to purchase basic food staples and soap for the most vulnerable older persons and the grandchildren they are raising. Older persons decided to develop more sustainable solutions to these challenges and have created a project to do intergenerational training in backyard gardening of traditional nutritious foods in order to ensure food security and income generation. Unfortunately, older persons were not able to access loans for their project as they are considered risky borrowers by banks in Uganda. As a result, older persons started their own saving scheme. They contributed their own money to a SACCO (Savings and Credit Cooperative Organization) account. They also raised money from global partners to engage in impact investing, where the community is the steward of investing funds for social impact, with a "heart rate of return", investment return firmly rooted in a philosophy of partnership, relationship, and love.

### 2.4.2 Canada - Post-humanism and Multi-species Collaboration *(by Vanessa Vegter)*

Vanessa Vegter is a doctoral student at the University of Calgary in Canada exploring multispecies entanglements and rural mental well-being. That is, she is interested in the co-constituting (together constitute each other and the world) interspecies relationships that feature in the understandings and practices of mental well-being among rural citizens. For many rural people, animals – and varied ways of relating/orienting to them – meaningfully "co-constitute" daily life (together constitute each other and the world). In counselling psychology and related mental health fields, animals have served as intervention tools to enhance conventional forms of therapy and are typically described in terms of their utility in reducing symptoms of

mental illness or enhancing mental health. Such perspectives on human-animal relationships and mental health are arguably anthropocentric (regard humans as central and most important) and fail to account for the significant and varied human-animal relationships that comprise some rural lives.

The “animal turn” is a scholarly movement, inspired by a posthumanist decentering of the “human” and acknowledgment that all elements (human-nonhuman, living-non-living, material-discursive) are inextricably linked and mutually influential. The animal turn represents a shift in how animals are viewed (i.e., no longer reduced to their utility), but remains an undertheorized area in counselling psychology. If rural people are always already interconnected with animals in their environments, supporting everyday mental well-being in rural communities requires a greater appreciation for these multispecies entanglements.

For Vanessa, shifting to a multi-species frame was prompted by her draw to critical forms of inquiry (and a myriad of contributing scholars)- which raise the questions of who can know and what is knowable. If humans are not the only beings capable of knowing, and thus are not the only subjects or objects of inquiry, then the “tectonic plates of knowledge building” must undergo yet another shift – one that might better account for the complexities of multispecies realities. Vanessa is curious about the possibilities enabled when we shift our view from blinding human exceptionalism to one that recognizes humans and animals as inextricably linked, particularly in a field (counselling psychology) that has been so firmly held by the omnipresent grips of traditional humanism. Some scholars that have prompted her curiosities and informed her approach include Haraway, Barad, Braidotti, Mol, and Tsing, among others. In particular, Vanessa has been inspired by Haraway’s way of querying how critters “render” each other “capable” and what this means in terms of our “response-abilities” (abilities to respond).

### **2.4.3 Puerto Rico - Changing Culture through Art and Play** *(by Paloma Torres-Davila)*

Art has been valued for its aesthetic, economic, cultural, and social attributes, but above all, art is a means by which people, communities, and societies can express their experiences and identities, and therefore better understand and connect with another. Art therapy uses different methods (plastic art, visual art, photography, dance, music) for a person to express their lived experiences in ways that are not daunting and allows them to observe, process, and learn from it. Paloma Torres-Dávila is a community organizer and therapist. In Puerto Rico, she has collaborated with multiple artistic organizations (dance and theatre companies, art teachers, and museums) that have supported communities to express their experiences of hardship, trauma, and thriving through catastrophic Hurricanes Irma and María in 2017. During the earthquakes of early 2020, support brigades built cots for refugees in tents and each person painted their own cot. This allowed for processing of emotions as well as redefining the narrative of something initially seen as a rescue item to their own bed and support. Most recently during COVID, through virtual means, Paloma is facilitating creative writing and story work as a way for people living with cancer and their caregivers to process their experience and fragility in these times, as well as create a support network through the process.

#### 2.4.4 China - Using Data Science to Creating Bridges to the Future (*by Wenyue Xi*)

During the 2020 Google Summer of Code, a project called “Human-in-the-loop Frame Blends Nomination System” unfolded under the auspices of the Red Hen Lab<sup>1</sup> with Mark Turner as the lead mentor on using large multimodal data sets of media programs (like television news programs) to understand how human beings think about the future by blending cognitive frames, for example, using metaphors. Based on Berkeley FrameNet’s frame tagging system, this project explores computational solutions with machine learning algorithms for frame blends identification, especially in conversation about the future. Combined the merits of manual annotation and computational algorithms, this Human-in-the-loop system supports linguists and cognitive scientists to study frame semantics. In this cross-disciplinary study using qualitative and quantitative techniques, attention was also paid in one part of the project about how to use data science in the humanities, and how such blends can contribute to the transformation of both science and the humanities.

This GSoC project could potentially elevate how people use cognitive frames and frame blending to understand the past and think about the future. Making connections through history may provide insights into patterns of potential social change. Taking the COVID pandemic as an example, we can “blend our present condition in facing the COVID-19 virus with the ancient story of what happened to Rome, and how Rome responded, in dealing with the plague” (Red Hen Lab, 2020 [8]). Frame semantics, especially the study of frame blends, can contribute to comparing similar events that have happened and will happen again in the future. The computational approach brings knowledge from a different perspective than those offered by historical narrative accounts alone.

#### 2.4.5 Sweden - A social Democracy in Action (*by Patrik Standar*)

Sweden, as an example, has focused on an open approach to COVID-19. Instead of regulations, Sweden focused on strong recommendations. This approach has been both heavily criticised and praised both inside and outside of Sweden. However, this approach has also been misunderstood. Sweden has a long tradition of social obligation, and Swedes overall trust their government (at least to have the general populations best in mind). The Swedish constitution severely restricts how the government can force their population to act. However, to what extent the constitution really regulates this has been debated. When the Swedish state claims that, they have strong recommendations for the populace, they expect the Swedish people to understand the urgency. There is no space to debate the strengths and weaknesses of this open approach, neither is enough data available yet to say what methods will have been the most efficient. Data is also difficult to compare as different regions and countries have different cultural and political values that are seen as fundamental to their societies.

Whatever method we use to approach wicked problems it all boils down to one important principle, the need for people to change. Not only must we change individual habits but also create real structural change that will in turn require rethinking

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<sup>1</sup><https://www.redhenlab.org/home>

old beliefs and values, this change process is ultimately of learning. Peter Jarvis defines learning as [9]:

*“The combination of processes throughout a lifetime whereby the whole person - body (genetic, physical and biological) and mind (knowledge, skills, attitudes, values, emotions, meaning, beliefs and senses) – experiences social situations, the content of which is then transformed cognitively, emotively, or practically (or through any combination) and integrated into the individual person’s biography resulting in a continually changing (or more experienced) person.” (Jarvis 2009)*

This viewpoint captures not only the intergenerational but the intergenerative.

## 2.5 Conclusion

Intergenerative approaches that allow people of different ages, cultures, ethnicities, nations, disciplines etc. to interact should be seen through the lens of the need for fundamental changes in society. It is an approach that aims to create collaborative learning opportunities for personal and social development. The social aspect here is key, we are never truly alone and we always interact with other beings whatever they are there physically, mentally or just figments of our imaginations. By using and creating spaces for intergenerative practice, it is possible to ask people to challenge their own values and grow in relationships with others. Intergenerational and broader intergenerative approaches create learning spaces where the whole person-based relationships can change. It is about growth, not in an economic but rather spiritual and cultural sense. It is about collective learning and hopefully collective wisdom.

### 2.5.1 A Final Act and Invitation

In this COVID-19 era we have created a digital space using Zoom called InterHub<sup>2</sup> as part of the Presencing Institute GAIA (Global Activation of Intention and Action) project to collaborate across many of the projects mentioned in our article and many others as well. Our aim is to bring people together to discuss how to work and play together to change the world by changing ourselves and our communities. We are pleased to be collaborating with SCORE, the Taos Institute,<sup>3</sup> the International Center for Transdisciplinary Research (CIRET),<sup>4</sup> and others in this dialogic space. Please check us out and join us.

**Author Contributions:** Research team members equally contributed.

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**Conflicts of Interest:** The authors declares no conflict of interest.



<sup>2</sup>InterHub Presencing Institute - Hubs - InterHub - intergenerational and transdisciplinary futuring - <https://www.presencing.org/community/hubs/interhub-intergenerational-and-transdisciplinary-futuring>

<sup>3</sup>The Taos Institute - <https://www.taosinstitute.net/>

<sup>4</sup><http://ciret-transdisciplinarity.org/>

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## About the Authors



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# PART **3**

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## The COVID-19 Crisis and Complexity in the United States

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*The main objective of this research is to present a transdisciplinary research process which identifies the complexity of the issues surrounding COVID-19 using collective intelligence through transdisciplinary collaborative effort. Interpretive Structural Modeling (ISM), a methodology for dealing with complex system design and development has been the key component of this research. Building collective intelligence to understand how factors affecting COVID-19 transmission and fatality and their relationships were investigated. Two different approaches were used to describe the complexity of the COVID-19 issue. (a) the Situation Complexity and (b) Cyclomatic complexity. The results showed that the complexity of the COVID-19 is difficult to understand and handle.*

**Keywords:** Transdisciplinary, COVID-19, complexity of the pandemic, cyclomatic complexity.

### 3.1 Introduction

First identified in Wuhan, China, in December 2019, the coronavirus disease 2019 (COVID-19) pandemic has resulted in over 20.9 million cases and over 350 thousand deaths in the United States (U.S.) as of January 5, 2021. The U.S., one of the biggest superpowers in the world, quickly became the epicenter for the COVID-19 pandemic. Whether people are aware of it or not, the virus has affected almost every part of their lives—many lost their jobs, mental health had been negatively impacted, healthcare workers, specifically, have been put under copious amounts of stress due to the added COVID-19 patients. They also faced many supply shortages, in particular, blood shortages due to social distancing and the public's fear of the virus.

The pandemic caused a significant negative impact on supply chains and disrupted many industries in the U.S. as well as around the world. The oil and gas sector was severely affected by the pandemic. With the sudden drop in demand for oil, largely due to travel restrictions and shutdowns, the oil and gas industry saw some of the biggest losses it has seen in decades. Retail, travel, and tourism were

faced with extraordinary situations that have crippled them. Several small businesses such as accommodations, food service, and educational services are closed because of the changes in customer behaviors, in particular, the physical distancing and mandated operational restrictions – recovery of those businesses may take years or many of them may never reopen [1].

The COVID-19 pandemic is a transdisciplinary societal challenge that requires collective intelligence and coordinated systemic thinking in the context of uncertainty—it is an example of complexity in action.<sup>1,2</sup>

*“Effective responses to the complexity, emergence and uncertainty of coronavirus SARS-CoV-2 and the compound nature of health, economic and social impacts of COVID-19 require understanding and implementing the virtuous relations between disciplinary knowledge and professional know-how, several types of resources, coordinated multi-level governance, and individual and collective behaviors that should be combined in transdisciplinary contributions.”*<sup>2</sup>

**Roderick J. Lawrence, 2020**

Important factors affecting COVID-19 transmission and fatality appear to include: person to person contact, behavioral risk, indirect transmission, underlying health conditions, worldwide traveling, economic dimension, availability of testing, and government regulations.

## 3.2 Method

This section aims to discuss how the aforementioned factors affecting COVID-19 relate and interact with one another using Interpretive Structural Modeling (ISM). ISM is a methodology for handling and decomposing complex problems. Proposed by Warfield in 1973.<sup>3</sup> ISM identifies and reviews relationships among identified parameters. It provides a fundamental understanding of how those parameters are relevant to the complex issue. Thus, it helps researchers to structure complex issues such as COVID-19 in a meaningful way to overcome challenging problems.<sup>4</sup>

### 3.2.1 Context

*Transdisciplinary Collective Intelligence:* ISM methodology implementation against this problem consisted of a group of 32 undergraduate students in senior design class, all pursuing Mechanical Engineering degree at Texas Tech University, one Ph.D. student, and one faculty member. This student research team recognized the significant challenges and related countermeasures of COVID-19. They sought to identify the main factors affecting the issues surrounding COVID-19 and how they were interrelated to improve the rate of success to reduce the transmission and fatality.

<sup>1</sup>Lawrence, J. R. Deciphering interdisciplinary and transdisciplinary contributions. *Transdisciplinary Journal of Engineering & Science*, Vol. 1, pp. 111-116, 2010.

<sup>2</sup>Lawrence, J. R., (2020). Responding to COVID-19: What’s the Problem? *J Urban Health*, The New York Academy of Medicine, <https://doi.org/10.1007/s11524-020-00456-4>.

<sup>3</sup>J. N. Warfield, (1974). Developing Interconnected Matrices in Structural Modeling. *IEEE Transactions on Systems, Man and Cybernetic*, 4(1), pp 51-58.

<sup>4</sup>Ertas A. (2016). Transdisciplinary Trans-Sector Integration in Education: Convergence. *Transdisciplinary Journal of Engineering & Science*, Vol. 7, pp. 55-68.

### 3.2.2 Process

Understanding of COVID-19 is evolving and requires transdisciplinary collaboration among, and within, institutional sectors to manage the complexity and prevention of COVID-19. Partnering must occur between organizations such as health-care organizations, social services, education, government, community-based organizations, and others. For this research purposes, some (limited) evidence-based information were produced from the aforementioned organization by the advisor of the student research team. The student research team developed transdisciplinary collective intelligence using the Interactive Collective Intelligence Management (ICIM) workshop to investigate the issue. (1) The Nominal Group Technique (NGT) was used to develop and clarify a list of main factors affecting the complex issue<sup>5</sup>, (2) ISM process was used to develop:

1. Structural self-interaction matrix
2. Final reachability matrix
3. Digraph
4. MICMAC Analysis

The student research team identified eight factors for how to handle complex issues of COVID-19. The factors were grouped into four levels. Through MICMAC analysis, it was shown how these factors are interrelated and how the results of MICMAC analysis could help to manage the complexity and prevention of COVID-19. (see Figure 1 for Sequence of activities to develop an ISM model).

### 3.2.3 Content

The student research team developed a set of factors hypothesized to be affecting the complexity of COVID-19 showing how the identified factors were related to each other. The ICIM workshop was facilitated by a PhD student, who is familiar with the concept.

### 3.2.4 Identifying Factors

During the first stage of the ICIM workshop, through group brainstorming, potential factors that affect the successful management of the complexity and prevention of COVID-19 were identified. The research team developed twenty four factors affecting the COVID-19.

### 3.2.5 Structuring the Factors

After three organized ICIM workshops, the student research team determined which factors were most important. From the set of twenty four factors, the following subset of eight, namely underlying health conditions, behavioral factors, indirect transmission, worldwide traveling, government regulations, availability of testing, economic dimension, and person to person contact, was structured using the methodology of ISM. Those were the ones receiving the highest scores in voting on the most important main factors.

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<sup>5</sup>Delbecq, A. L.; VandeVen, A. H (1971). A Group Process Model for Problem Identification and Program Planning. *Journal of Applied Behavioral Science*.7, pp. 466–91. doi:10.1177/002188637100700404

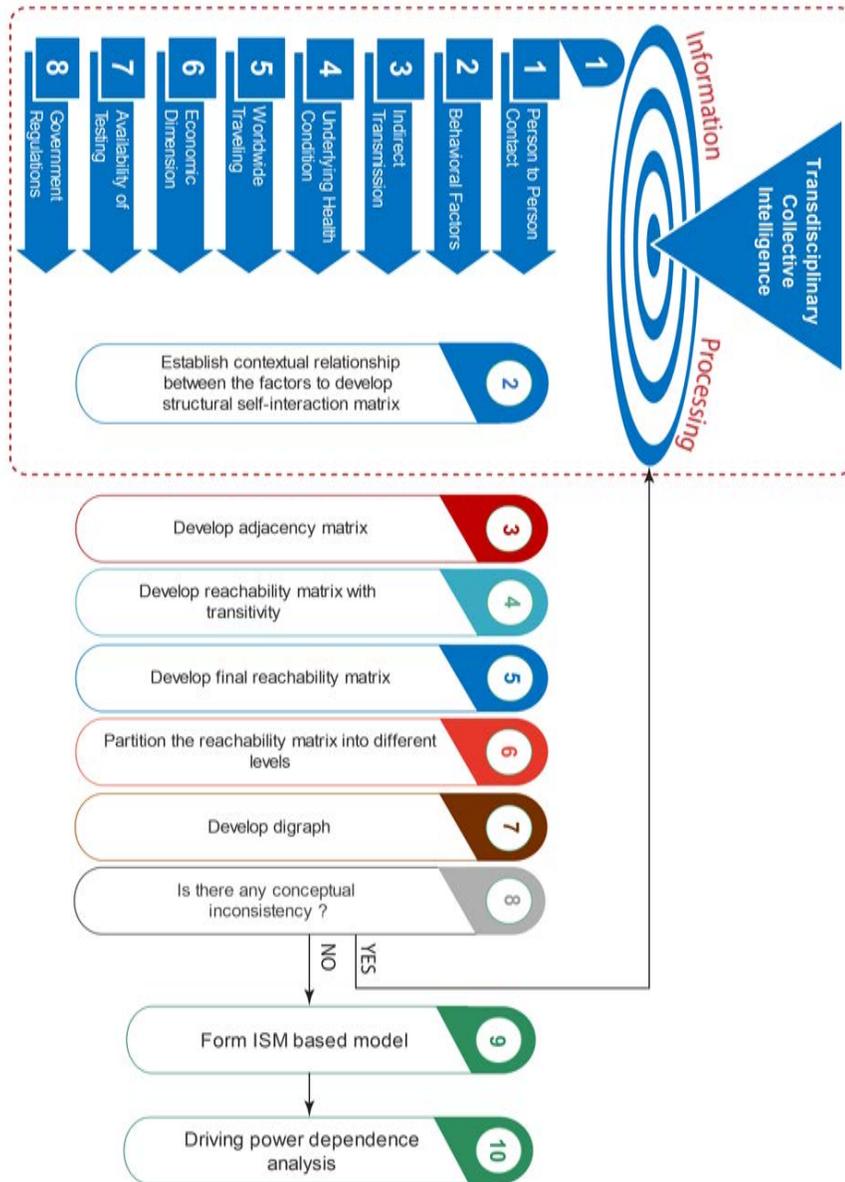


Figure 3.1: Sequence of activities to develop an ISM model.

