Athens Journal of Health and Medical Sciences

Quarterly Academic Periodical, Volume 12, Issue 4
Published by the Athens Institute
URL: https://www.athensjournals.gr/ajh Email: journals@atiner.gr
e-ISSN: 2241-8229 DOI: 10.30958/ajhms

December 2025

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Front Pages

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Published by the Athens Institute

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The *Athens Journal of Health and Medical Sciences* (AJHMS) is an Open Access quarterly double-blind peer reviewed journal and considers papers from all areas of medicine (including health studies and nursing research). Many of the papers published in this journal have been presented at the various conferences sponsored by the Health & Medical Sciences Division of the Athens Institute for Education and Research (ATINER). All papers are subject to ATINER's Publication Ethical Policy and Statement.

Athens Journal of Health and Medical Sciences
ISSN NUMBER: 2241-8229 - DOI: 10.30958/ajhms
Volume 12, Issue 4, December 2025
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Athens Journal of Health and Medical Sciences

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President's Message

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The current issue is the fourth of the twelfth volume of the *Athens Journal of Health and Medical Sciences (AJHMS)*, published by the Health & Medical Sciences Division of ATINER.

Gregory T. Papanikos
President
Athens Institute

25th Annual International Conference on Health Economics, Management & Policy, 22-26 June 2026, Athens, Greece

The Health Economics & Management Unit of Athens Institute will hold its **25th Annual International Conference on Health Economics, Management & Policy, 22-26 June 2026, Athens, Greece s**ponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics, researchers and professionals in health economics, management and policy. You may participate as stream leader, presenter of one paper, chair of a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2026/FORM-HEA.doc).

Academic Members Responsible for the Conference

- **Dr. Paul Contoyannis**, Head, Health Economics & Management Unit, Athens Institute & Associate Professor, McMaster University, Canada.
- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Division, Athens Institute & Assistant Professor, School of Nursing, Johns Hopkins University, USA.

Important Dates

- Abstract Submission: **3 March 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **25 May 2026**

Social and Educational Program

The Social Program Emphasizes the Educational Aspect of the Academic Meetings of Athens Institute.

- Greek Night Entertainment (This is the official dinner of the conference)
- Athens Sightseeing: Old and New-An Educational Urban Walk
- Social Dinner
- Mycenae Visit
- Exploration of the Aegean Islands
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4-8 May 2026, Athens, Greece

The Medicine Unit of Athens Institute is organizing its **15th Annual International Conference on Health & Medical Sciences, 4-8 May 2026, Athens, Greece** sponsored by the Athens Journal of Health and Medical Sciences. The aim of the conference is to bring together academics and researchers from all areas of health sciences, medical sciences and related disciplines. You may participate as stream leader, presenter of one paper, chair a session or observer. Please submit a proposal using the form available (https://www.atiner.gr/2026/FORM-HSC.doc).

Important Dates

- Abstract Submission: **20 January 2026**
- Acceptance of Abstract: 4 Weeks after Submission
- Submission of Paper: **6 April 2026**

Academic Member Responsible for the Conference

- **Dr. Vickie Hughes**, Director, Health & Medical Sciences Research Division, Athens Institute & Assistant Professor, School of Nursing, Johns Hopkins University, USA.
- **Dr. Carol Anne Chamley**, Head, Nursing Research Unit & Associate Professor, School of Health and Social Care, London South Bank University UK.
- **Dr. Andriana Margariti**, Head, Medicine Research Unit, Athens Institute & Lecturer, Centre for Experimental Medicine, Queen's University Belfast, U.K.

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Psychological, Emotional, Cognitive and Familiar Factors Associated with Academic Engagement in Students of a Public University in Mexico during the COVID-19 Pandemic

By Octaviano García Robelo[*], Jesús Cisneros Herrera*[±], Gelacio Guzmán-Díaz*[•] & Maritza Librada Cáceres Mesa*[°]

Research is carried out on factors that influence academic performance in a group of students of Educational Sciences, from a public university in Mexico, after confinement due to COVID-19 pandemics. In a non-experimental, cross-sectional design was used, a Likert scale is used, to analyze mainly variables related to students' mental and emotional health and academic engagement. A sample of 34 students (85% female, 20-25 aged). All participants came from other states or towns near to the city, from medium-low economic resources; some of them had work to continue studying. Students reported that they suffered moments of anxiety, fear, loneliness, depression, claustrophobia, and constant stress. Regarding academic engagement, it was found that they were easily distracted, it was difficult for them to complete their homework on time, to learn and to study, and some of them dropped out of school to work in order to financially help his family. It is suggested that research must be carried out to test interventions aimed at preventing and overcoming emotional and mental problems that may affect students' learning and integral development.

Keywords: *academic engagement, anxiety, depression, stress, undergraduate students, COVID-19 pandemics*

Introduction

Due to COVID-19 pandemic, schools, colleges and universities had to close their doors and they continued their activities through alternative ways. Confinement was the main measure taken by governments all around the world in order to reduce the number of new COVID-19 positive cases. This measure implied also reduced opportunities for students to have face-to-face interactions outside the family life.

The Autonomous University of the State of Hidalgo in Mexico was also affected and had to close its classrooms at the beginning of 2019, so during the confinement students had to receive online education at home. The university authorities, together with professors, administrators and other staff members, reorganized to offer distance education, which generated new needs and the emergence of several problems that affected the entire development of students, from the cognitive, social, academic,

[*]Full Time Research-Professor, Autonomous University of the State of Hidalgo, México.
[±]Full Time Research-Professor, Autonomous University of the State of Hidalgo, México.
[•]Full Time Research-Professor, Autonomous University of the State of Hidalgo, México.
[°]Full Time Research-Professor, Autonomous University of the State of Hidalgo, México.

psychological and emotional, in addition to other related factors, such as family interaction and support.

In 2022 the return to face-to-face classes began at this university. Then, it came the need to know how the students lived through this situation, how they perceived the consequences of the confinement period, what areas of their development were affected. So, we proceeded to carry out research on students of the Bachelor of Science in Education of this public university, based on the next research question:

Is there a relationship between psychological, cognitive, metacognitive, affective and family factors, with the academic engagement of Bachelor of Science in Education students at a public university in Mexico after the COVID-19 pandemic?

The general objective of the research was to analyze how the main psychological, cognitive, metacognitive, affective and family factors are related to the academic engagement of Bachelor of Science in Education students at a public university in Mexico after the COVID-19 pandemic.

It is expected that by conducting this research, the results will help to accurately identify some of the main variables and factors related to academic engagement, through the development of a Likert scale, the use of descriptive and inferential statistics for data analysis, which is further described in the methodological part.

Identifying these variables will help to understand this phenomenon about the serious consequences suffered and experienced by students during this time of the COVID-19 pandemic, with the possibility of generating diagnostic, preventive and remedial programs in similar and emerging cases.

Academic Engagement in University Students

Academic engagement has been studied because of its close relation to academic performance (Heng 2013). There are different definitions of academic engagement. It was first defined as the mental and physical involvement that students show in different academic activities, including class attendance, relations to peers and teachers and extra-curricular activities (Astin 1984). Academic engagement has also been understood as the quality of effort made in three core activities: contact with teachers, cooperation with peers, and active learning (Pace. 1990). Kuh et al. (2008) have a broader perspective on academic engagement, since it includes not only the students' effort, but also the educational institutions' efforts devoted to effective educational practices. A different approach is taken by Schaufeli et al. (2002); they took see academic engagement from the point of view positive psychology applied to organizational settings, where job satisfaction was proposed as the opposite side of burnout. In this sense, academic engagement is defined as a state of mind characterized by vigor, dedication and absortion. However, the most fitting definition of academic engagement comes from Fredricks and McColskey (2012), Eccles and Wang (2012), and Sinatra et al. (2015). They consider academic engagement as made up of behavioral, emotional and cognitive aspects. The behavioral aspect encompasses the participation in academic activities, such as class attendance and homework involvement. The emotional aspect refers to the

relationship the students have to peers, professors and the educational institution. The cognitive aspect is considered as the effort devoted to comprehend complex topics and learn difficult skills (Fredicks & McColskey 2012).

This research draws on the definition of Fredricks and McColskey (2012) referred to academic behavioral engagement, since it is the clearest one in terms of empirical content. Schauferli et al.'s (2002) view is discarded because it implies considering the educational setting as if it were an organizational one, where profit is the main objective.

Depression, Anxiety and Stress in University Students

University students have been associated to certain mental health problems related to the difficulties and challenges involved in this life stage. For example, before the pandemic in Germany, 36.6% of students reported depressive symptoms, 41.8% high levels of anxiety and mental stress due to excessive demands and the uncertainty in economy, job and social relationships (Herbert et al., 2020). In a study carried out in UK, Germany, Italy and Spain lower levels of mental health were observed during pandemic compared to pre-pandemic normative scores (Allen et al. 2022). This finding was interpreted in the context of temporary or permanent job loss of nearly half of working students. So, the psychological distress experienced by university students was related to the inability to pay de life and study costs during pandemic (Allen et al. 2022).

The psychological problems among university students have been related to loneliness (Allen et al. 2022). Other symptoms observed in university students are sleep problems, short temper, low self-esteem, feelings of helpless, feeling worthless and feeling unhappy (Almonami et al. 2021).

Depression is an important problem among university students. Herbert et al. (2021) found in Germany that 51.82% of university students obtained scores above the cut off for depression, while 19.09% were exactly at the cut off. Besides, there were no differences between men and women. And the same pattern was observed in Egypt, implying that these rates transcend cultural differences. In an Italian sample, moderate levels of depression as measured by the short version of the BDI were observed (Giusti et al. 2021). However, when analyzed by gender, a severe level of depressive symptoms is observed in a high proportion of women. Russell et al. (2023) could document the changes from prepandemic to pandemic times in their longitudinal study that began in April 2019. They found that percentage of probable major depression increased from 21.7% in April 2019 to 36.7% in October 2020. A similar increase was observed in anxiety in the same study. Roche et al. (2022) also had the opportunity to compare results from two different samples of the same university in the United States taken in the 2016 Fall and in the 2020 Fall. Self-reported stress, depressive symptoms and anxiety symptoms were significantly higher in 2020.

Anxiety is repeatedly found among university students in several countries. Allen et al. (2022) found anxiety levels higher than normative scores in UK, Germany, Italy and Spain. This rise in anxiety levels has been associated to concerns

about the future. Since economy has been so affected by pandemic, university students anticipate adverse conditions in the labor market (Mariononi et al., 2020). Russell et al. (2023) also found greater concerns among students regarding future job prospects. Also in a Peruvian sample, results show that a significant percentage of university students presented significant symptoms of anxiety (23%), depression (24%) and insomnia (32%) (Vilca et al. 2021).

Regarding emotions experienced by university students, Herbert at al. (2021) found that feeling not happy, sad, angry, surprised, disgusted and afraid were de most frequent emotions, appearing in 56% to 93% of university students.

During pandemic, university students (65.5%) considered that the worry about their mental health more than before the pandemic, and also they worry more than before about their physical health (71.4%) (Herbert et al. 2021). Russell et al. (2023) found that students consider that their mental health worsened during pandemic.

Rates ranging from 31.8% to 76.4% of university students report to have gained weight, to eat more than before the pandemic. They don't sleep nor exercise more than before the confinement.