## 3.3 Important Factors Affecting COVID-19 Transmission and Fatality

### 3.3.1 Underlying Health Conditions

Individuals that have underlying health conditions are the most susceptible to experiencing a significant ailment upon contracting COVID-19. Many conditions can cause an increased risk of severe illness, including coronary artery disease, active cancer, obesity, sickle cell disease, type 1 and type 2 diabetes mellitus, chronic kidney disease, asthma, cystic fibrosis, high blood pressure, and liver disease [2]. A large amount of the world population is at an increased risk of developing harmful and potentially life-threatening symptoms upon contracting COVID-19. According to a study done in 188 countries, it is estimated that approximately 22% of people worldwide have an underlying health condition [3].

Individuals with underlying conditions have been advised to take additional precautionary measures to limit their exposure to others, and likewise, to COVID-19 due to the severity of the symptoms [4]. An example of extra precautionary measures to avoid contracting COVID-19 is strict self-isolation. Though this is recommended for the sake of the physical health and well-being of people in almost every society, some negative ramifications accompany it. Studies have shown that people have felt increasing loneliness since the pandemic began [5,6]. This shows that strict recommendations that are set to help individuals with underlying conditions come with the cost of impacting other areas of an individual's or society's well-being.

Another important factor is the immune response to COVID-19. Each individual's immune system responds differently to the disease. Some people may contract the virus and not realize it, while others may contract it and suffer greatly. Since COVID-19 is a relatively new virus, there are still many unknowns, particularly related to the immune response to the virus. One thing which is known is that patients antibodies against COVID-19 were found in the blood of recovered patients and the antibodies can last up to 7 months.<sup>6 7</sup> Generally, antibodies help to prevent people from getting the same infection, but there is not currently enough data to prove that antibodies protect people from COVID-19.

A case currently being studied is the linkage between plasma gelsolin levels and the COVID-19 mortality rate. Plasma gelsolin is a protein with anti-inflammatory properties, and individuals with lower levels of plasma gelsolin, who suffered from serious cases of pneumonia.<sup>8</sup> Low levels of gelsolin may also correlate to a high mortality rate due to COVID-19, and gelsolin levels are currently being studied in patients to see if there is a relationship between gelsolin and the severity of the disease symptoms.

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<sup>6</sup>[https://www.who.int/docs/default-source/coronaviruse/risk-comms-updates/update-34-immunity-2nd.pdf?sfvrsn=8a488cb6\\_2#:~:text=For%20COVID%2D19%2C,long%20protection%20will%20last.](https://www.who.int/docs/default-source/coronaviruse/risk-comms-updates/update-34-immunity-2nd.pdf?sfvrsn=8a488cb6_2#:~:text=For%20COVID%2D19%2C,long%20protection%20will%20last.)

<sup>7</sup><https://www.cidrap.umn.edu/news-perspective/2020/10/studies-show-long-term-covid-19-immune-response>

<sup>8</sup><https://www.niaid.nih.gov/research/immune-response-covid-19>

### 3.3.2 Behavioral Factors

Behavioral factors like social distancing, wearing masks and avoiding large gatherings prove to be an effective combatant towards transmission. Physical distancing is very effective in preventing transmission. Chu et al. [7] 16 countries and 172 studies. There is a significant decrease in transmission with physical distancing of 1 meter, and risk protection continues to increase with distance. Even greater benefits arise at 2 meters, correlating with six-foot (approximately 1.83 meters) social distancing policies. This was determined through a pooled adjusted odds ratio in which 25,697 individuals were observed. Absolute risk percentage is exponentially decreasing with distance. Within a 95% confidence interval, absolute risk percentage is cut in half at one meter. At two meters the absolute risk is drastically reduced. Although distancing is effective, it is not the only tool in fighting transmission.

Mask use is a key behavioral factor in slowing the spread of the COVID-19. The importance of wearing masks is emphasized [8]. Masks prevent droplet spreading and transmission. In a study of 12,710 samples, proper face covers reduce the risk of respiratory infection by as much as 20%. In addition, public mask usage was given an odds ratio of 0.36 in a 2004 Hong Kong Study [8]. Odds ratio associates outcome with a comparison group. A low ratio indicates a decrease in risk of transmission. Through proper supply and emphasis, masks present a cost-effective reduction in infection.

Large gatherings greatly promote transmission of COVID-19. Transmission at these gatherings is reliant on: size, type of gathering, and the COVID-19 precautions taken [9]. These results suggest the reproduction number, ( $R_o$ ). Reproduction number is a way to estimate how contagious the virus can be in different situations. COVID-19 is unique in the fact that “superspreaders” raise its reproduction number. A high  $R_o$  value represents a greater risk. While one infected individual might refrain entirely from spreading the virus, a “superspreader” could drastically increase the  $R_o$  value. A mathematical model was created that relates the infection rate ( $ri$ ), reproduction number ( $R_o$ ), and the incubation period ( $N$ ). Many gathering events were taken into account, and guests were split into susceptible and infected individuals. Using this mathematical model, very accurate case numbers are estimated. This is a useful prediction tool, and helpful for contract tracing. In general, weddings were estimated at a  $R_o$  value of 5 [9]. This is supported by case studies based in Jordan and Uruguay. Specifically, the 500-guest wedding in Uruguay directly produced 44 cases. This is assumed to be induced by several infected guests entering from Spain. As a whole, Uruguay’s positive cases rose from 4 to 79 in a course of 8 days [10]. Similarly, religious gatherings estimated a  $R_o$  value of 2.5 [9]. Gatherings in South Korea and Malaysia supported this model. In the Malaysian study, approximately 10,500 attendees were present at Tablighi Jamaat. The event occurs in close proximity and involves both hand-holding and the sharing of food. As a result, 620 tested positive for COVID-19 in both Malaysia and surrounding countries, making it the largest transmission center in South-East Asia [11]. Although certain precautions may be taken, it is clear to see the negative impacts of large social gatherings. Maintaining behavioral factors is the most effective defense against COVID-19 until a sustainable vaccine is produced.

### 3.3.3 Indirect Transmission

The SARS-CoV-2 has been shown to still be detectable on non-porous surfaces, including stainless steel, glass, and paper bills, for at least 28 days at ambient temperature and humidity [12]. Low temperature and proper relative humidity are associated with the longer persistence of the virus. Public surfaces that require contact to operate, like door handles or touchscreens, can act as vectors for the virus for days or weeks after initial contact [13]. Simple disinfection procedures can cause no infectious virus to be detected after 5 minutes. Exposure to UVB in sunlight, 290-315 nm, can inactivate the virus on surfaces. Outdoor surfaces that are exposed to the sunlight, such as park benches or uncovered tables, will become relatively virus-free in short periods from Spring to Autumn. Sunlight does not instantaneously inactivate the virus; at least 10 minutes of exposure is needed for inactivation [14]. Transmission via indirect contact with surfaces exposed to the virus must be considered when dealing with the spread of COVID-19.

It has been shown that airborne transmission of SARS-CoV-2 can occur without direct contact with an infected individual. The virus has been detected in the air for at least 30 minutes in enclosed spaces and spaces with poor ventilation [15]. Public transportation, particularly buses and trains, represents elevated risk areas for airborne transmission [16]. The widespread use of face coverings has reduced the risk of indirect airborne transmission.

### 3.3.4 Worldwide Traveling

The global transmission of COVID-19 is associated with international travel and business operations. The SARS-CoV-2's capability to be transmitted across the world is partly why it is such a distressing problem to tackle. The earliest documented cases of the outbreak have been linked to the city of Wuhan in China. However, due to the high infection rate, it has spread to hundreds of countries around the world [17]. There are multiple factors that affect the global transmission of COVID-19 including the health of travelers, the regulations for travel, and indirect transmission.

One of the main factors involved in the global transmission of the COVID-19 virus is travel by people who had been exposed to the virus. The symptoms of COVID-19 usually take 2-14 days to appear, making it difficult to monitor and address early on. Furthermore, many of those infected are asymptomatic, meaning that they do not exhibit the symptoms associated with the virus. This makes it easy for hosts to infect those that they come in contact with. Due to the nature of mass transport, travelers that have contracted SARS-CoV-2 pose a high risk of infecting the people they share a trip with. Mass transport systems such as planes and trains are of particular concern, as passengers are placed in close proximity where the virus may be passed directly through respiratory droplets. The virus may have originated in the city of Wuhan, but quickly spread to Italy and eventually throughout the globe because of air travel by passengers that were already hosts for the virus [17].

Another important factor concerning global transmission is the regulations implemented on international travel. Soon after reports of the outbreak were broadcast, countries began to implement regulations to minimize the spread of the virus internationally. 59 countries have opted to close their border to international travelers, meaning that only citizens and residents may enter the country without the presence of special circumstances [18]. While the immediate response to the pandemic was to ban international travel to and from countries that were identified as centers for the

disease, more regulations were introduced to allow individual countries control over how they planned to address the pandemic. Regulations to minimize the spread now include temperature checks at the airport, required 14-day quarantines upon arrival into some countries, and even COVID-19 test results in some cases [19]. Being able to build and maintain business with multiple countries is essentially important for the survival of many nations, as the global trade and shipping routes enable access to resources that they otherwise would not be able to attain. Limitations on shipments for extended periods can lead to devastating consequences such as the inability to import food and water. Therefore, most countries have opted to continue trading at a slower pace, while adhering to the new regulations being enforced [20].

Lastly, the SARS-CoV-2's ability to be transmitted indirectly also contributes to its global transmission. Indirect transmission with respect to global travel includes touching previously contaminated areas, as well as sharing food or drinks with someone who is contaminated. The virus is resilient enough to survive for 5 days on certain surfaces such as metal or glass, which allows it to be passed on from hosts long after they have departed the contaminated area [21]. While not as common as direct transmission of the virus, airports and businesses have made efforts to clean common use areas multiple times a day to minimize the chances of infection.

Living in modern society allows us to explore foreign countries, enjoy the benefits of international trade and attain an interconnected global economy. However, it also allows the virus to easily spread across the world. To minimize the global spread of COVID-19, government agencies, international businesses, and healthcare experts must be aligned in their mission for a safe method of travel and commerce.

### **3.3.5 Government Regulations**

The first case of COVID-19 was reported in China in November 2019. In March of 2020 the World Health Organization declared COVID-19 as a pandemic. At this point, it forced governments to quickly create regulations and laws for the safety of their citizens. Within the first six months, the spread of COVID-19 reached 188 countries and killed hundreds of thousands of individuals [22]. Due to the rapid spread of COVID-19, different policy responses were used within countries around the world. These policy responses were put in place to limit the spread and assist the burden on health systems [23]. In Asia and Southern Europe, very drastic approaches were implemented, whereas places such as Sweden were found to be less strict and more flexible [23]. Governments must take into consideration how individuals would adjust to the information based on the regulations put in place. It has been shown that individuals respond in a rational approach, by making behavioral adjustments and thinking more carefully about their choices when individuals know all of the health risks. However, a negative drawback of COVID-19 was how little was known about health risks when the first lock-down was announced [23]. These government regulations around the world included policies that dealt with “international travel controls, cancellation of public events, closing of public transportation, closing of schools, closing of workplaces, and restrictions on internal movements...” [23]. All of these policies were used in hopes of limiting physical contact between individuals by avoiding any social interactions. It is important to notice that there were obvious differences in the speed at which different countries to respond to the pandemic [23].

One of the most common government regulations is putting in places quarantines. A quarantine is when there is a separation between individuals who have been

exposed to a contagious disease. This is not to be confused with isolation, which is when there is a separation of individuals who are known to have said disease. Quarantines were seen in China, where whole cities were locked down, in Italy, where restrictions were placed throughout the country, and in the U.S., where thousands of people were placed in quarantines [24]. Quarantines are typically the initial response when new infectious diseases are known. The U.S. government has put in place regulations that include banning entry from non-U.S. nationals traveling from China, Iran, and the majority of Europe and screens passengers that return from any heavily affected countries [24]. The U.S. government policies of the travel ban, quarantines, and social distancing are not going to end the outbreak alone. Other policies that have been put in place are the availability of free testing and the ability to allow individuals to work from home. “For individuals who cannot afford to work from home, there is a Families First Coronavirus Response Act which hopes to provide paid sick leave and unemployment insurance...” [24]. Two examples of the more effective government regulations can be stated as “limiting international travel and closure of non-essential workplaces” [22]. An example of a government regulation that had a smaller impact was closing schools [22]. Government regulations are a key part of decreasing social interactions which helps the spread slow down. The main goal is to flatten the curve and reduce transmission of SARS-CoV-2.

### **3.3.6 Availability of Testing**

Most activities are now subjected to COVID-19 testing. For instance, since November 23, travel to Canary Island is subjected to a negative PCR COVID-19 test result taken within 72 hours of arrival [25]. Testing plays an important role in the prevention of COVID-19 transmission. The isolation of infected individuals contributes to the reduction of the spread of the disease and allows contact tracing for people exposed. It provides knowledge of regional and national rates of infection and influences public health interventions [26]. The results of testing are used to construct mathematical models predicting the trend of the disease and provide insight to decision-makers. Unfortunately, some tests seem to be more sensitive to COVID-19 than others. One dramatic example of the failures of airport screening just played out in China, eight Chinese citizens arrived at Shanghai Pudong International Airport on 27 and 29 February they were screened by “non-contact thermal imaging” after taking chartered cars to Lishui, their hometown, one of the passengers fell ill; she was tested positive for COVID-19, on 1 March. The next day, the remaining seven were tested positive as well. They were the first confirmed cases in Zhejiang province in 1 week [27].

In another example, a COVID-19 patient had a nasopharyngeal/oropharyngeal RT-PCR swab that was negative for COVID-19, but RT-PCR of BAL fluid was positive [28]. In another case, a clinical study of 80 patients from the Jiangsu Province who were ultimately diagnosed with COVID-19. Nine of those 80 patients (11.3%) had two negative RT-PCR nasal or oral swabs before their third swabs came back positive [28].

While the exact sensitivity and specificity of RT-PCR tests for COVID-19 are not fully known, it appears that a positive test is highly suggestive of true COVID-19, but a negative test does not rule out the disease. In the case of COVID-19 symptoms, it is best to assume that patients have the disease even if their test was negative. The push for increased testing in areas that already have widespread COVID-19

may be overstated, as the benefits of large-scale use of a moderate sensitivity test are minimal [28].

In general, a single negative test result may not be informative if the pre-test probability is high. In some cases, someone with a negative test has a 74% chance of having COVID-19; with two negative tests, this risk is still around 47% [26].

A reliable and quicker test seems vital for limiting the spread of COVID-19. The current swab test used in the U.S. and most countries requires a minimum of 24 hours waiting times. During this period, some patients will still go shopping or work, and only then get a positive result, risking the community spread of the virus.

The rapid test allows people to test themselves at home and know the results within minutes. It should be noted that the current at-home test cost around \$150 at Costco, Walmart, LabCorp, and Quest. The obtention of the results requires 24 to 48 hours waiting time [29]. On November 17 FDA authorizes the Lucira Health's "All-In-One" at-home test. The single-use molecular-based kit developed by California Biotechnology is expected to sell for less than 50 dollars and will be available by spring 2021. The result is available in 30 minutes, but the kit requires a prescription.

Ellume test is expected to cost \$30 and only requires a smartphone application to learn the results. Another at-home test authorized is BinaxNow from Abbot Laboratories. It cost \$25 and requires a smartphone app called Navica and guidance from a telehealth company called eMed. Currently, most at-home tests have a reliability of about 90% [30]. The consequence of a widely available at-home test is that some people will lower their guard relying on the result of testing. They might not socially distance or respect safety measures advised by medical communities and local authorities, which will lead to a spike of contagion.

The availability of vaccines should not shadow the importance of testing as, the period of immunity of vaccines, and the long-term impact of COVID-19 on the body are still not fully known. Moreover, countries with fewer resources will not be able to provide vaccines to their citizen at the same pace as developed countries.

### 3.3.7 Economic Dimension

Although the COVID – 19 pandemic emerged as a global health crisis, it swiftly became an economic crisis as well [31]. COVID – 19 impacted primary sectors, which deal with the extraction of raw materials, secondary sectors, that are responsible for production, and tertiary sectors, such as aviation, tourism, and sports [32]. Agricultural businesses were affected because of the reduced labor, decrease in necessary inputs and output prices [33]. Additionally, the demand for oil and oil products decreased by 30% compared to demand in 2019 as a result of the deceleration in production. In the early stages of the pandemic, China stopped all manufacturing operations in order to stop the spread. This action led to scarce supplies of raw materials and spare parts globally [34]. The global efforts to reduce the spread of COVID – 19 led to a drastic decrease in demand for air transportation. The number of commercial flights dropped by 40% and has not yet recovered [35]. It was predicted that the aviation industry might have lost \$314 billion in 2020 due to the pandemic as both national and international travel are major parts of the global economy [36]. Due to the concerns related to the pandemic and travel restrictions, global tourism related revenues, such as export from tourism and tourist spending, was reduced by approximately \$1 trillion [37]. The year of 2020 was an anticipated year for a lot of

athletes as the summer Olympics and European soccer championship were scheduled to take place. Hosting Olympic games requires years long preparation and investment by the hosting country. The International Olympic Committee postponed the event to summer 2021. The economic consequences of the postponement were estimated as \$6 billion for Japan, the hosting country [38]. The Union of European Football Association followed the same approach and decided to postpone the European soccer championship to summer of 2021. Unlike the Olympics, the event would be hosted by 12 different countries. It is estimated that the hosting countries will lose a total of \$327 million [39]. In addition to the financial problems, the delay will result in scheduling issues to national and international soccer competitions.