Difficulties in learning have also increased due to pandemic. Most university students (76.4%) have trouble in self-regulated learning and are unable of focusing their attention on classes. Moreover, they find difficult to study due to the pandemic situation (Herbert et al. 2021).

A widely found difficulty for university students involves technological devices. In a sample from Italy, Giusti et al. (2021) found that students had connection problems because of sharing their WiFi network with other users. This hinders the academic performance of students.

The confinement brought about changes in the study context. Giusti et al. (2021) found that 80% of university students were used to study in company of classmates in open spaces or in the library at the university facilities. So, they had to change. This factor was the only predictive one of low academic performance, while gander, age, working status and lack of sharing learning experiences did not showed any predictive value. Giusti et al. (2021) explain this relationship between study context and poor academic performance as a consequence of the difficulty for concentration in the home environment. Moreover, this relationship was increased by more than 3 times when students presented COVID-19 contagion anxiety.

A major disadvantage of distance education is the lack of face-to-face interaction between students and teacher. Moreover, the scarce opportunity for pair socialization is also a disadvantage of distance education (Giusti et al. 2021). Russell et al. (2023) also found that students consider that several aspects worsened due to pandemic, such as connection to university peers, connection to the university and connection to friends.

However, the changes introduced by pandemic had also some advantages according to students' perspective. Distance classes allowed students to draw on new academic resources such as video lessons, having de possibility to be more autonomous in their study activities (Giusti et al. 2021). Female students present more psychological symptoms than males (Almonami et al. 2021).

Some correlations have been observed between age and psychological symptoms in university students. Almonami et al. (2021) found that young students, aged 18-20 years, show low self-esteem, hopelessness, helplessness, worthlessness and unhappy

feelings. While students, aged 21-25 years, presented mainly depression, and students older than 30 years experienced anxiety, sleep problems and short temper.

Regarding coping, several strategies have been observed: 1) studying, 2) working, 3) exercising, 4) playing video games, 5) worshiping (meditation), 6) sleeping, 7) watching COVID-19 news and updates, 8) watching entertainment programs like (movies and series), 9) cooking, 10) house chores like cleaning and organizing, 11) helping their siblings or kids in studying and homework, and 12) volunteering in hospitals or seniors' houses (Almonami et al. 2021). Female students draw on strategies 6, 1, 5, 9 and 11, while males draw on 2, 4, 7 and 8.

Method

A non-experimental correlational design was used. The use of a correlational approach is quite common in education and psychology because associations among variables are often explored. This approach does not involve an experimental manipulation of treatment variables, and therefore the results should not be used as a proof of cause-and-effect relationship (Mertens 2015).

Participants

A sample of 34 students participated, 8 men and 26 women, with an average age of 22 years, between 20 and 27 years old, who were studying for a Bachelor's degree in Education Sciences, at the Autonomous University of the State of Hidalgo, in the central zone of Mexico.

Instrument

A Likert scale was applied to collect data at a single point in time. The scale was designed in Google forms, with 40 items, divided into five factors.

Procedure

The scale link was sent through e-mail to the students. Once the scale was answered, the database was recovered in Excel and the analysis was done in SPSS 22. software, where first its internal validity and reliability was analyzed, by Cronbach's Alpha test and factor analysis.

Subsequently, a descriptive statistical analysis of the data and a Pearson correlation test among the scale's factors were performed. After applying the scale to the sample and obtaining the average of the total scale, a low group and a high group were formed; in the items that measure an aspect or positive perception, the response values were changed to make the summation logical and avoid adding items that measure a positive aspect or perception.

We proceeded to change their response values so that the summation would be logical and avoid adding positive and negative items. To form the two groups, approximately the mean (M= 66) was considered as the division point to make

these groups, with the score of 65 percent below the measure was the low group and a score of 66 percent above the mean was the high group (it is clarified that the higher the percentage obtained in the total scale, the greater the problems or difficulties and vice versa). With these groupings it was possible to differentiate with the t Student test for independent samples.

A last analysis was a multiple linear regression in order to check the influence of independent variables, in the case the five factors of Liker scale about the Scholar average.

The following hypotheses were proposed:

H1 There is a statistically significant correlation between the Factor cognitive and metacognitive problems and the Factor academic performance in Bachelor of Science in Education students.
H2 There is a statistically significant correlation between the Factor psychological and emotional problems and the Factor academic performance in students of the Bachelor of Science in Education.
H3 There is a statistically significant correlation between the Factor psychological and emotional problems and the Factor family in students of the Bachelor of Science in Education.
H4 There is a statistically significant correlation between the Factor psychological and emotional problems and the Factor cognitive problems in students of the Bachelor of Science in Education.
H5 There is a statistically significant correlation between the Academic Performance Factor and the Grade Point Average Factor in Bachelor of Science in Education students.

Results and Discussion

Results are described as follows: scale and sub-scales' reliability, scale's factor analysis, graphs for each of the five factors, correlations among the factors, Student's t test of differences and finally multiple linear regression analysis.

Reliability and Validity Results of the Family, Cognitive, Mental Health, and Academic Engagement Factors Scale in College Students after COVID-2022.

Table 1. *Reliability of the Family, Mental Health, and Academic Engagement Scale in College Students after COVID-2022*

Factor	**p**
General Alpha	.91
Family	.73
Resources at home	.21
Academic Engagement	.69
Cognitive and metacognitive problems	.90
Psychological and emotional problems	.91

A Cronbach's Alpha (.91) was obtained, which means that the instrument is highly reliable (Table 1) to evaluate family, academic, cognitive and psychological factors in a sample of 34 students of the Bachelor's Degree in Education Sciences who were in their sixth semester at a public university in the State of Hidalgo in Mexico.

Table 2. *Results from a Factor Analysis of the Scale of Psychological, Emotional, Cognitive and Family Factors on Academic Engagement in University Students*

	Factor loading				
Item	1	2	3	4	5
Factor 1. Psychological and emotional problems					
1. I wanted to run a way	**.56**	.27	.25	.23	.48
2. I was invaded by fears for no reason	**.51**	.41	.45	.00	.38
3. I was short of breath	**.60**	.45	.35	.06	.21
4. I was easily depressed	**.54**	.26	.54	.11	.33
5. I felt sad	**.51**	.00	.52	-.16	.15
6. I felt alone	**.44**	.51	.28	.20	.16
7. I repeatedly felt stress	**.52**	-.35	.15	.06	.32
8. My head ached continuously	**.33**	**.56**	.49	.13	-.05
9. I felt claustrophobic	.01	**.84**	.12	.00	.09
10. I got sick continuously	.37	**.53**	-.05	-.08	.30
11. I received psychological treatment	-.02	**.29**	.22	-.11	.74
12. I felt emotionally out of control	**.51**	.13	.51	-.05	.40
13. It was difficult for me to relate to others	**.72**	.20	-.08	.27	.04
14. I attacked people	-.05	**.76**	.09	.17	.26
15. I used some drug	-.19	**.73**	.05	-.34	.26
16. I consumed alcohol to seek relief	-.07	**.76**	.02	-.15	-.03
17. I was distressed	**.70**	.21	.22	.37	.08
Factor 2. Cognitive factors					
18. It was difficult for me to learn	**.89**	-.03	-.05	.01	.17
19. It was difficult for me to understand the topics	**.79**	.01	-.10	.21	-.04
20. It was worried about not understanding the instructions	**.81**	-.08	-.07	.10	.16
21. I was easily distracted	**.72**	-.15	-.25	.39	-.01
22. It was difficult for me to study	**.78**	.11	.37	-.09	-.02
23. I lost a close relative	**-.13**	.15	.63	.05	.33
Factor 3. Family					
24. I had problems family	.25	.06	**.75**	.14	-.13
25. I take care of a sick family member	.06	.22	**.70**	.12	.03
26. I had a sick family member	-.01	-.09	**.59**	.38	.36
27. I dropped out of school to support my family financially	-.06	.56	**.32**	.35	.10
28. I worked to contribute to family expenses	.16	.07	**.43**	.63	-.21
29. I carried out activities at home	.11	-.58	**-.06**	.61	.03
Factor 4. Academic Engagement					
30. My school performance lowered	**.46**	.59	.03	.09	-.01
31. I failed to full fill the task	**.54**	.62	.10	-.02	-.17
32. I did my homework at the last minute	**.74**	.11	.16	-.21	-.04
33. Finishing a simple activity took me longer than usual	**.77**	.00	.30	.03	-.37
34. Did other activities while in class	**.76**	-.25	.27	-.02	.11
35. I participated during classes	-.16	-.11	-.24	**-.78**	.02
36. I liked team work	.06	-.01	.26	**-.45**	-.09
Factor 5. Home resources					
37. I had computer equipment to myself	-.12	.08	-.18	**-.51**	.02
38. I had a quality internet connection	-.10	-.03	.01	.01	**-.57**
39. I shared the computer equipment t home for homework	**.29**	.04	.11	.14	.25
40. My family provided me with the necesary resources to continue studying	-.18	.51	.47	-.04	**-.39**

Note: N=36. A factor analysis was performed with a principal component extraction method; five fixed factors were extracted with a varimax rotation.

Table 2 shows that most of the items are distributed and grouped in the 5 factors. However, in Factor 5 Resources at home, the factor loadings are dispersed.

On the other hand, the results of each factor are presented below, where the arithmetic mean of response for each item is observed for the entire sample (N=34)

of participating students. Here, it is important to consider that the response values correspond to: 4=Always, 3=Frequently, 2=Rarely and 1=Never.

Figure 1. *Family Factors*

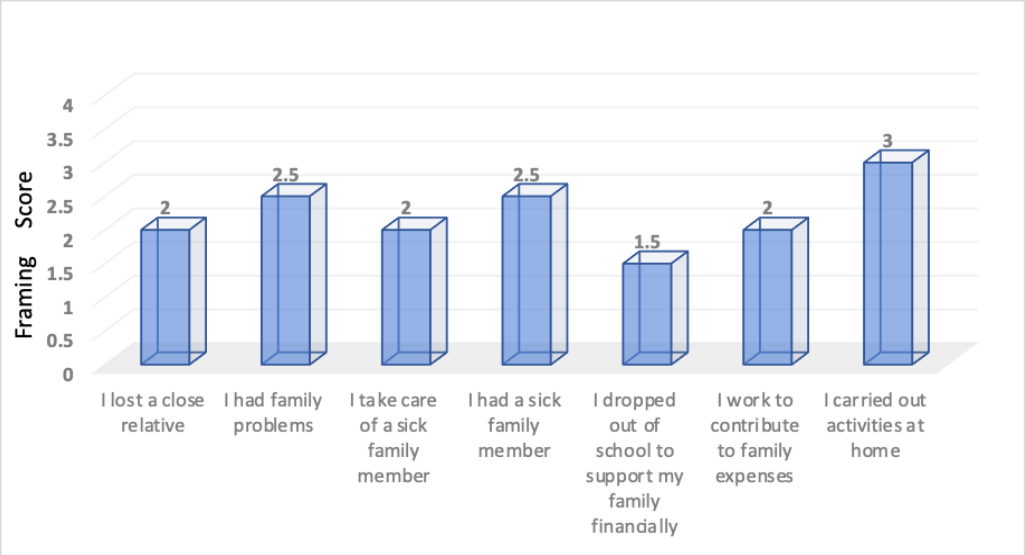
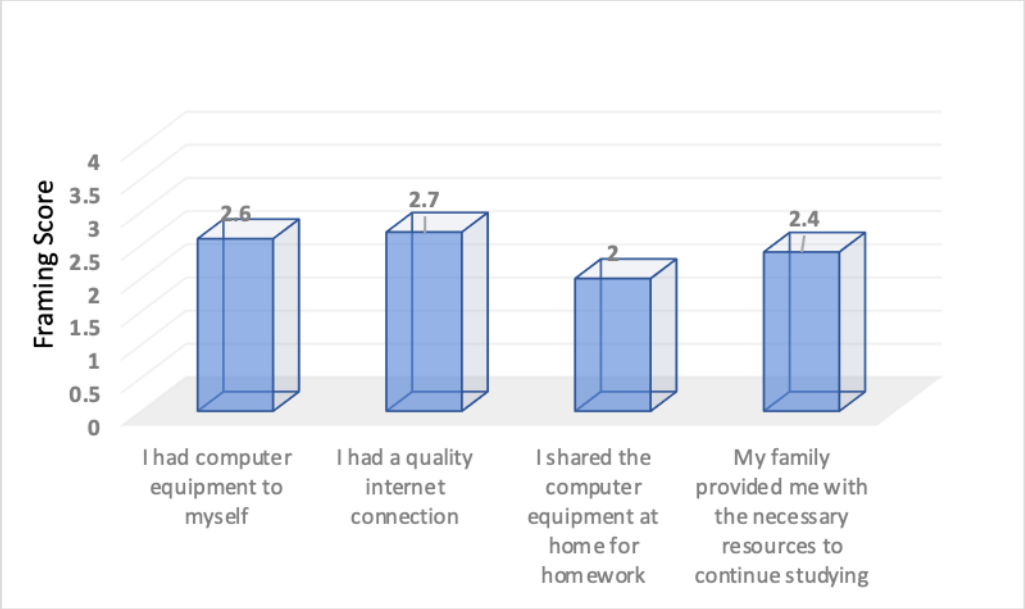