### 3.3.8 Person to Person Contact

With exponential growth of reported cases of COVID-19 both in the United States and globally, health administrators are focused on reducing the spread. By understanding how the virus is transmitted from one to the other, we can revenue the right steps to slowing the spread. Experts believe COVID-19 spreads mostly from “person to person contact”, also called “direct transmission”. The transmission occurs when an infected person touches or exchanges body fluids with someone else. There are different forms of direct transmissions such as a droplet, respiratory infections, and airborne transmission. The droplet transmission occurs due to the direct contact with a person with respiratory symptoms or indirect contact through surface or objects [40]. It was observed that the virus can survive on plastic and stainless-steel surfaces for up to 72 hours [41]. High-risk contact occurs when a person lives in the same household with a COVID-19 patient [42]. Medium high-risk contact is frequent contact with people who have recently tested positive for COVID-19 such as a friend, coworker, and classmate. Medium risk contact is close contact with a person positive test of the virus but not regularly meet [42]. Low-risk contact is being in the same indoor setting with a person with symptoms [42]. Non-contact is interaction with a person with a virus, for example, walk by the patient [42].

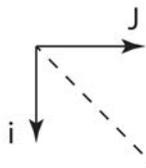
## 3.4 Interpretive Structural Modelling (ISM) Process

### 3.4.1 Development of TD collective intelligence

ISM approach starts with the development of transdisciplinary (TD) collective intelligence which includes identifying main factors affecting the complexity of the issue (Step-1) and the development of the Structural Self-Interaction Matrix (SSIM) (Step-2). This is accomplished by exercising the Interactive Collective Intelligence Management (ICIM) workshop (see Section 2).

### 3.4.2 STEP 2: Structural Self-Interaction Matrix (SSIM)

After providing clear definitions, the SSIM was used to define the relationship between these factors to determine their effects on one another. As seen from Figure 2, four symbols were used inside the matrix (A, V, X, O). A, is entered when the relation is from j to i. V, is entered when the relation is from i to j. X, is entered when



FACTORS	Person to Person Contact	Behavioral	Indirect Transmission	Underlying Health Condition	Worldwide Traveling	Economic Dimension	Availability of Testing	Government Regulations	
FACTORS	#	1	2	3	4	5	6	7	8
Person to Person Contact	1		A	V	V	A	V	A	A
Behavioral	2			V	V	V	O	O	A
Indirect Transmission	3				V	X	O	O	A
Underlying Health Condition	4					V	O	O	O
Worldwide Traveling	5						V	A	A
Economic Dimension	6							O	A
Availability of Testing	7								A
Government Regulations	8								

**Figure 3.2:** Structural Self-Interaction Matrix (SSIM).

the relation is both from  $i$  to  $j$  and  $j$  to  $i$ . O, is entered when there is no relation at all. The identified factors are assumed to be interrelated, rather than independent: some factors may increase the effects of other factors. Using expert opinions along with the student research team, the SSIM was developed.

As shown in Figure 1, the combination of two steps is called *Transdisciplinary Collective Intelligence Development*.<sup>9</sup>

### 3.4.3 STEP 3: Development of Adjacency Matrix

Then the adjacency matrix shown in Figure 3 is developed by transforming SSIM into a binary matrix, by substituting V, A, X, and O by 1 and 0 per the outline

<sup>9</sup>Aldana M. et al., (2019). Just-in-Time Supply Chain Innovation through Additive Manufacturing: A Trans-disciplinary Educational Experience. *Transdisciplinary Journal of Engineering & Science*, ISSN: Vol. 10, pp.199-223.

FACTORS	#	1	2	3	4	5	6	7	8
Person to Person Contact	1	1	0	1	1	0	1	0	0
Behavioral	2	1	1	1	1	1	0	0	0
Indirect Transmission	3	0	0	1	1	1	0	0	0
Underlying Health Condition	4	0	0	0	1	1	0	0	0
Worldwide Traveling	5	1	0	1	0	1	1	0	0
Economic Dimension	6	0	0	0	0	0	1	0	0
Availability of Testing	7	1	0	0	0	1	0	1	0
Government Regulations	8	1	1	1	0	1	1	1	1

Figure 3.3: Adjacency matrix.

FACTORS	#	1	2	3	4	5	6	7	8
Person to Person Contact	1	1	0	1	1	1	1	0	0
Behavioral	2	1	1	1	1	1	1	0	0
Indirect Transmission	3	1	0	1	1	1	1	0	0
Underlying Health Condition	4	1	0	1	1	1	1	0	0
Worldwide Traveling	5	1	0	1	1	1	1	0	0
Economic Dimension	6	0	0	0	0	0	1	0	0
Availability of Testing	7	1	0	1	1	1	1	1	0
Government Regulations	8	1	1	1	1	1	1	1	1

Figure 3.4: Reachability matrix with transitivity.

described below:

- When the (i, j) entry in the SSIM is V, then the (i, j) entry in the reachability matrix becomes 1 and the (j, i) entry becomes 0.
- When the (i, j) entry in the SSIM is A, then the (i, j) entry in the reachability matrix becomes 0 and the (j, i) entry becomes 1.
- when the (i, j) entry in the SSIM is X, then both the (i, j) and (j, i) entries of the reachability matrix become 1.

- when the  $(i, j)$  entry of the SSIM is 0, then both the  $(i, j)$  and  $(j, i)$  entries of the reachability matrix become 0.

In other words, looking only at the upper right triangle, all the Xs and Vs from the input Figure 2 are recorded as 1s, whereas the As and Os of the upper right triangle have transformed to 0s (zeros). On the other hand, the As are 1s and the Vs are 0s on the lower left triangle.

#### 3.4.4 STEP 4: Reachability Matrix with Transitivity

Figure 4 shows the reachability matrix with transitivity. The reachability matrix is tested for the transitivity rule and is updated until transitivity is confirmed. The transitive rule is “if A has a relationship to B and B has a relationship to C, then A has relationship to C”. In other words, the reachability matrix with transitivity takes the information given in the initial reachability matrix and adds more 1s to represent the indirect relationships between terms. Following the transitivity rule, a reachability matrix shown in Figure 4 is developed.

#### 3.4.5 STEP 5: Final Reachability Matrix

As shown in Figure 5, the row labeled “Dependence” contains summations of ones in each of the columns, and the column labeled “Driving Power” contains summations of ones in each of the rows. The summation in the bottom right corner of the matrix contains a summation total of 41. This represents the summation of the Driving Power column and the Dependence row. The summation of the column and row is always equal in any reachability matrix with transitivity. Figure 5 is the final form of the relationships of all the factors involved with the problem under consideration. Calculated driving power and dependence in Figure 5 were used for MICMAC analysis.

#### 3.4.6 STEP 6 Level Partition:

The driving force and dependence obtained from the final reachability matrix will help us to classify the factors into groups. These groups are determined by the separation of the antecedent set and the reachability set which will provide an intersection set – the intersection set includes the common factors in the reachability and the intersection sets. These three sets will help us to identify the levels of the factors. When the factors of the intersection and reachability sets are the same, then that factor will be identified as the top-level group in the ISM hierarchy. Once the top-level factors are identified, they are removed from the set to find the next level. As seen from Tables 1 through 4, this iteration process is repeated until all the levels are identified. These levels will be used to build the digraph.

#### 3.4.7 Formation of Digraph

The digraph is a graphic that shows the direct and indirect relationships between the factors. As shown in Fig. 6, the relationship of sets and binary associations through matrices can now be translated into graphical form by using the theory of digraphs

FACTORS	#	1	2	3	4	5	6	7	8	Driving Power
Person to Person Contact	1	1	0	1	1	1	1	0	0	5
Behavioral	2	1	1	1	1	1	1	0	0	6
Indirect Transmission	3	1	0	1	1	1	1	0	0	5
Underlying Health Condition	4	1	0	1	1	1	1	0	0	5
Worldwide Traveling	5	1	0	1	1	1	1	0	0	5
Economic Dimension	6	0	0	0	0	0	1	0	0	1
Availability of Testing	7	1	0	1	1	1	1	1	0	6
Government Regulations	8	1	1	1	1	1	1	1	1	8
<b>Dependence</b> 		7	2	7	7	7	8	2	1	<b>Σ 41</b>

Figure 3.5: Final reachability matrix.

Table 1: Level 1 (first iteration).

Factors #	Reachability Set	Antecedent Set	Intersection Set	Level
1	1,3,4,5,6	1,2,3,4,5,7,8	1,3,4,5	
2	1,2,3,4,5,6	2,8	2	
3	1,3,4,5,6	1,2,3,4,5,7,8	1,3,4,5	
4	1,3,4,5,6	1,2,3,4,5,7,8	1,3,4,5	
5	1,3,4,5,6	1,2,3,4,5,7,8	1,3,4,5	
6	<b>6</b>	1,2,3,4,5,6,7,8	<b>6</b>	<b>1</b>
7	1,3,4,5,6,7	7,8	7	
8	1,2,3,4,5,6,7,8	8	8	

(directed graphs).<sup>10</sup> If there is a relationship between factors and j has impact on i, the connection between factors will go from j to i digraph.

<sup>10</sup>F. Harary, R. V. Norman and D. Cartwright, Structural Models: An Introduction to the Theory of Directed Graphs, Wiley, New York, 1965.

**Table 2:** Level 2 (second iteration).

Factors #	Reachability Set	Antecedent Set	Intersection Set	Level
1	13,,4,5	1,2,3,4,5,7,8	1,3,4,5	<b>2</b>
2	1,2,3,4,5	2,8	2	
3	1,3,4,5	1,2,3,4,5,7,8	1,3,4,5	<b>2</b>
4	1,3,4,5	1,2,3,4,5,7,8	1,3,4,5	<b>2</b>
5	1,3,4,5	1,2,3,4,5,7,8	1,3,4,5	<b>2</b>
7	1,3,4,5,7	7,8	7	
8	1,2,3,4,5,7,8	8	8	

**Table 3:** Level 3 (third iteration).

Factors #	Reachability Set	Antecedent Set	Intersection Set	Level
2	2	2,8	2	<b>3</b>
7	7	7,8	7	<b>3</b>
8	2,7,8	8	8	

**Table 4:** Level 4 (fourth iteration).

Factors #	Reachability Set	Antecedent Set	Intersection Set	Level
8	8	8	8	<b>4</b>

### 3.4.8 MICMAC Analysis

The MICMAC (cross-impact matrix multiplication applied to classification) analysis is used to identify and examine the driving power and the dependence of the par-

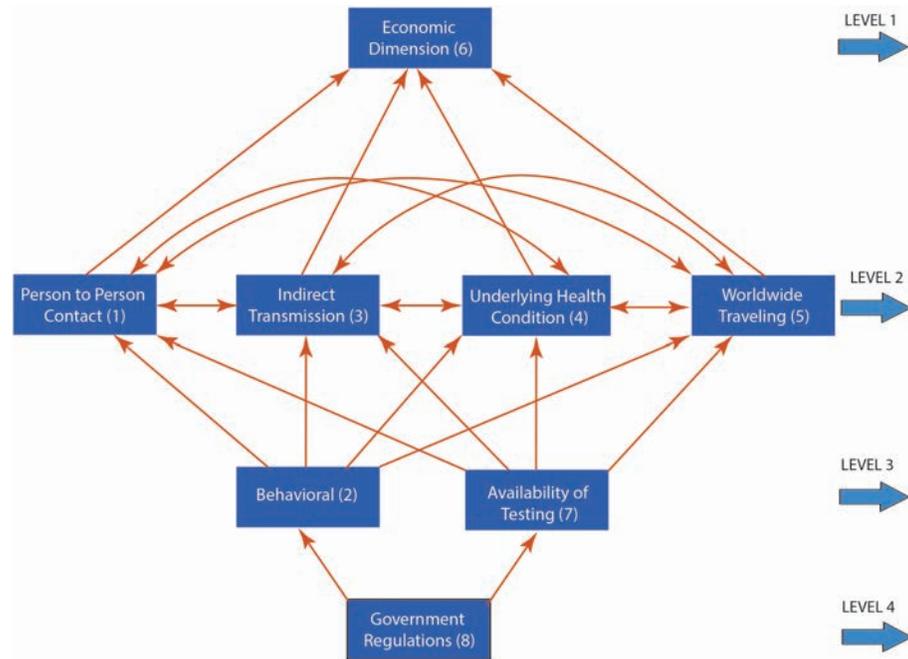


Figure 3.6: Digraph.

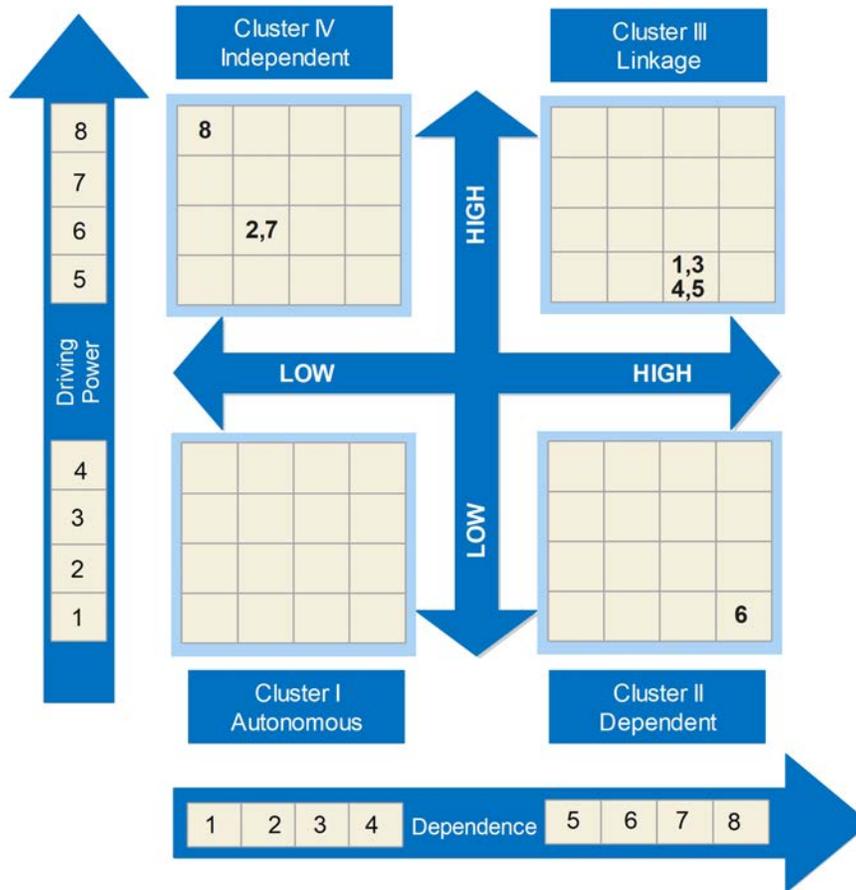
particular issues was developed by Duperrin and Godet in 1973.<sup>11</sup> Factors are arranged through MICMAC analysis with respect to their driving power and dependence in four clusters:<sup>12</sup> (1) autonomous, (2) dependent, (3) linkage, and (4) independent factors. The driving power and dependence of each of the factors are imported from Figure 5. Figure 7 shows the driving power-dependence map for the important factors affecting COVID-19 transmission and fatality.

### 3.5 Discussions

The main objective of this research is to present a TD research process that identifies the complexity of the COVID-19 using collective intelligence through the transdisciplinary collaborative effort. Interpretive Structural Modeling (ISM), a methodology for dealing with complex system design and development, is the key component of this research. Building collective intelligence to understand how factors affecting COVID-19 transmission and fatality and their relationships are an important part of interpretive structural modeling. After removing the transmissivities based on the reachability matrix as explained in the ISM approach, the digraph (Figure 6) is

<sup>11</sup>J. C. Duperrin and M. Godet, *Methodologie De Hierar Chization des Elements D`um System*, Rapport Economique de CEA, 1973, pp.45-51.

<sup>12</sup>A. Mandal and S. G. Deshmukh, *Vendor Selection Using Interpretive Structural Modelling (ISM)*, *International Journal of Operations & Production Management*, 14(6), 1994, pp. 52-59.



*Figure 3.7:* MICMAC Analysis.

obtained and finally, the MICMAC analysis was used to identify and examine the driving power and the dependence of the factors related to the COVID-19 issue.

### **Measuring Situational Complexity**

The Situation Complexity Index (SCI) is combined single metric to compare complexity among a group of problematic situations. It is the product of Miller Index, the Spreadthink Index, and the Demorgan Index and defined as:<sup>13</sup>

<sup>13</sup>Warfield, N. J. Understanding Design Science and its Implementation. First World Conference on Integrated Design & Process Technology, The University of Texas at Austin Texas, 1996.

$$SCI = \left(\frac{N}{7}\right)\left(\frac{V}{5}\right)\left(\frac{K}{10}\right) \tag{3.1}$$

We considered the situation as complex if SCI is over 100.<sup>13</sup> In Equation (1), (N/7) is known as the Miller Index. Miller discovered the famous “magical number seven, plus or minus two”. If the number N is equal to 7, the value of the Miller Index will be 1.0 which can be taken as a reference point. For values less than seven, it is assumed that human being is capable of functioning well.

In Equation (1), (V/5) is identified as the *Spreadthink Index*. which is a measure of the disagreement among the participant group on the relative importance of the N problems they have generated. In the same equation, V is chosen to be the “selected subset”. The NGT voting system accepts each voter to choose confidentially the 5 most important problems as he/she sees significant. If V=5, then the spreadthink index will be equal to 1 – this means that complete consensus achieved. For values greater than 1, Spread Index indicates that the consensus is not achieved – this indicates that complexity is exist.

In Equation (1), the *De Morgan Index* can be obtained from the simple formula K/10. When the De Morgan Index is 1, it shows that the relationships among problem factors of an issue are acceptable and manageable with usual practices. For values exceeding 1, the De Morgan Index shows that complexity is present.

Beside the student research team, several research engineers from different companies and Local government workers were reached out by the faculty member to discuss the issue of COVID-19.

Through collective research effort, more than seventy five problem areas were identified and twenty four factors affecting the COVID-19 were developed. Eight major problem areas (factors) selected and twenty relationships among the main factors were identified (see Figure 6). Table 5 shows the values of the Miller Index, the Spreadthink Index, and De Morgan Index from ICIM workshop carried out in 2020 Fall semester at the Mechanical Engineering Department.

**Table 3.5:** Values of metrics of complexity.

Problems Identified (N)	Problems Selected (V)	Problems Structured	Number of Relationships (K)	Complexity Index (SCI)
75	24	8	20	102.8

$$SCI = \left(\frac{N}{7}\right)\left(\frac{V}{5}\right)\left(\frac{K}{10}\right) = \left(\frac{75}{7}\right)\left(\frac{24}{5}\right)\left(\frac{20}{10}\right) = 102.8 \tag{3.2}$$

Since the value of SCI is larger than 100, it was concluded that COVID-19 issue is complex to handle.