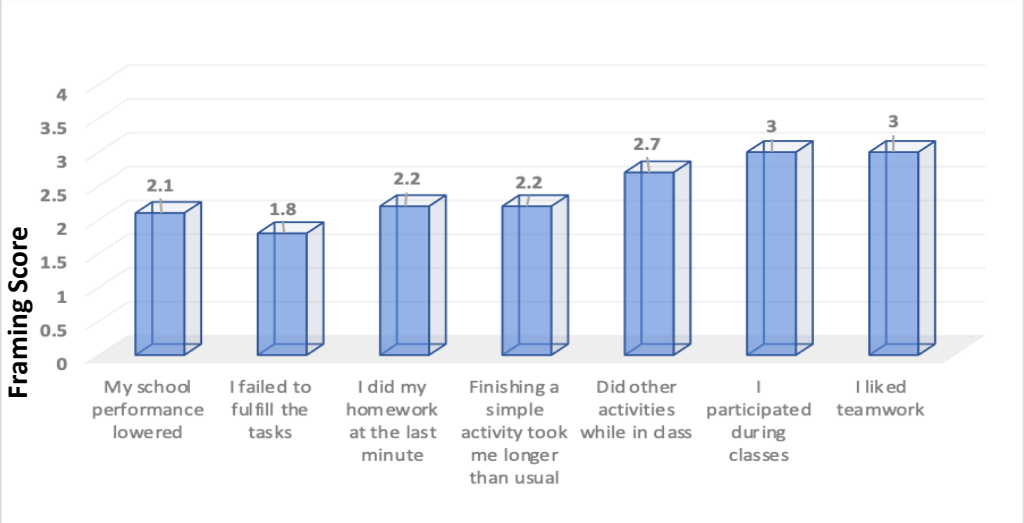
Figure 1 shows that the students reported that they frequently performed different activities at home, such as taking care of a sick family member, preparing food, cleaning the house, and other house tasks, which was also observed by Almonami et al. (2021). Students reported that they rarely worked to contribute to the family's financial expenses. Importantly, they reflect that they sometimes dropped out of school to support family expenses and rarely lost a sick person.

Figure 2. *Home Resources Factor*



Regarding resources at home (Figure 2), students reported that they often had a computer and a quality Internet connection, which may have favored their connection during their online classes. At the same time, students reported that their families supported them with the necessary resources to continue their studies. Family support is fundamental to ensure better school performance, permanence in college and graduation, and continued insertion in the labor market (Shaw 1998).