### **Cyclomatic complexity**

The digraph (Figure 6) illustrates the factors affecting COVID-19 transmission and fatality. In particular, at level two, it shows complex interactions among the factors. This complexity can be described using cyclomatic complexity through digraph as:<sup>14</sup>

$$M = E - N + 2p \quad (3.3)$$

where

- $E$  = the number of edges of the graph
- $N$  = the number of nodes of the graph
- $P$  = the number of connected components

The number of edges (depicted as arrows) shown in Figure 6 is 20, the number of nodes (depicted as rectangles) is 8, and the number of connected components, P is equal to 1. Then, the cyclomatic complexity M of the digraph given in Figure 6 is

$$M = 20 - 8 + 2 \times 1 = 14$$

The tolerable upper bound that has been used for cyclomatic complexity is 10.<sup>14</sup> Since the complexity of the COVID-19 through digraph shown in Figure 6 gives a complexity of 14, we can conclude that it is difficult to grasp the complexity of the COVID-19 situation.

As seen from Figure 6, the issue of COVID-19 transmission and fatality consists of multiple levels of combinations and functional behaviors can arise at many of the levels. It is normally difficult in dealing with complex issues such as this one. The complexity of the COVID-19 transmission and fatality is due to the existence of many factors and interactions among them. The existence of interacting factors complicates the solution of the problem which may or may not be explained clearly. However, the understanding of COVID-19 is evolving.

We can think about these eight factors shown in Figure 6 as the performance measures to control the spread of the COVID-19. Since a large number of edges enter and leave the factors in level 2, four main important factors, person to person contact (measure 1), indirect transmission (measure 3), underlying health condition (measure 4), and worldwide traveling (measure 5) shown in Figure 6 are the most critical factors which need to be considered first to control the spread of the virus that causes COVID-19. These four factors not only affect but also are affected by the other factors.

As shown in Figure 7, all performance measures of factors affecting COVID-19 transmission dynamics have been classified into four categories. Cluster I includes autonomous factors. As seen from this figure, they have low driving power and low dependence, hence they can be eliminated from the consideration of COVID-19 spread in the model. For this case, no factor has been identified as an autonomous factor, therefore all these identified factors influence and shape the outcome of COVID-19 spread.

Cluster II includes dependent factors that have low driving power and high dependence. As seen from Figure 7, only the economic dimension (measure 6) is positioned in this cluster. As shown in Figure 6, factor economic dimension is positioned at

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<sup>14</sup>McCabe, T. J. (1976). Describing Cyclomatic Complexity, IEEE Transactions on Software Engineering, Vol. 2, No. 4, p. 308.

the top of the hierarchy – affected by all the other factors. It has very little driving power but very high dependency. In other words, the COVID-19 transmission and fatality due to the existence of many factors and their interactions created disasters and consequently resulted in an economic shutdown.

The factors in the linkage cluster III should be given extreme consideration due to their high driving power and high dependence power. Cluster III includes linkage factors of person-to-person contact (measure 1), indirect transmission (measure 3), underlying health conditions (measure 4), and worldwide traveling (measure 5). These key factors affect and depend on other factors in COVID-19 spread and fatality. The four major factors in this cluster must be carefully managed.

Cluster IV includes the independent factor of behavior (measure 2) and availability of testing (measure 7) with a moderate drive power but very weak dependence. These two factors are controlled and derived by the government (measure 8) which has a strong drive power. This factor (government) is the key driver for the COVID-19 transmission and fatality dynamics.

### 3.6 Conclusion

In conclusion, the complexity of COVID-19 was investigated through Interpretive Structural Modeling (ISM). The student research team developed transdisciplinary collective intelligence using the Interactive Collective Intelligence Management (ICIM) workshop to investigate the issue of the COVID-19. It is important to note that this workshop was repeated three times in three different times. During the iterative Interactive Collective Intelligence Management, research team has generated numerous of scenarios to address the COVID-19 issue—more than 75 different problem areas were identified and discussed. After openly discussing conflicting ideas, heavily dialogue and debate, the research team identified eight main factors out of twenty four affecting the complexity of the issues surrounding COVID-19.

Two different approaches were used to describe the complexity of the COVID-19 issue. (a) the Situation Complexity and (b) Cyclomatic complexity. When analyzing situation complexity of a complex issue of COVID-19 solving in teams, varying perceptions among the team members were noticeable. That is why ICIM was repeated three times. Both approaches revealed that the complexity of the COVID-19 issue is complex and difficult to handle the issue with routine approaches.

The digraph showed that the COVID-19 is a multilevel problem. The economic dimension, which was measure 6, located at the top of the digraph as a result it was determined to be the most dependent factor of the model. On the other hand, government regulations, the measure 8, was found to be the driving factor of the model.

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# PART 4

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## Impact of COVID-19 in Mexico: A vision

**Joel E. Valencia Hernández, Diana M. Sarmiento Páez, Raúl Romero Galindo, David A. Saucedo Alfonso, Edgar O. López de León, Claudia Hernández Aguilar**

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*The current SARS-CoV-2 pandemic is a historical event that has come to change the way of life for humanity; where the population is the main subject of cause and solution. Considering the global variation of propagation, each country has taken different positions, decisions and resources where the time for making different decisions has also been an important factor. In Mexico, the SARS CoV-2 situation has been confronted mainly with government decisions and the actions of the population. The successes or failures have impacted various dimensions of society in each of the states that make up the country. In this research, some impacted life dimensions are analyzed: Social, mental, educational, economic and environmental. It is possible to say that the impact of the pandemic were influenced, among other aspects; by the state of health and nutrition associated with the lifestyle in which the population was at the arrival of the pandemic. This impact is also influenced by commercial activities, which are linked to the economic mobility of those who buy and those who sell. Also, other aspects that have influenced the impact of this pandemic; it is possible to highlight the lack of culture on the part of the population in the use of face masks and the non-obligatory use of it by the leaders. This, added to various other factors, have had a great impact on the number of infected cases and deaths in the country; primarily in Mexico City and the State of Mexico. It is worth mentioning that, despite the negative impact due to the pandemic, there are also positive aspects. Finally, it is possible to say that it is necessary for the population to develop more awareness. The population has a definitive role in containing the pandemic and to incorporate the new changes, in its life in order to precisely preserve*

**Keywords:** Social, mental, educational, economic, environmental, COVID-19.

### 4.1 Introduction

Mexico is in a critical phase (more than 100,000 deaths) of the pandemic due to the SARS-CoV-2 virus (UNAM, 2020; Conacyt, 2020) [1-2], after of the first reported cases of COVID in Mexico City (OMS, 2020a) [3]. The localities with the highest number of accumulated cases and deaths have been Mexico City and State of México

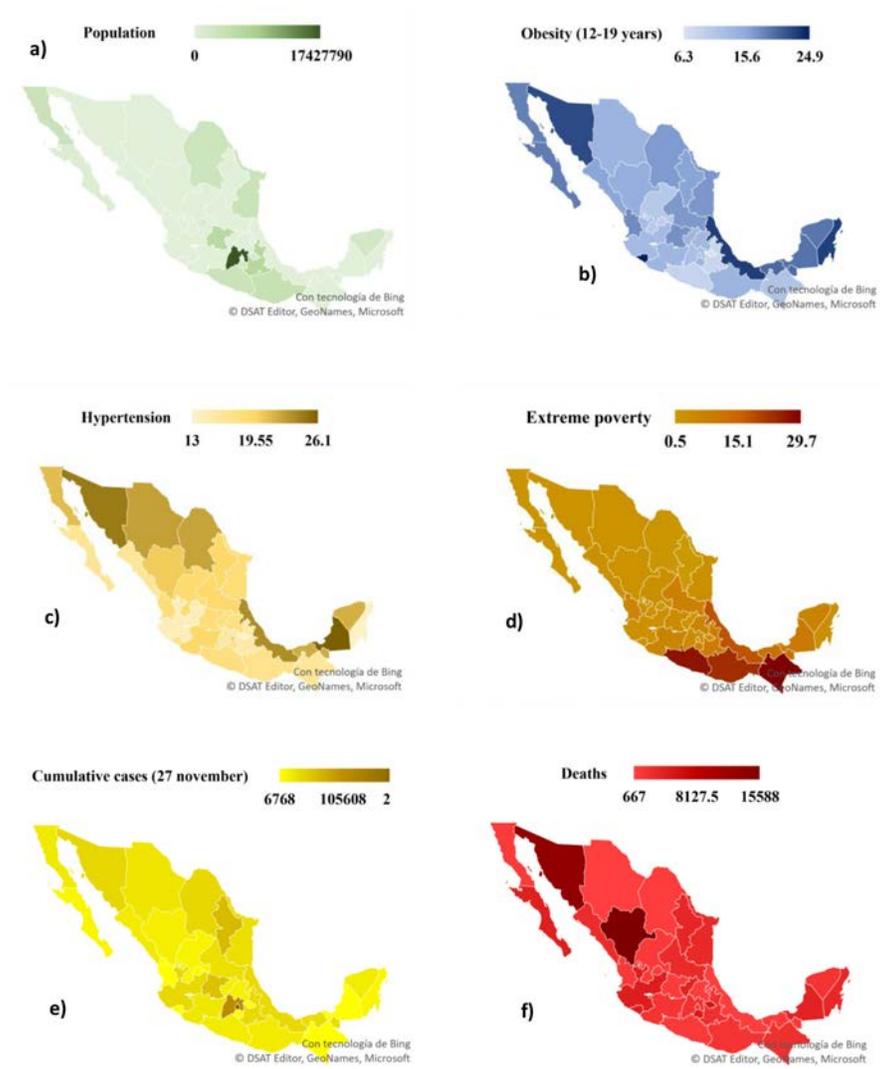
[2]. The Mexican government implemented some health contingency strategies by COVID-19: suspension of financial activities, social distancing, cancellation of massive events, school closings, non-essential shops, and hand washing (Suarez et al., 2020) [4]. In the New Normality (NN) format (orderly, staggered and regionalized return to economic work activities) it was carried out based on an “Epidemiological Traffic Light” (Dimas, 2020) [5]. In addition, due to problem of metabolic syndrome in the population (ENSANUT, 2018) [6], one factor that complications the COVID-19 was applied the modification to the Official Mexican Standard NOM-051-SCFI/SSA1-2010 (food labeling) (DOF, 2020) [7]. Also, extraordinary program “today does not circulate” (Infobae, 2020) [8], etc. has been established.

The measures of “stay at home”, social distancing, use of face mask, and COVID diagnostic tests, as well as follow-up of sick cases, etc. were not mandatory at the beginning of the pandemic. Of this way, the population depending on their educational, economic, cultural, geographical level, age, etc. complied or not the established recommendations. Later some states made it mandatory, at least the use of face masks. Causing, that the pandemic has not been able to contain and thus health sector workers have a strong physical and mental exhaustion and as well as a large number of deaths (Coria-Lorenzo, 2020; Villasís-Keever and García-Bolaños 2020; Martínez-Fierro et al., 2020) [9-11]. In addition, they did not have the most adequate working conditions in general to face the pandemic, including attacks that at some point have also suffered during the pandemic (Caldera-Villalobos et al., 2020) [12].

Mexico facing, a serious complex problem that has caused a series of impacts in different dimensions of social life, economic, educational, health, environmental, cultural, and political dimensions, among others [13-17]. In this context, some of the impacts that the COVID pandemic has brought in Mexico are detailed below. Impact in a country with more than 100 million inhabitants and divided into 32 locations (INEGI, 2020a; WLE, 2020) [18-19]. The amount of population by state, it is possible to observe in Figure 1a.

## 4.2 Social Impact

COVID-19 reached a Mexican population, characterized by a problem of previous chronic diseases such as hypertension, diabetes, obesity, diseases of the respiratory system and cardiovascular diseases, which has caused greater vulnerability and severity to infection [GOB.MX, 2020; Bello-Chavolla et al., 2020; Parra-Bracamonte et al., 2020; Hernandez-Galdamez, 2020] [20-23]. Due to the prevalence of metabolic syndrome, diabetes, obesity and hypertension (ENSANUT, 2018) [6], society is exposed to a greater risk of the COVID-19 disease. Figure 1 b and Figure 1c show a map of the percentage of the population with obesity and hypertension problems (ENSANUT, 2018) [6]. The states with the highest percentage of the population with obesity (ages 12-19 years) are Campeche, Colima, Quintana Roo, Sonora, Tabasco, Veracruz and Yucatán. In relation to hypertension, the states with the highest percentage of hypertensive population are Campeche, Chihuahua, Coahuila, Sonora, Tabasco, Veracruz, Yucatán. Being hypertension the disease that reaches the highest percentage of the population that suffers from it in the country. Of this way, the population faces a greater risk of mortality due to COVID-19, the mortality rate in Mexico has been at the moment 10% (DGEM, 2020) [24]. In addition to the fact that not all the



**Figure 4.1:** Indicator of Mexico a) Population (number of habitants), b) Obesity (% population).

population has a health system within reach, such as indigenous populations (Diaz de Leon-Martinez et al., 2020) [25]. In Mexico there are percentages of the population between 15 - 29% with extreme poverty in the south of the country (Figure 1d). The states of greatest poverty are Guerrero, Oaxaca and Chiapas (CONEVAL, 2019) [26]. Although it is true, they are the states with the greatest poverty, and the least reach to health systems. They are not the ones with the highest number of accumulated cases or deaths (Figure 1e and Figure 1f). In general, COVID-19 due to SARS-CoV-2 is the leading cause of death compared to the previous year (WHO, 2020) [27].

In Mexico, the current positive cases of COVID-19 are associated with comorbidities mainly of hypertension and obesity with 18.53% and 16.67% respectively. And in cases of deaths, 45.56% with hypertension and 38.57% with diabetes, followed by 23.69% with obesity. Which gives a relationship that 2 out of 10 deaths from COVID-19 suffered from obesity, 4 out of 10 had hypertension and 3 out of 10 had diabetes. This information should highlight the importance of the process of taking care of health and of eating a healthy and healthy diet. In times of COVID-19 and in the future, as preventive health stages. In this way, the Government of Mexico decided to incorporate nutrition subjects at the basic level (GOB.MEX, 2020) [28]. Since the need to re-educate the population is evident, likewise, the development of nutritious and low-carbohydrate basic products is important.

The COVID-19 pandemic has caused emotional disorders that led to eating disorders, one of them is the increase in cravings for junk food and / or sweets that is directly related to weight gain. According to the UVM Public Opinion Center (2020) [29], 30% of those surveyed indicate that they eat much more than before the pandemic where are 24% women, and 16% men. This is reflected in people's weight gain, as 47% of people reported that they gained weight. However, other sectors of the population have been concerned with maintaining or creating healthier habits, where 35% of those surveyed indicate that their healthy habits are the same as before, and 32% that they are healthier than before and the 17% of the population underweight.

Food security (access to food) in households was also affected by the pandemic. It has been identified that only 35.9% of the CDMX households had food security, but the most affected population is households with minors where they only obtained 26% of food security, where severe food insecurity affects 18.8% and the moderate to 22.4% of households with a lower socio-economic level. In contrast, these indicators are only 2.2% and 6.1%, respectively, among households with a higher socioeconomic level (UNICEF, EQUIDE and EVALÚA CDMX, 2020) [30]. However, the purchase decision is also important about the foods that poor families can buy, where it is based on more carbohydrates than protein.

For the care of the population, in the case of Mexico City, the government enabled the COVID-19 detection and diagnosis service. According to survey ENCOVID-CDMX (2020) [30] the 7.3% of the households surveyed there was at least one person with symptoms associated with COVID-19, where only about half of these cases were contacted by detection and diagnosis services authorized by the Government of Mexico City (Locatel, SMS and others).

### 4.3 Mental Impact

The majority of society lives in a context of uncertainty due to the current situation, affecting their human behavior individually and collectively. This uncertainty, produced by the pandemic itself, is also increased by government decisions, the media (negative news value), false information from social networks, social norms, social and cultural inequality, political preferences, access to scientific information, etc. (Van Bavel et al., 2020) [31]. The response of the population to this is manifested in emotional responses (fear, anxiety and anguish), changes in behavior, beliefs and knowledge, individualistic behaviors, social and individual psychological aspects (González Martín, N. and áceres Nieto, E., 2020) [32] or defensive responses: skepticism, optimism and indifference bias, "reckless behavior" derived from denial or rejection of the situation, among others (Acuna-Zegarra, M. et al., 2020) [33]. Other problems related to mental health are disorders derived from the fear of contracting COVID-19.

The Covid-19 pandemic caused an unprecedented mental health crisis throughout the American Continent, with half of adults stressed (Del Valle, and Juárez, 2018; EL UNIVERSAL, 2020) [34-35]. In Mexico, according to Villavicencio-Ayub (2020) [36] before the pandemic, 25% of the workers presented some mental disorder such as depression, although not all required psychiatric treatment. Due to the pandemic and work at home, among other causes, it is estimated that stress affects 43% of the working population in Mexico.

Contreras-Ibañez (2020) [37] indicated that the general average of the global stress index of a mexican sample is 2.71, observing that it has a moderate degree of stress compared to the rest of the world. It was found a negative correlation between stress and age. Young people around 20 years of age presented greater stress than adults over 65 years old. It also indicated that women presented more physical or emotional tension than men. Other factors include the multiple tasks they must do, as well as childcare during the pandemic. It is considered that 6 out of 10 mothers were in charge of guiding their children in their classes and schoolwork [37]. The stress also occurred due to falling ill with COVID-19

The population of Mexico City (the population most affected by the pandemic), according to statistical data indicated different levels of concern about COVID; 65.8% high, 24.6% medium and 9.6% low concern. Regarding to use of face masks, 83.4% of Mexicans and 89.1% of the surveyed capitalists make correct use of the mask (Centro de Opinión pública UVM, 2020) [29] only in some places. There are delegations and communities where they do not finish adjusting to the use of face masks to be co-responsible for their health and that of others. In fact, as a result of "good end" there was a drastic increase in cases of infected. However, there are still people who do not use the masks, much less stay at home. Being an alarming situation, for Mexico City and the State of Mexico.

Another emotional impact that the population affected by COVID-19 in Mexico has experienced is coping with and recovering from grief in times of pandemic. The critical situation of not being able to perform rituals for the family that dies from COVID-19 or other causes. Nor has accompanying the disease perhaps caused a longer time of mourning (Arlanzón E., 2020) [38]. This can also generate feelings of anger and resentment in some people and / or family members who have lost a loved one to COVID-19 causes. On the other hand, there are people who, due to this pandemic, have learned to value more life and time shared with their families,

for which they are grateful and enjoy the treasures that God gives us, which is life, health, love of family and friends, and have allowed themselves to increase and grow spiritually and draw closer to the presence of God, filling them with peace and faith to cope with the times of COVID-19.

Reflection, rediscovery of the common good, human solidarity, philosophy of life (Velázquez, 2020), [39], adaptation, optimization of resources, reeducation and hygiene habits (Nielsen, 2020) [40], were positive aspects developed by some fraction of the population in the face of this pandemic. In social security, there has been a reduction in crimes such as kidnappings, extortion and theft and robbery of vehicles (ONC, 2020; Arciniegas, 2020; Balmori de la Miyar, et al., 2020) [41-43]. All these aspects modify the life of the country's society in the different states. The economic, educational and social differences in the face of this pandemic are highlighted.

## 4.4 Educational Impact

Mexico has suspended face-to-face classes at the national level in order to reduce the chains of contagion, this fact is supported by the experience of previous pandemics, which would help reduce it by 15% (OECD, 2020) [44]. For this reason, the government, in addition to translating educational materials into different dialects to make them reach indigenous communities, has implemented strategic models for distance education (Mérida and Acuña, 2020) [45] through television programs, telephone service, radio and platforms. Therefore, the Mexican government seeks to meet the demand of approximately 36 million students (OECD, 2020) [44].

The health emergency has highlighted the educational inequality that exists in Mexico (Lloyd, 2020) [46], generating ethical questions regarding the equity of the implemented model since in Mexico 48.8% of the population is in a state of poverty (CONEVAL, 2019) [47].

On the other hand, in Mexico there are 72 indigenous languages (INEGI, 2015) [48] of which, about a million people do not speak Spanish (INEE, 2018) [49]. In addition, the high cost of mobile devices such as computers and cell phones complicate the education situation, also students are forced to hire an internet service [50]. Likewise, it is estimated that 56.4% of the population has internet, and 43% of the population uses a computer. However, only 76.6% of the urban population and 47.7% of the rural population have access to the internet (IFT, 2020) [51]. It is clear that access to Information and Communication Technologies (ICT), is not equitable and affects students of any educational level; due to the social class condition that determines who can access and learn from online education (INEGI, 2018) [52]. There is a digital divide as a consequence of economic inequality (Winters, N, et al., 2020) [53].

Other interesting aspects that occurred in the educational dimension is that there was an increase in the time dedicated to carrying out educational tasks. Also, there was greater communication with teachers and companionship, increased family coexistence, etc. (MEJOREDUC, 2020) [54], depending on the school level.

## 4.5 Economic Impact

Another important impact derived from the pandemic in Mexico is seriously in the economic dimension. On March 30, the "agreement declaring a health emergency

due to illness caused by the SARS-CoV2 virus (COVID-19)” was published, through which essential and non-essential activities in the economy are defined. In this way non-essential activities had to be stopped during the quarantine. But this provision was not strict as in other parts of the world (OIT, 2020) [55]. However, anyway, there was a decline in the national economy. As in the world, in Mexico the industrial sector is affected, such as manufacturing, accommodation, restaurants, and the street trade, etc. As well as various events that finally had to be canceled were affected (Shrestha et al., 2020) [56].

Many of the activities were temporarily closed, the workforce was unable to find work, which impacted 12 million economically active people. The pandemic also affected informal employment, having a contraction of 8 percentage points that is, it fell from 55.7% to 47.7%, however, this later had some small recovery, but currently due to a drastic increase in cases, again economic activities is in danger; there are festivities and events that are canceled (OIT, 2020) [55].

The commercial opening is one of the most complicated decisions in the country since it has to do with the possible mobility of the population. Having consequences, such as the increase in cases infected by COVID-19. In recent times, this has happened after the commercial activity intensified by the period of “Buen Fin” (November, 9-20) and by purchases at the end of the year. Although it is true, sales intensified, but also, the mobility of the population.

The indicator of Gross Domestic Product (GDP) decreased 17.1% in real terms during the second quarter of 2020 compared to the immediately previous quarter (INEGI, 2020b) [57]. In addition, the loss of 1,117,584 formal jobs from March to July 2020, most of which were permanent jobs (IMSS, 2020) [58]. In August, 92,390 formal jobs were recovered. However, this has implied that more formal jobs have been destroyed in five months than those created in 2019, this means that the reactivation and recovery of formal jobs will not be rapid (OIT, 2020) [55]. Likewise, the closure of 1 million 10 thousand 857 establishments (20.81%) closed their doors permanently, being the small and medium with the highest percentage of permanent closings (21.17%) compared to the micro establishments that had 20.80 percent closings.

Regarding the population and depending on their economy, some of them were able to acquire purchasing habits using online shopping applications, grocery delivery and restaurants (Survey, 2020) [59]. Worth mentioning that much of the population. They do not even imagine what to buy because they have gone through unemployment crisis inside their homes and they barely have to eat. Of this way, in Mexico, social programs with economic support were implemented, in CDMX 45.8% of the people interviewed in the ENCOVID-CDMX [30] reported that at least one person in their household received some support, and priority was given to households with fewer resources and/or with child population.

## 4.6 Environmental Impact

During the pandemic, vehicular activity decreased and many people stayed at home and as a consequence the concentration of emissions decreased in several states; especially in the metropolitan area, where there was an improvement in air quality in Mexico City during the first weeks after the quarantine, finding reductions in concentrations of  $\text{NO}^2$ ,  $\text{SO}^2$ , and  $\text{PM}_{2.5}$  (although later the situation tends to reverse)

(ECLAC, 2020) [60]. In Mexico City, there was a 2% reduction in pollutants compared to the week before the quarantine (Rodríguez-Urrego and Rodríguez-Urrego, 2020) [61]. In particular, ozone indicators decreased during the blockade period compared to the pre-blockade period and compared with the historical average of the same interval of the last 5 years. (Kutralam-Muniasamy, et al., 2020) [62]. Although the satellite images show the same concentration of ozone with that of the previous year, it is found that ozone precursors did decrease (during March-May 2020) (Peralta, et al., 2020) [63].

Others environmental aspects were also impacted, there was a reduction in the use of plastics during the confinement (Mora, 2020) [64] and on some beaches in Mexico they look cleaner and clearer (Zambrano-Monserrate et al., 2020) [65]. On the other hand, in relation to the increase in garbage generated by the use of protective elements, such as face masks, which has produced another subsequent contamination.

According to the above described, in a synthesized way, Figure 2 presents a rich vision of the impacts on the different dimensions of life in Mexico. It is presented according to the perception of fellow students and evidence reported in the literature. It can be seen that there are positive and negative impacts. Because although it is true it has been a tragedy, there are also positive aspects in this situation that are worth rescuing and it is possible to observe in Figure. As mentioned, there are positive aspects related to the environment, the opportunity to spend more time with the family, etc.

Finally, it is interesting to observe the behavior of some indicators of the country, such as Cumulative cases (November 27), Deaths, Population, Homes with internet, Occupation in commerce, Diabetes > 20, Hypertensive>20, Obesity (12-19), Poverty (%) (2018), Education, Tobacco consumption (10-19), Alcohol consumption (> 20), etc.

Through a principal components analysis, the relationships between the vectors representing each of the mentioned variables are observed (Figure 3). In this representation, the vectors with the smallest angle formed between them are the ones that are most correlated. Then, it is observed how the vector that represents the variable of accumulated cases of infected by COVID-19 and number of deaths by state, correlate more with the amount of population with occupation in trade that has to do with the mobility of people and by the other hand, with the educational level and the size of the state's population. In this way, one could think about the importance of stopping economic activity to reduce the cases that are currently occurring in Mexico, mainly in Mexico City, since the most correlated cases are infected by covid-19 and deaths is this indicator. According to those that are being considered in this research work. Another important factor is the educational level of the people, which could be related to their discipline to adjust to the regulations of the new normal, their type of employment, perhaps they had the opportunity to work from home and then they are less likely to be infected and possibly die. Of course, not counting that people in the health sector are the most damaged and the one with the highest number of deaths.



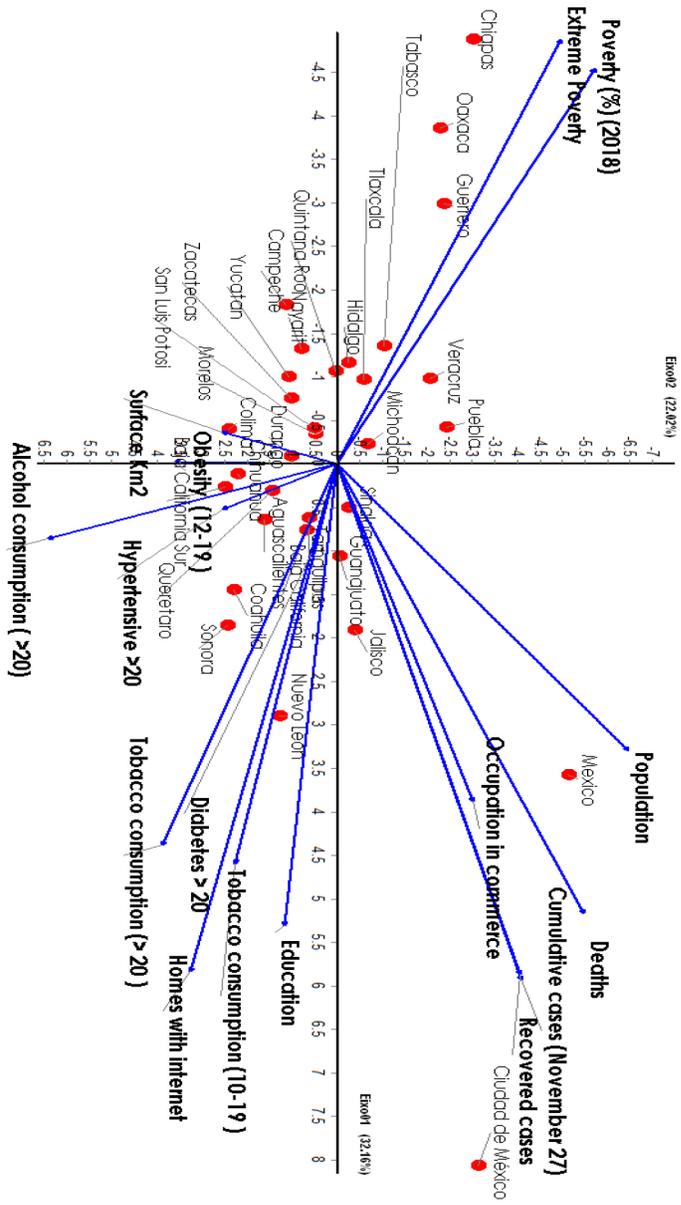


Figure 4.3: Impacts of Sars-Cov 2 in Mexico. according to UNAM, CONACYT, ENSANUT, etc. [1, 6, 18, 19, 47, 48].

## 4.7 Conclusion

The facts alert society to adapt to a new world, new habits, customs, thoughts.

There is the importance of looking inward and outward. This means being co-responsible for the other and the other (neighbor) and environment and also being responsible for oneself. So, constantly reprogram yourself, learn to develop more resilience, grow spiritually and also nutritionally stronger.

An unprecedented fact that teaches and transforms.-A fact that impacted life, and changed all its dimensions. Where a perspective from 50 years ago: *transdisciplinarity*.

Today it could support the formation of current and future students, where self-knowledge is greatly rescued, which will be a current and future support for all students. Know yourself.

*“When I was a young man, I wanted to change the world.*

*I found it was difficult to change the world, so I tried to change my nation.*

*When I found I couldn’t change the nation, I began to focus on my town. I couldn’t change the town and as an older man, I tried to change my family.*

*Now, as an old man, I realize the only thing I can change is myself, and suddenly I realize that if long ago I had changed myself, I could have made an impact on my family. My family and I could have made an impact on our town. Their impact could have changed the nation and I could indeed have changed the world.”*

Unknown monk, c. 12th century [66]

We believe that there is still time to stop the most serious impacts of this pandemic. Hernandez and Dominguez (2020) [67] mention, act as if you and me, and all had COVID-19, because many of us could be atypical and then infect. In this way, in countries where insufficient tests are carried out, such as Mexico (which has recently been promoted in Mexico City), it could help to contain the pandemic. The population of Mexico City should be aware and there should be leaders who guide the best path and attitudes of all to achieve survival.

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# PART **5**

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## **The impact of the COVID-19 lockdown rules on the socio-psychological condition of the people over 65 in Azerbaijan**

*Lala Huseynova and Paul Gibbs*

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### **Short Letter**

The new coronavirus (Covid-19) epidemic, was first detected in Azerbaijan in February 2020. This epidemic, in addition to the impact on human health, has had a negative impact across the country for the economy, tourism, social relations and the conditions necessary for human life. International reports show that the group most at risk of the pandemic is the older population. The coronavirus pandemic has disproportionately affected this group, both in terms of hospitalizations and deaths, but also by the consequences of restrictions on social contact resulting in physical de-conditioning and worsened mental health (Briguglio, 2020 [1]) which caused them to be more vulnerable to the other socio-cultural and economic factors.

I contend that the global research response to the COVID-19 pandemic has not been focused on the general needs of older people; rather research has focused on treatment more than prevention or rehabilitation, on hospital care rather than community care, on counting deaths rather than measuring function and on younger people rather than older people (Fraser, 2020 [2], Lithander, 2020 [3]). The consequences of the pandemic not only affect the health of the elderly, but also their psychological, physiological and social status. Thus, isolationist speeches against them, such as self-loathing, death phobia, loss of contact with peers, make life difficult for them. They thought that if they contracted the virus, their lives would end, their beliefs about overcoming the disease would weaken, and their failure to continue their social life as usual would lead to depression. Indeed, recently Soto-Perez-de-Celis (2020 [4]) has claimed that there are negative social media messages about COVID-19 and aging, often characterizing older adults as helpless and expend-

able individuals. Kluge (2020 [5]), WHO Regional Director for Europe, addressing journalists at a virtual press briefing said “I am reminding governments and authorities that all communities must be supported to deliver interventions to ensure older people have what they need. All older people should be treated with respect and dignity during these times. Remember, we leave no one behind”.

**Azerbaijan:** Azerbaijan has enacted very restrictive for the whole urban population and the list of quarantine rules that apply specifically to people over 65 include the following:

- People over the age of 65 should not be allowed to leave their homes. To provide social services to this category of single people in accordance with the legislation.
- Prohibit access to vehicles without medical masks, catering facilities, shopping centers.
- Restrict labor activities during the quarantine period for the health of the elderly.

When dealing with pandemic-related problems, people over the age of 65 should be aware of the challenges posed by physical and social distance. In the first place, during the pandemic, in addition to the COVID-19 virus, the elderly should be interested in other necessary needs and problems. This is one of the steps to be taken to regulate the psychological state of the elderly during the period of isolation. When an elderly person stays in an isolated home, they may not take sufficient care about their diet or the level of fluids they need to drink, which might aggravate underlying health problems and lead to heart failure or other problems. The consequences of the most important psychological effect of isolation are loneliness and carelessness. The thought that they can spread the infection among themselves and their loved ones, and that this time is getting longer, leads to a kind of exhaustion and psychological trauma in the elderly. This pattern of everyday physical distancing worldwide, particularly for adults aged 65+. Such distancing can evoke subjective feelings of loneliness among older adults, but how this pandemic has influenced that loneliness is not yet known. Seifert and Hassler (2020 [6]) concluded that this loneliness was directly or indirectly related to “(a) limiting social contact opportunities; (b) making older individuals reflect on their social/support networks, potentially evaluating them as frail; (c) labelling older adults as “at risk,” possibly causing them to be shunned; and (d) making older individuals feel lonely because society considered them old and frail and, therefore, lonely”.

Older people think psychologically that it is more difficult for an elderly person in an urban area to protect themselves from the COVID-19 pandemic. If an elderly person in the city protects himself from the Covid-19 pandemic, it means that he should not leave his place of residence, always use disinfectants, pay attention to those who come and go, avoid contact with relatives as much as possible. This has a psychological effect on people over 65 years of age. It is psychologically easier for people over the age of 65 living in a district or village to protect themselves from the Covid-19 pandemic than in a city. While elderly people living in the city are forced to stay at home due to quarantine rules, people over the age of 65 living in the district or village can go outside and get fresh air, because there is not much crowding in the district and village.

In Azerbaijan social workers provide service to vulnerable older people at their homes. During the special quarantine period, citizens over the age of 65 and currently

living alone are provided with social services at home. Social services at home are provided by local branches of the Agency for Social Services and DOST centers under the Ministry of Labor and Social Protection of Population of the Republic of Azerbaijan. This support for older people, their families and their caregivers is an essential part of the country's comprehensive response to the pandemic. Further it has been assumed centrally, albeit for compassionate reasons, that older people need safe access to nutritious food, basic supplies, money, medicine to support their physical health, and social care, but they are unable to provide this for themselves. This service did little to help a most pressing problem, that of isolation and of enhancing the self-efficacy of older people. For example, during the pandemic services were provided for older people which are included in the list below, but social workers do not enter the house to engage in social interaction. Moreover, such a service, where the people are able, removed the dignity and confidence of the person in acting within their own competency: it often reduced independent agents to one of dependence and learned helplessness. These services include:

- Purchase of medicines
- Purchase of necessary food, industrial and household goods
- Take to the doctor, etc.
- Social services at home are suspended in the following cases:
  1. When another person moves to the citizen's house
  2. When lonely elderly people are placed in state social service institutions
  3. When a person in need of social services dies

This support for older people, their families and their caregivers has been seen an essential part of the country's comprehensive response to the pandemic but there is growing if anecdotal, evidence important that in providing services there is no marginalization of older people. Further research is needed to substantiate this premise but this papers suggests that the response derived from such study ought to be transdisciplinary, focusing on the wide impacts of the pandemic not just the protection of the elderly from contracting the virus but also on ensuring that their way of life is supported, that they retain their dignity and that remaining safe embraces their mental as well s physical condition.