Figure 3. *Schoolar Performance Factor*

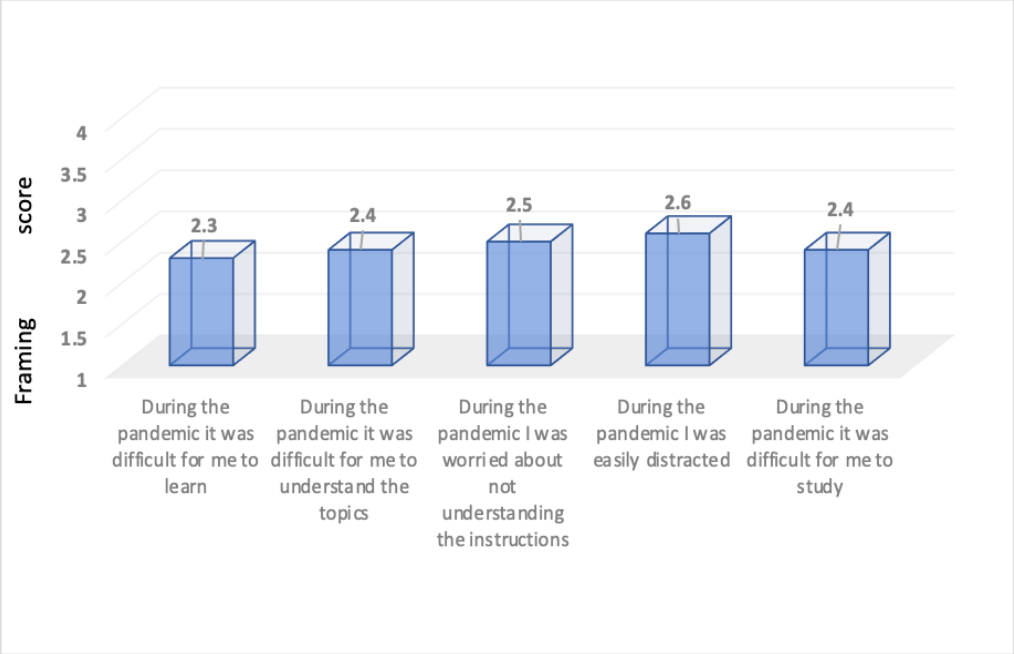


According to Figure 3, students' responses reflect that they often enjoyed teamwork and participation in classes, which probably helped not only to improve their learning but also to develop and test their social skills with their peers and the teacher.

In their school performance, students consider that during the pandemic their academic performance was low, they failed to turn in their homework, were distracted during classes and took longer to finish their homework.

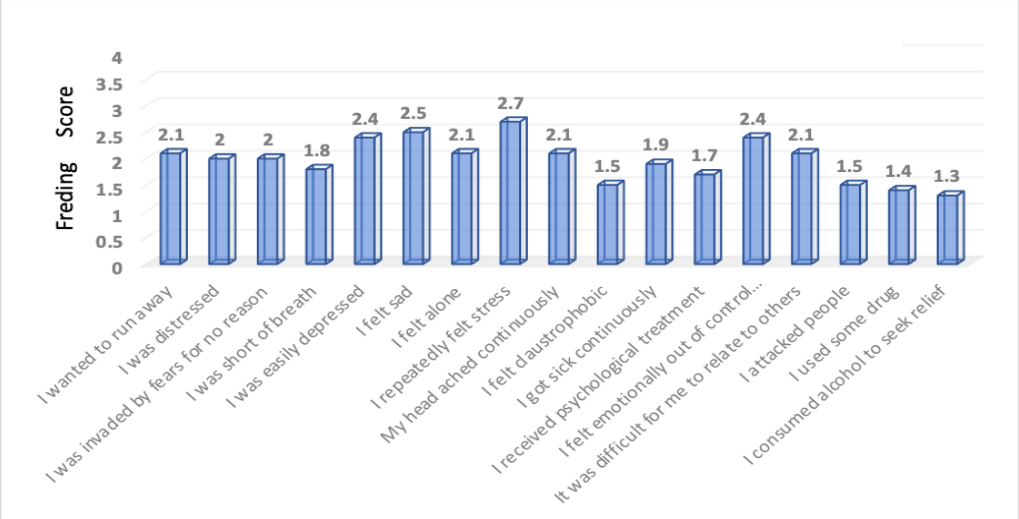
Sheehy et al. (2023), in their work they found that the teacher can help improve and strengthen students' epistemological beliefs about the importance of studying. Therefore, it is important to consider the teacher as a fundamental resource to work on this possibility with their students, helping them to value their efforts to learn.

Figure 4. *Cognitive and Metacognitive Problems Factor*



In Figure 4, according to the students' responses, it is showed that they reported cognitive and metacognitive problems, such as difficulties in studying and paying attention, as well as understanding class topics and learning. These competencies are fundamental for the best professional development of students, as well as key for them to acquire the necessary knowledge during their career or profession.

Figure 5. *Psychological and Emotional Problems Factor*



Regarding psychological and emotional problems, students report in their responses (Figure 5), that they frequently felt stressed, sad, felt emotionally out of control and easily depressed, among other characteristics. These emotional problems have been observed consistently in different studies such as Herbert et al.'s (2021)

and Giusti et al.'s (2021). Similarly, they report that they felt symptoms related to distress, anxiety, such as fear and the feeling of running away. To a lesser extent, the students' responses suggest that they consumed drugs and alcohol, which undoubtedly affected their psychological and emotional health more in those who gave these responses.

Table 3. *Descriptive Statistics and Correlations for Study Variables*

Factor	N	M	SD	1	3	4	5	6
Family	34	56.09	16.60	_				
Schoolar performance	34	62.18	14.01		_			
Cognitive and metacognitive problems	34	61.91	20.11		**.66****	_		
Psychological and emotional problems	34	50.34	15.49	**.44****	**.59****	**.50****	_	
Scholar average	34	9	.35		**-.51****			_

Note: In Mexico normally the Scholar average is between 0 to 10 points.

According to the results (Table 3), it was found that there is a statistically significant and directly proportional correlation between the Cognitive and metacognitive problems factor in relation to the Academic performance factor.

There is a statistically significant and inversely proportional correlation between the academic performance factor and the general average factor.

The Factor psychological and emotional problems is the one that correlates statistically significantly, and is directly proportional, with the Factors: Family, Academic engagement and Cognitive and metacognitive problems.

This last factor indicates that the more psychological and emotional problems a student presents in this sample of university students, the greater the academic performance problems will be, as well as family, cognitive and metacognitive problems.

A final statistically significant and inversely proportional correlation was between the school approach factor and the academic performance factor.

Table 4. *Results of Student's t-test for Differences between High Group and Low Group*

Factor	Group1 (N=15)		Group 2(N=17)		*t*(34)	*p*
	M	SD	M	SD		
Family	48.9	13.6	63.2	16.5	-2.74	.010
Home resources	60.6	13.9	64.7	15.9	-.788	.437
Schoolar performance	55.2	10.6	69.1	13.7	-3.28	.002
Cognitive and metacognitive problems	52.0	14.9	71.7	20.1	-3.24	.003
Psychological and emotional problems	37.7	8.1	62.9	9.4	-8.33	.000

In these results (Table 4) it was found that there were statistically significant differences in the four of the five factors evaluated, where the arithmetic mean was

higher for Group 2 compared to Group 1. However, there were no significant differences between the two groups in the home resources factor.

Table 5. *Multiple Linear Regression Model of Cognitive and Metacognitive Problems on Academic Engagement*

Predictor variables:	F(1,33)	R^2	B	SE*a*	p
Model 1					
Constant			33.31	5.9	
Cognitive and metacognitive problems	25.95	.44	.66	.09	<.001
Dependent variable: Academic engagement					
Note: *a* Standard Error					

Table 5 shows that the Model 1, taking the Cognitive and metacognitive problems as independent variable, can predict significantly 44% of the dependent variable Academic engagement variable.

Table 6. *Multiple Linear Regression Model of Cognitive and Metacognitive Problems and Psychological and Emotional Problems on Academic Engagement*

Predictor variables:	F(2,33)	R^2	B	SE*a*	p
Model 2					
Constant			25.09	6.4	
Cognitive and metacognitive problems			.49	.49	<.001
Psychological and emotional problems	17.92	.53	.34	.34	
Dependent variable: Academic engagement					
Note: *a* Standar Error					

Table 6 shows that the Model 2, taking the Cognitive and metacognitive problems and the Psychological and emotional problems as independent variables, can predict significantly 53% of the dependent variable Academic engagement.

Conclusions

According to the descriptive analysis it is concluded that the students of the Bachelor of Science in Education, reported that during the pandemic their academic engagement was affected, which affects directly their academic performance, given that their learning diminished and they were affected by diverse psychological and emotional factors; cognitive and metacognitive and family and resources provided at home during the pandemic COVID-19.

The psychological and emotional state of the students was affected, mainly because they often felt stressed, sad, depressed and anxious, sometimes felt out of control, and sometimes resorted to alcohol and drug use. Although some of them reported having received psychological care, it is important that the university

should try to review these mechanisms and alternatives for remedial care and prevention in the future when students may present these or similar situations, not just pandemics. In countries with scarce resources or in the process of development, this type of psychological care may not exist in this case, which is limited due to the lack of health psychology professionals and other community health disciplines.

Emotional problems are a very serious problem among university students. Therefore, universities should design programs where clinical psychologists, psychiatrists and other mental health professionals participate in order to reduce these problems in university students. Mental health promotion is needed, but also treatments for those who already suffer from an emotional disorder. Mental health is not only important for the students' wellbeing, but also for their cognitive functioning and learning skills.

In daily life in the classrooms, teachers are needed to promote the development of high psychological functions, such as reflective analysis, in order to improve learning and complex thinking. Teachers should also guide their students to acquire the study habits that best fit their characteristics in order to engage them in the academic activities and tasks that will help their academic performance.

In terms of cognitive skills, there were difficulties in learning and understanding certain subjects. In their mathematical and cognitive skills, they had difficulty concentrating, as they were easily distracted. In their tasks they spent more time than necessary, so they were delayed to conclude them. The results of this study reflect the need to develop and test more workshops or programs that encourage and support the development of these cognitive and metacognitive skills and abilities, from the time students enter and remain in college.

Regarding the analysis of differences with Student's t-test, it is concluded that there are statistically significant differences between the results of the applied scale, between a group of students with low scores and another group with high scores, where the arithmetic mean is higher for the group of students who report having greater difficulties. However, there are no statistically significant differences in their academic average, but the arithmetic mean is lower (M=8) for the group with high scores than in the group with low scores (M=9), both in their answers in the Scale applied. This indicates that the greater the difficulties in these factors, the lower the school average and vice versa. Therefore, it is necessary for universities to guarantee the psychodiagnostic evaluation and its intervention to continue supporting students who may present diverse difficulties, such as those mentioned in this research.

This work provides data for future research, to investigate and test preventive programs to address various pandemic situations in universities and other schools, such as providing emergency care to students who present serious conditions, related to psychological, emotional, cognitive, metacognitive and family problems that affect their school performance and as such their academic average, and their quality of life in general.

Finally, this research contributes methodologically, a highly reliable Likert scale that measures the factors already described, which has possibilities of improvement to evaluate the factors mentioned. This scale can be applied in schools in Mexico and in other schools around the world. It can be used to carry out studies in comparative

education and comparative sociology, on this delicate and complex subject that has affected humanity at all levels and social strata, referring to the COVID-19 Pandemic.

Recommendations

The *Scale of Psychological, Emotional, Cognitive and Family Factors on Academic Engagement in University Students* can be used, since it proved to have reliability and validity. However, the scale might also be improved by removing items with low factor load. The Family factor items show low factor load as well as low reliability. This suggests that the items could belong to a different construct. Therefore, it could be necessary to design another instrument aimed at measuring exclusively the family factor and its relation to the academic engagement.

Moreover, more specialized statistical analysis is needed, such as structural equations models, that allow to predict more exactly the effect of independent variables on dependent variables.

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Athens Journal of Health & Medical Sciences – Volume 12, Issue 4, December 2025 – Pages 239-258

Analysis of the Economic and Social Costs of Suicide in Yucatán, Mexico: An Approach for the Design of Postvention Public Policy

*By Maria A. Pacheco Pantoja**

Suicide is a public health problem that, despite having prevention programs, rates are rising every year in Mexico. But beyond this situation, there is a little studied and analyzed issue: the economic and social costs that are generated after the suicide of a person, and that have repercussions on the family nucleus and society. The expenses associated with this type of death can last for years and considerably reduce the family income and, therefore, the quality of life of the survivors of suicide. The short- and long-term costs destabilize the economy of families and have long-term negative consequences for them, as well as for the business sector and society. The professional interest in this research stems from the current lack of information regarding the aforementioned consequences and the absence of public policies addressing them. This oversight in the political agenda may be attributed to the limited in-depth studies on the practical consequences of suicide within families, as well as in business and social spheres. The continuation of this research has the potential to foster greater recognition of this widespread issue.