#### **A Transdisciplinary Response:**

Pandemics are likely to become more frequent given the increasing interconnectedness of the world and our closer proximity to wildlife due to human encroachment. To be prepared requires transdisciplinary preparation: Lawrence has argued that the coronavirus pandemic "should be considered as a transdisciplinary societal challenge that requires coordinated systemic thinking and actions in the context of uncertainty". Indeed the health, economic and social impacts of Covid-19 are complex, emergent and unpredictable and a transdisciplinary approach might have advantages in dealing with the identified problems above. Transdisciplinarity (transdisciplinary research) is understood here as comprising a commitment to the framing of the question of over 65 care by integrating different domains and disciplines of knowledge, even when this means working across different theoretical perspectives and methodological practices. This brings a focus on real-world problems, where context and complexity are recognised and confronted as part of the methodology.

Transdisciplinarity however, requires systems thinking. Systems thinking is a set of skills to recognize parts of systems and their interconnection, identify and understand cause-effect feedback loops, and understand system structure, dynamic behavior, and systems at different scales – in other words, systems thinking is the ability of seeing both the forest and the trees. We see that the potential of systems thinking and transdisciplinary science has not yet been utilized in the attempt to overcome the COVID 19 crisis. Lawrence concludes “that transdisciplinary contributions can make a crucial contribution in defining the contingent factors that enable or inhibit decision making to deal with societal challenges” (2020a: 198).

This is not easy. A recent report by the OECD Global Science Forum (2020) found that despite increasing interest at the policy level, there are significant barriers to conducting rigorous transdisciplinary research. In this report they offer a number of case studies that address complex public health issues or crises. The report suggests policy makers and other actors with a shared interest in how science can effectively support solutions for complex societal challenges. These include actions from Governments, research agencies, research institutions and international bodies to design and implementing effective policy initiatives. They advocate mutual learning, collaboration, and exchange are required at the policy level as well as at the practitioner level. As Lawrence has suggested, that important as discipline-based expertise is needed in dealing with Covid, this alone cannot “provide a comprehensive understanding necessary for effective responses to its multiple impacts within and beyond the public health sector” (2020a: 1). He goes further to support the OECD report’s recommendation suggesting that Covid should be considered as an “emergent, complex, contextual, and systemic societal challenge that requires concerted actions involving not only disciplinary and professional expertise but also other types of knowledge and know-how” (ibid).

Such collaboration within the stakeholders of Azerbaijan’s policy and implementation services would create a more cohesive and comprehensive approach to the problems expressed by the older population. These problems are not those where one agency working from within one type of portfolio or supportive agency can solve. It needs a clear and collaborative approach which addresses the problems as presented by those who suffer. Solutions will come from working with those affected, understanding their concerns and seeing how the resources available can be brought to together to solve these pressing problems. The challenge is huge and it is one that Azerbaijan, in dealing with and responding to the post-Covid situation, shares with the rest of the world.

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Heidegger, Duns Scotus, and Deleuze and the theoretical insights of Basarab Nicolescu. He is also the series editor of SpringerBriefs on Key Thinkers in Education.

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# PART **6**

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## **Understanding the Impact of the COVID-19 Pandemic on Student Nurses – A Transdisciplinary Problem**

*Aygun Muradli and Paul Gibbs*

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### **Short Letter**

The COVID-19 pandemic has had a devastating impact across Azerbaijan. Official statistics suggest that there have been well over 3000 COVID-19 deaths in Azerbaijan, and this is generally accepted to underestimate the true number. There is growing evidence that health and social care workers appear to have a heightened risk of infection and mortality as do people from Black, Asian and Minority Ethnic (BAME) backgrounds. For example an analysis of COVID-19 deaths at St George's hospital in the UK demonstrated a similar age distribution to deaths normally observed in the hospital which was in contrast with BAME communities who were "disproportionately affected by COVID-19 and non-COVID deaths, and the excess in mortality in the BAME groups remains after adjustment and is not fully explained by available hospital information on comorbidities age, sex or poverty". (Perkin et al, 2020:70 [1]).

It is clear that the challenges which all students are experiencing have been magnified for those studying to enter these medical professions, but each in very different ways. In nursing and midwifery students have been offered the opportunity to opt for extended placements within NHS services to support the national response to COVID-19 (Jackson et al, 2020 [2]). Each of these different options presents both challenges and opportunities for students. These students are likely to have a range of experiences, both positive and negative and may be placed in challenging situations; some predicable, others potentially unforeseen. Nurses have been in the front line of the response to COVID-19 with many being redeployed as in-patient services were reconfigured to ensure the health service retains the capacity to treat the expected

large numbers of patients with COVID-19. In parallel, the public health response to the pandemic with its twin principles of ‘social distancing’ and the ‘self-isolation’ imposed during a national ‘lockdown’ present huge challenges. Social care services have had to manage unprecedented social upheaval. Social workers have had to rapidly adjust their practice in order to discharge their statutory responsibilities. For community based mental health nurses the best practice principles of patient centred and recovery focused care have been fundamentally challenged by the need for social distancing, while for midwives whether working in the community or in hospital the need to maintain both patient and personal safety generate extraordinary challenges and require complex decision-making.

For example, year two students, expressed that they had fears about the loss of academic time during the extended placement and the pressure this brought to catch up on hours during the final year of their programme. For some, this carries with it a fear of not being able to achieve their best in academic work now or later Swift et al (2020: 3113 [3])

As Swift et al (2020 [3]) asserts, professional identity is important to nurses. There is an intrinsic reward in being a nurse that for some is linked to the notion of nursing as a vocation or a calling, and many students describe this as a key driver in their choice of career (Eley, et al, 2012 [4]).

This could occur because professional identity is so closely connected to knowledge and experience and linked to their agency which itself is vulnerable as well as their own health. It therefore follows that thus, professional identity is always dependent upon personal identity (Holmesland, 2010:3 [5]). The research paradigm follows in the most part that developed by Lawrence (2020 [6]) which proposes a transdisciplinary conceptual framework represents a complex and dynamic open system in which each set of variables has unique properties in response to the emergence, complexity and uncertainty of student identity. It requires “several types of resources, coordinated multi-level governance, and individual and collective behaviours, that should be combined in transdisciplinary contributions” (2020:196 [6]).

For BAME students the pressure on self and professional identity in the context of a colonial context with racism evident in the societies for which they work, the situation is more confusing and anxiety inducing. Add to this the higher chance of death and the belated recognition of the specific risks to BAME students and the delayed process to ameliorate these risk. It is suggested that BAME students in Nursing and Midwifery are particularly vulnerable. At Middlesex University students from BAME backgrounds make up around two thirds of the nursing student population and research by Moorthy and Sankar (2020 [7]) indicated that more than 70% of BAME of medical care workers were anxious about their role during the pandemic and concluded that current anxiety level is very high and “adequate provision of mental health support with clear risk stratification for return to work is required urgently” (2020:486 [8]). Supportive of this position Albott et al, (2020 [8]) observed the need to identify mental health concerns and for those medical care students studying for professional qualifications in nursing and midwifery the impact has been particularly significant. The research attempts to understand the experiences of these students.

## 6.1 Situation in Azerbaijan

As the Covid-19 pandemic began to spread to other countries, a number of precautions were taken in the country. As a precautionary measure, an order was signed in January to establish an Operational Headquarters under the Cabinet of Ministers of the Republic of Azerbaijan.

The first quarantine regime in Azerbaijan was signed on March 23, 2020 under the leadership of Prime Minister A. Hasanov. During this period, it was decided to:

1. Prohibit people over the age of 65 from leaving home.
2. Restrict access to and exit to Baku, Sumgayit and Absheron districts, except for the movement of special purpose vehicles, including ambulances, emergency response, rescue, as well as trucks.
3. Suspend the activity of district and intercity passenger transportation in the country, regardless of the type of property.
4. Ensure that families with young children, the elderly, persons in need of medical care and women are brought to Azerbaijan by special charter flights with compulsory quarantine for 14-21 days within the established schedule, giving preference to women.
5. Baku Transport Agency to apply special express bus lines between 06:00 and 22:00 on the basis of the established route between metro stations. Passengers are advised to minimize the use of the subway, to use transport.
6. Prohibit the concentration of individuals in groups of more than 10 people in public places, including streets, boulevards, parks and other places.
7. Recommend that citizens keep a distance of 2 meters in interpersonal contacts.
8. Apply a new mode of work to public catering establishments: to set the time of on-site service for customers from 12.00 to 15.00, to allow home pick-up, delivery and online sales without restrictions;
9. Suspend the activity of shopping centers and malls in the country, except for nearby supermarkets, grocery stores and pharmacies;
10. Ensure the operation of food stores, pharmacies and other vital facilities.
11. Entrust control over the implementation of the requirements of the special quarantine regime to the Ministry of Internal Affairs of the Republic of Azerbaijan. (<https://nk.gov.az/az/article/761/>)

At the next stage, the following measures were taken in connection with the medical staff. On March 18, 2020, the President of the Republic of Azerbaijan signed a decree on strengthening the social protection of health workers participating in measures to combat a new coronavirus (COVID-19) infection [9].

In March, the President signed a decree, guided by Article 109, paragraph 32, of the Constitution of the Republic of Azerbaijan, in order to strengthen the social protection of health workers involved in the fight against and prevention of coronavirus (COVID-19) infection. According to the order, a periodic supplement to the salaries of employees of state medical institutions in the amount of 3-5 times the monthly official (tariff) salary shall be established [9].

In April, a law was signed to pay tuition fees to students belonging to vulnerable groups affected by the pandemic. According to the decision, these are:

- Recipients of targeted state social assistance

- both parents (or one is a single parent) or their legal representatives belong to any of the following categories:
  - Persons with I and II degree disabilities
  - Those registered as unemployed
  - labor pensioners by age
  - recipients of old-age social benefits [10].

From the first months of the pandemic, social isolation measures covering many areas of the country have also shown themselves in the field of education. Thus, in the first week of March, classes began to continue online. The fact that the education system is online has affected people studying medicine like other students.

Conducting classes online also had a negative impact on the quality of education. Due to the pandemic, nurses trained in their specialties had problems practicing in hospitals.

However, as a result of mass infections and the need for medical staff in the country, nurses and paramedics who are final-year students have begun to work in hospitals designed for people living with the virus.

The first ideas of student nurses and staff about the nature of the virus and how to provide effective care to patients were later developed when working with patients.

The constant work with patients and the atmosphere full of viruses led to the infection of student nurses and medical staff.

During a mass infection, people suspected of being infected may be tested at home without going to the hospital. Nurses who come home for tests are sometimes infected. Among those who died of the mass infection were nurses and doctors.

Student nurses care for infected patients, but sometimes these people become victims of the virus, and the deaths of patients they look after for days deal a devastating psychological blow to nurses.

Because student sisters work with infected people most of the day, they experience some types of fatigue and weakness. They refuse to go home because they are infected with the virus, which causes them to see family members and stay away from home for months.

During the pandemic, student nurses, even if they have acquired a number of skills when working with patients, are at risk and their academic performance is changing due to distance learning.

## **6.2 A Transdisciplinary Approach**

To understand and to assess these students' experiences in respect of their professional identity whilst working and studying through the Covid-19 pandemic, we are conducting a research project which reflect, transdisciplinary methodology and theoretic underpinning. The complexity of the issues involved in understanding identity and how the Covid-19 pandemic might have revealed the tension hidden without it will requires a phenomenological approach in the investigation which contextualises the identity study in the racial and political context of the presenting situation in higher education. The onto epistemological approach was used in this study to transcend the traditional disciplinary (or inter and multi-disciplinary) approach for we are seek an understanding of the student through their intersectional relationship

with their transformation and emergence of their professional identity within the complex and confusing spaces that emerge from their ethnicity, within a professional environment in flux and which limits support mechanisms especially for BAME students. It is complex and an underdeveloped methodology for it accepts the notion of emergence as the creation of the way students formulate how they identify themselves and how they significant others. With an expanded approach which weaves the realities of person, institution and perceive world health issue linked to products and alienation the research is likely to produce symptomatic outcomes unlikely to improve the context in which the BAME students find themselves with COVID- 19 and beyond.

### 6.2.1 Suggestions and Musings

If these preliminary results are supported in the larger study it indicates that the university alone cannot be a causal force for change. The results indicate a blindness to ethnicity and even cultural racism from all those involved in the provision of care. It shows a lack of thought and duty of care. We would suggest a transdisciplinary response to the situation which might be revealed when the full results are presented. It is clear thought beyond the functionary use of human resources or protection, of investigations into potential systemic racism would be included in the problem as identified.

However, the process of systems solution has itself risks as all transdisciplinary study as it questions the hegemony of the powerful who control the notion of professional identity and behaviour associated with that. Moreover, this is like to reveal tension and anxieties within the students which need to be managed although not avoided in order to the impact of the COVID19 situation is seen as a global but also a distinctly personal issue.

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# PART **7**

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## **The Impact of the Covid-19 virus on Domestic Violence**

*Aygun Fuad gizi Gurbanova and Paul Gibbs*

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### **Short Letter**

Violence against women, especially by intimate partners, is one of the main problems throughout the world. Based on data from the World Health Organisation (WHO), as well as the Organization for Security and Co-operation in Europe (OSCE) almost 30% of women worldwide are sexually or physically abused by their partners at least once in their lifetime: up to 38% of women's deaths are caused by intimate partners, and only 11% of victims report the violence to the authorities. Women of any age are also exposed to various forms of violence in their homes by family members, usually referred to as 'domestic violence'. Crises and times of unrest have been linked to increased interpersonal violence, including incidents of violence against women and children (Fraser, 2020 [1]). Pandemics are no exception. In fact, the regional or global nature and associated fear and uncertainty of pandemics provide an enabling environment that may exacerbate or spark diverse forms of violence. Fraser, E. (2020 [1]). Peterman et al. (2020 [2]) document nine (direct and indirect) pathways linking pandemics and violence to women.

This paper presents a transdisciplinary approach to the problem of domestic female violence in Azerbaijan especially during COVID-19.

It discusses the literature in terms of transdisciplinarity and then, with this as a contextual basis, considers how Azerbaijan might act. The advantage of a transdisciplinary approach to gender violence is that it analyses the problem as well as its possible causes and considers the consequences from different points of view and hence, can put forward various proposals to diminish the gender violence rate. Flood and Pease (2009 [3]) in an Australian study found two clusters of factors associated with domestic violence and these were; gender and culture. These had an influence at multiple levels of the social order on attitudes regarding violence. Additional factors operate at individual, organizational, community, or societal levels in particular, although their influence may overlap across multiple levels. They proposed five ways of approaching the problem but none are possible as a disciplinary response. They

require, although they don't call it as such, transdisciplinary problem solving. We have paraphrased them as:

1. The process of changing attitudes must be located within a project of changing familial, organizational, community and societal norms which support violence against women.
2. Interventions must address the wider clusters of attitudes related to gender and sexuality which normalize and justify this violence.
3. Violence prevention interventions must be culturally appropriate.
4. Interventions aimed at attitudinal and cultural change must be accompanied by changes in structural relations and social practices if violence against women is to be prevented.

Such a framework might apply to Azerbaijan where the UN's Special Rapporteur on violence against women found that violence toward women was "underpinned by the persistence of patriarchal social norms, deeply-rooted gender stereotypes and misconceptions, as well as customary practices that are harmful to women. Azerbaijan has strong cultural traditions that place a high value on family and community" (2013 [4]).

Musso, Proietti and Reynolds (2012 [5]) investigate the international literature and find violence against women is a feature not only present in widely differing geocultural realities but also persistent and showing a polymorphic, transverse character related to male dominance which enables it (until now) to survive many social and legislative changes. Yet the research on this issue has remained disciplinary and their work on gender violence tends to remain discrete and fragmented. This disciplinary compartmentalization inhibits the understanding and possibility of coherent and consistent action, and approach which transdisciplinarity embraces. As Carew and Wickson, (2010 [6]) have stated, the study of gender violence necessarily transcends the academic and disciplinary boundaries traditionally utilized to understand and resolve research problems.

One transdisciplinary approach regarding violence against women was conducted by Adelman, Haldane, and Wies (2012 [7]). It was a study on violence against women on a USA campus in which they detailed how a transdisciplinary group reflecting a range of issues that might create a culture where such abuse might flourish or at least be resistant to confrontation. To achieve this requires the involvement of all those that create the salient cultural in which the problem is located and this culture perspective transcends the male and the female as the sole actors in any abuse. This widens the movements against gender violence from just within criminal justice and social services agencies, so as well as identifying the particular features and changing forms of this type of violence, the authors stress the adaptive, endemic and persistent character of this phenomenon and highlight its intimate and political matrix.

### 7.0.1 Situation in Azerbaijan

Publication of statistical indicators entitled "Women and men in Azerbaijan" by the State Statistics Committee of the Republic of Azerbaijan for 2018 shows that 76.0% of victims of domestic violence crimes are women. The Committee's report for 2019 notes the total number of victims of domestic violence is shown as 1,358, of which 1,038 are women, 12 are girls under 18. Thirty-seven female victims of domestic

violence were killed, 831 were intentionally injured, eight were tortured, and two were threatened with death.

The following is a report of a small, anonymous survey in which 67 people attended a one-day survey to investigate the impact of the COVID-19 pandemic on domestic violence.

When asked if they had to spend more time at home during the “stay home” campaign than in previous periods, 95.52% of respondents answered “yes” and 49.25% of respondents answered “yes” to the question of whether spending more time with family members during quarantine caused family conflicts. When asked, 41.79% of respondents said that domestic violence is caused by both sexes, and 37.31% that it is men who generally inflict violence at home. When asked what type of violence was most common, 22.67% of respondents reported that it is harassment (checking and misappropriating personal belongings such as telephone, etc.); 22.9% of answers cited psychological violence (indifference, intimidation, disturbing); 16.28% responded by selecting economic violence (failure to meet basic material needs, misappropriation of income) and 12.21% answered by selecting physical violence (pushing, hitting, dragging). When respondents were asked which age group was most affected by domestic violence, 22.28% of them reported that people over 65 years of age are mostly vulnerable to domestic violence: for 17.10% these are people aged 31-45, and 18.13% of them showed children aged 0-10 as victims of domestic violence during “stay home” campaigns. When asked what was done to protect the victim from domestic violence during quarantine, 52.13% of respondents said they could not leave the house; 29.79% of people said that they responded by resorting to various forms of violence as a way of self-defending. To the question of who protected the victim from the perpetrator, 60.56% chose the answer “nobody”, while 36.62% of respondents asked other family members for help (son, daughter, father, mother, sister, brother, husband, wife, etc.). When asked what was used to protect the victim, 34% of respondents said they tried to make a phone call, 30% wrote a message and 30% tried to go to the doctor in order to avoid further disturbance. When asked who came home to protect the victim from the perpetrator, 85.96% of respondents answered “nobody”, the other percentage is divided between parents, friends and relatives. These results hide the actual causes of the problem but can be read in a cultural way opening up concerns which can only be dealt with in ways that address a wide range of issues together and at a different level of reality.

To help understand the plight of women who suffer domestic violence in Azerbaijan we provide two narratives from two people involved in helping these vulnerable women. The first is a director of a shelter, the second a university academic.

Reflecting on these results, M. Zeynalova, director of the women’s shelter “Clean World” under the auspices of Aid for Women Public Union, said that quarantine measures created conditions to cover up domestic violence. According to her, the facts from various countries about family members remaining indoors in quarantine creates conditions for an increase in domestic violence is also true for all of Azerbaijan. She confirms that during the quarantine period, women were placed in the shelter due to economic and physical violence. She said that during the quarantine period, most of the women victims of domestic violence who came with their children from both the regions and Baku (the capital), ran away from their abusive husbands and fathers. Police and local authorities tried to reconcile one of the couples, but to no avail. Some women, on the other hand, were unable to pay rent after losing jobs due to lockdown measures and had to seek refuge in the shelter. One of the reasons

why women living in remote regions and facing domestic violence were unable to come to the shelter is that they are not aware of their right to call the police and ask them to help to escape the domestic violence during the quarantine. Many of them think that lockdown rules are applied without any exception, whatever happens people must stay indoors and the local police are not allowed to leave the region either, so instead they call the shelter and ask someone from the management to come to help them leave the house. Once women were made aware of their rights of state support during the pandemic and the role of the police to take them to a shelter, they were more able to escape the violence. It was suggested that local authorities should play a key role in this but there seems to be an indifference in local authorities during the quarantine period and the lack of active participation in the referral of women victims of violence.

The second person is a senior academic and Head of Department of Social Work of Azerbaijan University, Dr. Verdiyeva. She confirms that lockdown rules and restrictions of workplaces, the closure of entertainment venues, and even the closure of parks during the tighter quarantine period, forcing people to stay indoors, have increased domestic violence, commonly in its economic and physical forms. Thus, this kind of atmosphere at home may affect the emotional state of children, and lower their self-confidence and self-esteem. Extending the quarantine period to prevent the spread of the virus during the expected larger wave and the imposition of strict bans are expected to exacerbate domestic violence.

From both the survey and the reflections of two experts, several factors might be considered. These include gender inequality, legislation, women's economic dependence on men, lack of education about the issues of mutual respect, gender equality and equal distribution of gender roles in the family. Some of the possible solutions could be giving much more emphasis to school education: teaching respect, gender equality, sensitizing students to any manifestation of violence in general, and gender violence in particular. As far as the public health service is concerned, wider access to medical services, offering timely medical assistance to the victims of gender violence, as well as educating health workers, especially family doctors, to deal with the consequences of domestic and gender violence is required. In response to these challenges, a multi-layered National Action Plan to combat domestic violence for 2020-2023 was approved by the President of Azerbaijan. The plan was developed in accordance with the UN Convention on the Elimination of All Forms of Discrimination against Women (CEDAW) Convention. This action plan recognizes the complexity of the issue and will coordinate cooperation between government agencies, civil society institutions and international organizations in further improving the legislation, as well as ensuring the implementation of existing legislation to prevent domestic violence.

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# PART **8**

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## **The COVID-19 Pandemic in Brazil: What is Happening on the Front Line**

*A. Isidoro Ferreira Prado, A. Karolina Barreto Berselli Marinho, C. Chaves Gattaz, W. Mendes-Da-Silva*

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### **Short Letter**

Knowledge about a disease, regardless of its etiology, passes through several spheres and the impact on health is known to be only the most obvious. The pandemic COVID-19, a disease caused by the SARS-CoV2 virus, has proved the resilience of communities around the world, especially in countries underprepared in terms of a variety of aspects such as infrastructure, technology and education. One of the largest economies in the world, Brazil as an emerging country has faced this great challenge. The number of deaths and the economic damage resulting from the pandemic are explicitly worthy of attention by the government, industry and academia.

This pandemic proved to Brazil and worldwide how much repercussion a bankruptcy in the health system can bring - there is no perfect health management when it comes to a disease that can also affect those who are not infected by it: the need for confinement and a change in habit has led to food shortages, unemployment and mental disorders. The speed, the way of conveying information and the advent of so-called fake news have increased cases of stress and anxiety about the disease and its consequences. The isolation imposed by the disease was once called Van Hoof's "greatest psychological experiment in the world" (Lima, 2020) [1].

There is an estimate that the psychological impairment generated by COVID-19 is between one third and half of the population if they do not receive adequate care. Obviously, the number of people psychologically affected by the pandemic is greater than the number of people infected by the virus itself. Health professionals and related areas such as drivers, cleaning staff and hospital administration are also classified as groups at mental risk due to the constant fear of infection and death.

Unfortunately, despite a pandemic of fear and stress within that generated by the coronavirus, it still lacks numbers that can assess specific population groups. Some

measures have been taken in order to minimize or treat such conditions - some societies such as Universities of psychoanalysis have set up online service groups to serve the general population. The Brazilian Ministry of Health announced the creation of a program that offers support with teleconsultations for frontline professionals in combating the epidemic. The regional nursing council of Sao Paulo provided a chat to assist and support the professionals' mental health. Such tools prove to be useful to minimize the damage caused to health professionals who are at the forefront in this pandemic (Angelo et al., 2020 [2]; Duarte et al., 2020 [3]).

The pandemic also brought political instability and polarization between parties, discussions about treatment and the lack of scientific support: in a short time Brazil made two exchanges of Ministers of Health with divergent opinions and coping strategies leading to a discontent of society by the lack clarity of information about the pandemic and future prospects (Angelo et al., 2020 [2]).

The economic change generated by COVID-19 was abrupt and brought discouraging numbers. Current economic estimates point, for example, to a drop in GDP in 2020 to 7.7% - in confirmation of this figure, it will be the worst economic recession in the country's history. Currently, the accumulated devaluation of the Brazilian currency is 45%. In April this year, the application for unemployment insurance was 39%. Unemployment reaches a rate of 12.8% with a catastrophic number of 12 million unemployed. Another data that speaks in favor of the recession is the shrinkage of industrial production, which varied between the states, showing a total value of the country of 9.1% in the month of March.

There is still no data to assess the environmental changes generated by the pandemic in Brazil, however globally we know that despite the discreet reduction in CO<sub>2</sub> emission rates, oil companies seek incentives from governments to maintain their production in order to minimize economic impacts and they may negatively compensate for the pollution rates once reduced at the beginning of the pandemic (Revista Exame, 2020 [4]).

In spite of all the changes and negative impacts caused by the pandemic in Brazil, we must consider some positive impacts in the health area, such as: greater investment in clinical research, especially related to the development of vaccines, drugs and diagnostic methods, as well as the development of technologies without health as implantation of telemedicine in much of the country. We are still a long way from achieving control of the current situation, but we hope that greater integration between the different spheres of society, both the public and private sectors, can result in solutions that help to face high impact events such as the pandemic.

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# PART **9**

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## **Social Environmental Inequalities in France When Facing Covid-19 Health Crisis**

*Samuel Lopes Pinheiro and Florent Pasquier*

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### **Short Letter**

The worldwide health crisis of SARS-CoV-2, the so-called Coronavirus, is a strong transdisciplinary exercise due its multisectoral societal actors that are involved in giving perspectives to build accurate responses for that. When facing this challenge of health crisis by getting close to a particular data, information or statistics that concerns the disease itself, we find that a health crisis is not a simple health problem, but health is also a matter of access to a healthy environment and it is about social issues as well. We cannot treat ecosystem in a reductionist perspective anymore, because the problems are not isolated, but on the contrary, they are inter related to each other. From now on, we are invited to consider the great interdependence of different systems of thinking and action. A Science that looks beyond the disciplines themselves. Alternatively, we could say an “ecological thinking” (Morin, 2020, p.35 [1]), in the sense that the ecological problem is not just about our relation with nature, but also the relations with ourselves.

According to Barton, H. and Grant, M. (2006 [2]): “The links between health and settlements are often indirect and complex. A tool to improve understanding and foster collaboration between planning and health decision-makers is badly needed”. For that, the authors have developed a health map that represents the complexity of socio-ecological systems, in which the category of “people” is centered positioned and simultaneously surrounded by several layers, like lifestyle, community, local economy, built environment, natural environment, and global ecosystems. If we take the centrality of people for our analyses in the context of France during the period of major demand of health care in the first half of the year of 2020 still in the first coronavirus wave in Europe, we will find many social environmental inequalities in the access of this care.

From ecological political studies, Machado (2020, p.29 [3]) points out that one third of the world human population is under social isolating measures and two thirds of world human population is under the yoke of injustices and inequalities. Moreover, that great part of these two thirds is directly in the effort of survival measures, risking themselves and families in the front line activities because they have to maintain their ordinary jobs and lifestyles in order to keep their minimum conditions of life. Therefore, it is more than a rational statistic overview, it is a matter of human ethics and solidarity to fight against those inequalities and look for scientific analyses which will help us to include the ones who are apart of the access of health in a broader sense of the term. Like the French Professor Florent Pasquier (2020, p.8 [4]) remind us: “The virus (...) is a revelation of our ways of doing things, of acting, of thinking, of existing. In this bad game, there are only two losers: the individual in particular and the human species in general.”

Those inequalities are worldwide felt and this is not different in France. About the social inequalities existing in this country, the dossier “Les inégalités sociales face à l’épidémie de Covid-19” presents a very extensive and profound study in this sense. A group of researchers coordinated by Claire-Lise Dubost, Catherine Pollak, and Sylvie Rey (2020 [5]) analyzed past scientific literature that has already highlighted the presence of social inequalities in other epidemics. It is mentioned the “inequalities in the face of exposure risk, vulnerability to infection, and the lack of access to health care”. Those characteristics are also present when facing COVID-19 and the fact that this particularly disease has rapidly happened it highlights even more the social environmental inequalities already present in different communities.

The study of (Dubost, Pollak and Rey, 2020) presented that territorial analysis reveals mechanisms of accumulation of difficulties when facing Covid-19. Other studies at the level of the Lyon metropolitan area or the Île-de-France region (Mangeney, 2020 [6]) show that the populations in suburbs and working-class neighborhoods more often present risk factors. That is because they are also more often affected by poor housing conditions, as well as by the need of maintaining a professional activity that requires the use of public transportation. In the research conclusions of Claire-Lise Dubost, Catherine Pollak, and Sylvie Rey (2020) there is the indication that the virus differently touched urban and rural areas in France. The more dense populated areas are in addition to bad live conditions it led to more deaths, on the other hand, less populated areas in rural surrounds may had to face the difficulty to access health care. Beyond territorial issues to approach inequalities, the authors also mention the populations considered in vulnerable situations, like elderly people living in medical institutions, homeless people, handicapped ones who are more expose to the risks of contamination.

In addition to those social inequalities marked by territorial differences, working condition and vulnerable situations, we will find many other, like the differences in access to internet and digital technologies, which will touch the educational maintenance of youth during confinement period. In France, in 2019, 12.0% of the people do not have Internet access at home (Dubost, Pollak and Rey, 2020 [5]). We have also to mention the increase of domestic violence in French houses during the confinement, estimated in 36% in the zone of Paris by the Ministry of Interior and reported in *Le Figaro* newspaper in March 2020 [7].

One of the lessons that we take from this health crisis due to COVID-19 is that the problems are all interconnected, and for that, transdisciplinarity analyses will be more and more needed to face it as well as a transdisciplinary pedagogical approach

that might help us to connect the dispersed knowledge. Besides that, the virus comes with a strong pedagogy in itself that remind us the social inequalities presents in society. Moreover, those social inequalities cross several layers of a health map, touching environment, education, relations, community and so on. In the direction of a transdisciplinarity education, Pasquier (2020 [4]) evokes that “it is more urgent than ever that transdisciplinary education truly transmit in a lively way the human values and not just the humanistic ones”. In a sense that help us “to look for ways of doing things that are fair, that is to say that are in the correctness of the action, correctness that we will define by: an appropriate approach, carried out in the right moment, in good proportions and for a good duration”.

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# PART 10

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## Georgian Approach to COVID-19

*Zurabi Jankhoteli and Paul Gibbs*

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### Short Letter

The COVID-19 pandemic, declared a global threat by the World Health Organization 2020, is a new challenge in the modern world. The virus has spread to almost every country, and this fact has affected many aspects, including the economy and healthcare. A new crisis has begun in the world, which is very difficult to overcome.<sup>1</sup> When the spread of the virus had just begun in the Chinese city of Wuhan, meanwhile Georgian government started discussion about the seriousness of this virus.

In Georgia, the virus had a negative impact on the economy, healthcare and the social status of citizens. To some extent, the crisis triggered by fears of a pandemic, as so far no governing body, as well as the public, has had no experience in dealing with threats of a similar magnitude. The ongoing processes in the world have become force majeure due to the rapid growth of the pandemic, resulting in the inability to share, use and coordinate the knowledge, which countries have accumulated in the fight against the virus. If such in-depth studies were available, Georgia would be able to reduce the expected economic downturn based on their analysis. As soon as the first case of Covid infection was confirmed, citizens panicked and began to over-purchase food and necessities for further storage and use. This fact caused the first micro shock to the economy, which was manifested in the depreciation of the national currency against the dollar, in its instability, in addition there arose to the real threat to logistics and supply.<sup>2</sup> Rising unemployment, rising risk of bankruptcy for small and medium-sized businesses, rising poverty rates, stagnant tourism businesses and declining international remittances are a combination of aspects that play an important role in shaping Georgia's economic climate.<sup>3</sup> The deterioration of these indicators means the aggravation of the economic crisis inside the country.

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<sup>1</sup>World Health Organization. 19.06.2020. WHO Director-General's opening remarks at the media briefing on COVID-19 [www.who.int](http://www.who.int)

<sup>2</sup>National Bank of Georgia. 05.12.2020. Official exchange rate of LARI against foreign currencies 24.02.2020 – 05.03.2020 [www.nbg.gov.ge](http://www.nbg.gov.ge)

<sup>3</sup>Economic Policy Research Center. 2020. COVID-19 Economic Consequences for the World and Georgia. [www.eprc.ge](http://www.eprc.ge)

According to the data, the contribution of tourism is 21.3% of Georgia's GDP,<sup>4</sup> thus the problems created in this segment will be dramatically reflected on the business entities operating in this sector as well as other indirectly related economic activities. To stop the spread of the pandemic and to localize it, the government approved regulations according to which all business entities activities had been suspend for a certain period except for grocery stores and pharmacies. According to the International Monetary Fund, the Georgian economy will experience a recession in 2020 and will reach -4%.<sup>5</sup> A more pessimistic forecast is made by Galt & Taggart in its report where company notes that the economic growth will be -6%,<sup>6</sup> although research on this issue continues, which would be based on more in-depth analysis and modeling. The construction business received a significant blow, which reflected in a sharp decline in sales and falling real estate prices. This situation turned out to be very dramatic in the first stage of the pandemic, because some companies in the construction industry was unable to repay bank loans. Generally in this business segment whole debt amounted to be about 9.2 billion GEL (18% of GDP).<sup>7</sup>

During the COVID-19 pandemic, the Georgian National Center for Disease Control and Public Health had consultation with international partners, mainly ambassadors from countries that already had some experience fighting against the virus. Through these meetings, there was analyzed received information and an action plan was further developed. The center established active communication with the public and various target groups, through which knowledge and recommendations from strategic partners share.<sup>8</sup> The Shota Rustaveli National Science Foundation of Georgia is actively participating in the ISTC COVID-19 pandemic regional meeting, which has an interdisciplinary nature and envisages the establishment of a regional scientific council. Its basic aim is to reduce corona virus induced damage in various sectors through coordinated programs, conferences and workshops in the Caucasus and Central Asia to help governments Improve Collaboration.<sup>9</sup>

The difficult situation created by the pandemic, which has strongly affected Georgia, requires the use of transdisciplinary approaches, which will allow the country to get the maximum effect and reduce losses in the current situation. Dr. Roderick Lawrence points out in his study that overcoming the social problems caused by the corona virus requires the use of both scientific and non-scientific knowledge and know-how, which in a way forms the common knowledge base. This aspect is very important in this situation, because the problems caused by the pandemic are complex and require coordination of different disciplines, government policies, individual and public responsibility.<sup>10</sup> Within the framework of the anti-crisis plan of

<sup>4</sup>World Travel and Tourism Council. 2018. GLOBAL ECONOMIC IMPACT & ISSUES 2018 [www.wttc.org](http://www.wttc.org)

<sup>5</sup>International Monetary Fund. April 2020. World Economic Outlook: The Great Lock-down [www.imf.org](http://www.imf.org)

<sup>6</sup>Galt & Taggart. 2020. Covid 19 [Covid-19 Impact on the Georgian economy] [www.galtandtaggart.com](http://www.galtandtaggart.com)

<sup>7</sup>Government of Georgia. 2020. „Report on the measures taken by the Government of Georgia against Covid-19“ [www.gov.ge](http://www.gov.ge)

<sup>8</sup>National center for disease control and public health. 2020. COVID-19 in Georgia report 3rd revision [www.ncdc.ge](http://www.ncdc.ge)

<sup>9</sup>Shota rustaveli national science foundation of Georgia. 13.12.2020. ISTC regional meeting on elimination of Covid Infection [www.rustaveli.org.ge](http://www.rustaveli.org.ge)

<sup>10</sup>Dr. Roderick Lawrence. 24.09.2020. Advancing with Transdisciplinarity: Effective Responses for Coronavirus. Transdisciplinary Journal of Engineering & Science [www.atlas-](http://www.atlas-)

the Government of Georgia, the country participated in the project "The Georgian Reality: Sustainable Scholarly Studies during the COVID-19 Pandemic" supported by the World Pandemic Prevention Organization, which aims to facilitate coordinated transdisciplinary research in the world scientific community.<sup>11</sup> The Ministry of Education noted that the data and findings obtained will be valuable not only in the current crisis but also will have significant importance for the future challenges.<sup>12</sup> Georgia is involved in several transdisciplinary research projects, such as CaucaSusT - Transdisciplinarity for Sustainable Tourism Development in the Caucasus Region<sup>13</sup> and The Caucasus Network for Sustainable Development of Mountain Regions.<sup>14</sup> The aim of the projects is to study the problems in the field of tourism with the involvement of local people and other stakeholders, so that the results can be answered real-life problems of sustainable development. During the current pandemic, the tourism business received the hardest blow. Doctor of Geography, Professor Ioseb KhelaSvili in his study "Problem identification in tourism through transdisciplinary research (Georgia as a case)" notes that, "at the current stage, there is a tendency to separate theoretical and practical knowledge. This led to the so-called the emergence of transdisciplinary approaches focused on overcoming these problems."<sup>15</sup> The need for this approach is discussed by Dr. Merab Khokhobaia in his paper where he notes that the tourism sector is complex and includes various stakeholders, sectors. Thus, in order to put scientific knowledge into practice, it is necessary to use a transdisciplinary approach, which will facilitate the integration process and fill the space between them.<sup>16</sup>

Taking into consideration the above-mentioned aspects, we can say that the severest crisis has affected to the tourism, construction and shopping entertainment centers. Companies began reducing staff in order to minimize costs and thus avoid bankruptcy. Rising unemployment remains a major challenge for the country, despite the government's efforts to help business by taking various measures. The problem is global and economic incentives implemented locally cannot be a panacea under these conditions, so the importance of the use transdisciplinary research in this situation is more tremendous.

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<sup>11</sup>See source 10

<sup>12</sup>First channel. 15.05.2020. Mikheil Chkhenkeli Minister of Education and Science: The importance of fundamental and research science in fighting the pandemic has become clear to everyone [www.1tv.ge](http://www.1tv.ge)

<sup>13</sup>CaucaSusT. 2020. Developing and Implementing a Transdisciplinary Field Case Study Course: Manual for University Lecturers [www.caucasust.boku.ac.at](http://www.caucasust.boku.ac.at)

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# PART **11**

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## **The Impact of the Covid-19 Pandemic on the Mental Health and Socio-Economic Conditions of the Portuguese People**

*André Leiria and Paulo Martins*

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### **Short Letter**

Recently, several studies have been published on the impact of confinement (due to the Covid-19 pandemic) on the mental health of the Portuguese people [1]. For example, the Instituto de Psicologia Clínica e Forense (Institute of Forensic Psychology) carried out a study with 10,500 participants from the general Portuguese population, and found that 49.2% of them showed “moderate or severe” psychological impacts. Many of these people reported no mental disorders prior to the pandemic. Women were the group most susceptible to presenting some of the psychological symptoms mentioned above [2]. These investigations support others works on the impact of socioeconomic crises on the mental health of Portuguese people, which have shown that there is a relationship between the increase in symptoms of anxiety and depression and a decrease in well-being due to job insecurity, loss of income, unemployment and social isolation [3]. We should also note the effects of the pandemic (e.g., high mortality, decreased sleep hours, rationing of equipment for personal protection, etc.) on health professionals (doctors, nurses, diagnostic technicians), during the fight against Covid-19 in Portugal, where it has been shown that 72% of these professionals have medium or high levels of physical and/or psychological exhaustion, identical to “burnout”. During non-pandemic times, this value is between 21% and 47% [4]. Furthermore, due to the pandemic, Portugal experienced an increase in mortality. The age group most affected was those 65 years or older [5].

Related to the above, for reasons of public health due to the pandemic, some sectors of activity in Portugal suffered an abrupt drop in their income (with values varying according to the sector). Catering and tourism, the clothing industry

and transport services (aviation), among others, were placed in a fragile situation. This affected about 30% of the total active labor force in Portugal. The affected companies sought to minimize the situation through simplified lay-offs and the temporary suspension of employment contracts. Thus, at the end of April 2020, absolute unemployment in Portugal increased by 22% compared to the same time one year previously. The most-affected age group was that of young people (especially among those with a low level of education), who had great difficulty in finding their first employment contract or who saw their precarious contract not renewed [6]. The generalization of teleworking has been an alternative form of work adopted by many companies during the confinement as a means of combatting unemployment. Thus, while in 2019 only 6.5% of workers in Portugal were in a teleworking situation, since the beginning of the pandemic, the number has grown from 17% (in the case of micro companies) to 74% (in the case of large companies) [7]. It should be also noted that families with school-age children began to use internet and television broadcasts as ways to attend classes at a distance.

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# PART 12

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## Forecasts of the Impact of the COVID-19 Pandemic on Russia's Development in 2020

*A. M. Chochiev and V. S. Moki*

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### Short Letter

The COVID-19 pandemic has exacerbated economic and social problems in Russia. According to the Russian Ministry of economic development, the largest drop in GDP in 2020 is expected in the second quarter (by 9.5% in annual terms), when the country's economy was slowed down due to quarantine. In the third and fourth quarters of 2020, GDP is projected to fall to 6.3% and 5.2%, respectively. Unemployment in Russia in 2020 will be the highest since 2011 and will grow to 5.7%. Real incomes of the population will decrease by 3.8% by the end of this year [3].

During the second wave of the epidemic (September-October 2020), a serious problem is arising for all regions. First of all, this is manifested in the shortage of doctors. Additional assistance - attracting medical graduates and students - is exhausting its potential. In the regions, there is a shortage of beds in hospitals and CT scanners [4].

During the pandemic, universities and other educational organizations switched to distance learning. Despite the fact that this forced measure allowed to reduce the number of infections among students and teachers, distance learning cannot fully replace face-to-face education, especially in medical faculties. As a result, students do not have a sufficient degree of mastering practical skills, which can lead to a decrease in the level of professional competencies [2].

**Conclusions:** Despite all measures to control the spread of viral infection, there is a steady trend towards an increase in the incidence. The population and government officials are getting rid of illusions on a global scale, understanding the long-term and, possibly, total nature of the problem. It is generally accepted that three factors play a role in the victory over a viral infection: anti-epidemiological and therapeutic measures; resources of the human immune system; mutations of the virus itself. However, in the recent history of mankind there are examples of viral pandemics (Spanish flu,

Hong Kong flu, SARS, MERS), viruses that cause these diseases, suddenly appearing and suddenly losing their dangerous properties or disappearing altogether. This calls for rethinking the circumstances of the theory of disease caused by viruses. Simply put, it is necessary to consider them as a disease, but understand as a biological phenomenon [1].

This reassessment allows us to talk about the existence of one more, perhaps the most important factor - a natural mechanism for the formation and control of the activity of dangerous viruses in the natural environment. Probably, such a mechanism is of an electromagnetic nature. The development of a systemic transdisciplinary theoretical justification, methodological support and technological solutions based on the use of elements of this natural mechanism, is able to offer more effective ways to control the activity and spread of existing viral diseases.

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# PART 13

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## Impact of COVID-19 Pandemic in Turkey

*N. Tuğay Güven and E. öztürk Işık*

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### Short Letter

Turkey is one of the countries affected by the COVID-19 outbreak relatively late with the first positive case reported on March 10, 2020. Following the first incident, COVID-19 cases escalated quickly and dramatically. As of December 10, 2020, Turkey's number of new cases was 30.424, which is fourth amongst all the countries, following highly populated countries like the USA, Brazil and India. Additionally, the total number of cases in Turkey since the beginning of the pandemic has reached 1.748.567 with a death toll of 15.751 (Turkish Ministry of Health, 2020 [1]).

Turkish Ministry of Health was quick in its response to the pandemic. Only a week after the first incident, the schools and universities were suspended. The restaurants, cafes, museums, shopping malls, hairdressers, nightclubs and wedding halls were temporarily closed. Wearing a mask in public places has become mandatory. Additionally, flexible working hours and shifts were adopted. Although a total lock down was never applied because of economical reasons, curfews during the weekends and holidays have become the standard.

In addition to these policies, a unique age selected curfew was adopted. Turkey is a relatively young country, with a population of 25.5 million children and adolescents while only 7.5 million people are over 65 (Turkish Statistical Institute, 2020 [2]). Turkey decided to and applied a strict curfew for these two age groups; elderly people aged over 65 as they have higher morbidity risk and youngsters aged under 20 as they have a higher chance of spreading the virus without showing any symptoms. Additionally, the youngsters and the elderly are mostly out of the work force, therefore their curfew has not affected the economy. Although in theory it is a very bright idea to lockdown 40% of the population, the isolation of these two age groups actually requires a special attention.

Geriatricians recommend regular social and physical activity for cognitive and emotional well being of the elderly (Soysal, Aydin, & Isik, 2020 [3]). Curfew interrupted their physical and social activities and has the potential of affecting them

negatively both psychologically and physically in the long run.

On the other hand, COVID-19 changed daily lives of adolescents drastically all over the world. A comparative study between Turkish and Danish adolescents' feelings indicated that Turkish adolescents were significantly more concerned about their future with it getting worse with the pandemic (61,4% vs 22.8%) along with worsening feelings of boredom of life. It is discussed that this dramatic difference might be the result of different pandemic measures between the countries such as the curfew. In addition to that Turkish students, even the ones attending private schools, were less likely to have technological equipment and encountered internet connection problems more frequently compared to Danish students (Seyahi, Ozcan, Sut, Mayer, & Poyraz, 2020 [4]). This by itself is a major concern for their future, especially when disadvantaged adolescents who live in far east villages of the country without any internet connection to attend classes is considered. On the other hand, it is suggested that curfew for adolescents in Turkey is a serious matter that has to be discussed in terms of developmental perspective as well. Adolescence is a time when teens have to go out and explore the world in order to develop a sense of self and independence.

There is a risk of adolescents perceiving this curfew period as a suppression of their will while rest of the population has the license to go out and work (Kanbur & Akgul, 2020 [5]).

In conclusion, Turkey is going through a rough time as the rest of the world and is not an exception in terms of increased symptoms of anxiety, depression, post-traumatic stress disorder and stress during the COVID-19 pandemic in the general population (Ustun, 2020 [6]); (Kazan Kizilkurt, Yilmaz, Noyan, & Dilbaz, 2020 [7]); (Xiong et al., 2020 [8]). Nevertheless this age-selected curfew and isolating them from the society, without any compensation mechanisms, might have severe future implications on the psychosocial development, education and psychological wellbeing of adolescents in addition to increased cognitive and physical impairments of elderly that has to be monitored in years to come. Although questions are way more than the answers about the future of Turkey, the answers are not yet to come.

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**N. Tuğay Güven** graduated from Istanbul Bilgi University, Istanbul, Turkey in 2004 with a Bachelor's degree in Psychology. She received her first Master's degree from the Psychological Sciences program of Bogazici University, Istanbul, Turkey in 2007 and her second Master's degree from Advertisement and Publicity program of Marmara University, Istanbul, Turkey in 2011. She has been doing her Ph.D. on Biomedical Engineering program of Bogazici University, Istanbul, Turkey since 2013 and is a Ph.D. candidate. Her current research interests include adoption of novel magnetic resonance imaging techniques to multiple sclerosis disease in order to understand the underlying mechanisms of the disease and increase patients' life quality in the long run.



**Dr. Esin Öztürk Işık** is Associate Professor and Director of Computational Imaging Laboratory at the Institute of Biomedical Engineering of Bogaziçi University, Istanbul, Turkey. She has been conducting research in the field of magnetic resonance imaging (MRI). The main aim of her projects has been developing novel molecular magnetic resonance imaging techniques to allow for a better understanding of underlying biochemistry of diseases in order to improve patient health. The

technical projects at her laboratory has focused on designing new algorithms for molecular MR imaging data acquisition, post-processing and quantitation, as well as biostatistical analysis. Her laboratory has also worked on developing computational methods based on machine learning for MR image analysis for understanding disease mechanisms. Another focus of technical projects has been developing novel quantitative molecular MR imaging methodologies for fast and accurate data acquisition and processing. She has worked on translating all the projects developed at her laboratory into the clinics in collaboration with the clinical investigators for the benefit of the patients. The projects she has proposed have focused on brain tumors, prostate cancer, and breast cancer, with the overarching goal of studying metabolism in various human systems.

Her Educational background is: Ph.D. University of California at Berkeley and University of California at San Francisco. Joint Graduate Program in Bioengineering (August 2002–March 2007), M.S. University of Alabama at Birmingham. Biomedical Engineering (September 1999–December 2001), and B.S. Middle East Technical University, Ankara, Turkey. Computer Engineering (September 1995–June 1999).

# PART 14

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## The Impact of COVID-19 on the United States of America

*Edred Melendez*

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### Short Letter

While February of 2020 began as a normal month for Americans, the country was not ready for what the end of the month had in store. The SARS-CoV-2 virus finally made landfall in the United States, only 3 months after it was first discovered in Wuhan, China. The U.S., one of the largest superpowers in the world, quickly became the epicenter for the COVID-19 pandemic. Whether Americans know it or not, the virus has affected almost every part of their lives and has exposed many faults in various U.S. systems.

COVID-19 has disrupted every aspect of daily life for Americans. Many lost their jobs not even two months after the United States started to feel the effects of the pandemic. In April of 2020, the unemployment rate hit its peak at 14.7%, a percentage that had not been seen since the Great Depression in 1932 (Falk, et al., 2020 [1]). If someone were fortunate enough to keep their job, they would notice a large change in the way they worked. Many have started working from home or have had to enforce and partake in various mask and social distancing restrictions. The newly created phrase “essential worker” is used to describe the part of the U.S. workforce that has not stopped working during the pandemic, due to them being employed in an industry that is deemed a necessity. Industries like healthcare, grocery stores, and postal services, have not seen any pauses in work during this time. Healthcare workers, specifically, have been put under copious amounts of stress due to the added COVID-19 patients. They also face various supply shortages and even blood shortages due to social distancing and the public’s fear of the virus. The effects of the virus not only change American’s work lives but even what they do in their free time has been affected by the pandemic. Restaurants, bars, movie theatres, gyms, and many other leisure activities were forced to limit capacity or shut down to slow the spread of the virus. While many have been able to get by with hobbies, and other at-home activities, much of the American way of life revolved around social gatherings and time spent with friends and family. This rapid and substantial

change in the way they partake in social interactions has played a large part in the negative psychosocial effects many Americans have experienced. The KFF, a non-profit, non-partisan organization that focuses on providing information on health issues, conducted a poll with adults in July of 2020. It was reported that 53% of respondents said their mental health had been negatively impacted by the COVID-19 pandemic. This number was up substantially from a similar poll conducted by the KFF in March of 2020, which showed that 32% of respondents said their mental health was affected (Panchal, 2020 [2]). These effects will likely play a long-term role in the mental health of Americans, even after the pandemic is considered over.

Near the end of 2019, the International Monetary Fund reported that the global economy had slowed substantially and was on its way to a financial crisis similar to the one that occurred in 2008 (Gopinath, 2019 [3]). COVID-19 then became the catalyst responsible for sending the economy spiraling, and every industry suffered as swift economic shutdowns occurred all over the nation. In mid-September, the National Restaurant Association reported that “over 100,000 restaurants had closed either permanently or long-term” in the first six months of the pandemic. The food-service industry is on track to lose \$240 billion by the end of 2020. This is a substantial loss for the U.S economy as the food-service industry was the second-largest private-sector employer before the pandemic. The National Restaurant Association reports that this loss has directly resulted in the unemployment of over 3 million workers (National Restaurant Association, 2020 [4]).

Another sector severely affected by the pandemic is the oil and gas sector. With the sudden drop in demand for oil, largely due to travel restrictions and shutdowns, the industry saw some of the biggest losses it has seen in decades. According to Rystad Energy, an independent energy research company, the oil and gas industry is forecasted to lose over \$1 trillion in 2020, where \$2.7 trillion was made in 2019 (Turak, 2020 [5]). In a report published by Deloitte, this loss resulted in 107,000 layoffs between March and August of 2020. Deloitte also predicts that 70% of these jobs will not be back by the end of 2021 (Dickson, Tilghman, & Bonny, 2020 [6]). These are just two examples of industries that have felt the impact of the pandemic.

Many more like retail, travel, and tourism are faced with unprecedented conditions that have crippled them. On October 18th, 2020, S&P Global Market Intelligence reported that 527 U.S based companies had filed for bankruptcy, and that, “U.S. bankruptcies are on pace to hit their worst levels in 10 years. (Irum & Hudgins, 2020 [7])” All these losses directly attribute to the Congressional Budget Office’s declining outlook for the future of The United States’ GDP. In May of 2020, the CBO projected a nominal GDP for 2020-2021 that was \$3.9 trillion lower than they had projected in January of the same year (Swagel, 2020 [8]). The difference between these two projections is how COVID-19 affected the economy. Regardless of when a vaccine is developed, the United States will be feeling the effects of the pandemic for years to come. On a global scale, the World Bank reports (2020 [9]), “The COVID-19 recession has seen the fastest, steepest downgrades in consensus growth projections among all global recessions since 1990.” They also predict that all advanced economies will shrink by at least 7 percent, and the emerging and developing economies by 2.5 percent. These emerging and developing economies will be hit the hardest as their growth will be the slowest it has been in sixty years according to the World Bank (2020 [9]). For the global economy to recover, complete cooperation from all nations is required.

The poet Robert Frost once said, “The only way out, is through”, a quote which

symbolizes life for Americans fighting to survive the COVID-19 pandemic. However, it is not enough to simply survive this pandemic. The United States must learn from this total systemic failure, to be better prepared for other hardships that will undoubtedly arise. With total cooperation between the public, politicians, and professionals, the United States of America will recover.

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