Keywords: *suicide, economic costs, survivors*

Introduction

This research addresses the economic and social costs that occur as a consequence of a person's suicide. Suicide is defined as the act of taking one's own life by any means, according to the World Health Organization (WHO), as stated in different documents on its official website. The causes are multifactorial and include biological (age, gender), psychological (mental illness) and environmental (personal conflicts) aspects. According to the WHO, about 800,000 people commit suicide every year. For every suicide, there are many more suicide attempts each year. Among the general population, an unsuccessful suicide attempt is the single most important risk factor.

There are guidelines for suicide prevention, dictated by the aforementioned organization, which have been adopted by some countries as part of their public health policies, although it can be said that these have not had the desired results when official statistics are reviewed and unofficial statistics are known in various regions or countries. On many occasions, these public policies end at the moment when a person commits suicide and becomes part of the statistics, without any follow-up and in-depth study of the effects that take place in the immediate moment, as well as in the medium and long term.

*Professor, University Anahuac Mérida, Mexico.

This research analyzes the consequences of suicide on the family, business, and social spheres to determine the impact that this type of death has on families. There is a wealth of information about the grieving process, the psychological effects that persist over time, and existing programs for its prevention. This paper uses a methodology to analyze the economic consequences and the impact on society in general when a suicide occurs.

And this research was conducted precisely because of the lack of information on the economic and social consequences of this type of death in Mexico, which affects a highly variable number of people. There is no program to address the inherent problems, primarily due to a lack of in-depth studies on the subject. Official figures can be found in government agencies such as the National Institute of Statistics and Geography, but only on the number of deaths and their causes, but not on the lasting consequences over time.

Literature Review

To define economic and social costs, we will first analyze what a cost is, the different types of costs, and some terms used in economics.

In everyday life, economic units carry out various types of transactions, such as the purchase and sale of goods and services. Goods can be basic or luxury consumer products, and services can include healthcare, transportation, or education, among others. Economic units include families and individuals, businesses, and government entities at any level: federal, state, or municipal. Transactions involve costs, which can be of various kinds (Parkin 2020). A cost is the price paid for the goods and services acquired, whether intermediate or final, as well as for the inputs used to produce goods, labor, and technology (Calleja 2013).

In economics, experts equate economic cost with opportunity cost, that is, a situation in which one option is sacrificed to choose another. According to Parkin (2015), cost is something that must be given up, a decision that involves not doing something in order to do something else, something that seems more convenient to the individual. Opportunity cost is a concept derived from subjective behavior.

The rational behavior of an economic unit, whether a person or a company, would then consider the benefits a choice could provide, in addition to, or in contrast to, the monetary gains it could achieve in the short or medium term (Parkin 2020). This rational behavior includes an analysis of all the advantages that the choice made could provide, such as, among others:

1. Improved current quality of life. This indicator can be provided by various variables, such as having access to healthcare and education services, owning a home or car.
2. Future prospects. The decision to have health or life insurance, have savings for unforeseen situations or retirement, or own properties to generate rental income.

3. Consumption expectations. The way a good or service is consumed is also a choice based on rational behavior and can change over time according to changing needs and the abundance or scarcity of resources.

Economic costs are also private costs, as individuals or companies decide to incur them, according to their needs and objectives. However, they also have a social component, as they are immersed in a collective context and the latter is the recipient of the consequences of the decisions of individuals or companies. The social cost falls on third parties; the number may be indeterminate, whether a sector of the population or society as a whole (Bassols 2005).

Social costs can be studied as variables that affect a group of people, businesses, or economic units. They can be difficult to measure, but when related to economic costs, they can be quantified. According to John M. Keynes (cited by Roll 1975), society assumes costs through a macroeconomic analysis of certain variables such as poverty, unemployment, productivity, economic inequality, income, savings, consumption, and investment.

Economic costs are closely linked to social costs. The decisions individuals make to satisfy their needs, regardless of their needs, will incur costs, but the decisions they make can affect all or part of society. The decision to close a business, for example, will have consequences for society; if the business was polluting, the decision to close it will result in a positive externality for its environment. Furthermore, closure can lead to unemployment, loss of human capital and production, and therefore, product shortages and decreased income.

Continuing with what was seen in the previously, the consequences of a suicide on society can be measured by the impact this event causes in terms of social costs. It is worth remembering that social costs are those borne by part or all of society as a result of the particular decisions of certain individuals or groups of people, which affect a sector of the population. Durkheim (1897) explains that there are certain social situations that can lead a person to make this decision. Although this author wrote the book “Suicide: A Study in Sociology” more than 100 years ago, the research he conducted over a long period of time is still relevant today. He analyzed cases from Europe, but the similarities with other countries and other eras are significant, according to various references in the literature that reference this author.

Durkheim identifies several social problems that can lead to the decision to commit suicide, such as poverty, unemployment, family situation, and mental illness, as causes that can disrupt an individual to the point of making such a decision. As other authors point out (Santos and Marcon 2017), it is difficult to attribute the cause of this phenomenon to just one factor. Not all people living in poverty commit suicide, and not all people who become unemployed do so. Similarly, not all people diagnosed with a mental illness commit suicide. Thus, the causes can be multifactorial, and it is not easy to determine a single one, although there may be a trigger that provokes it. However, the social environment affects individuals' decisions to varying degrees.

Durkheim's study of the social context is an analysis of the causes and consequences of suicide in the social context, and will be analyzed below. He establishes the role of the individual as part of a society, creating ties of family,

affection, and convenience, such as work. When analyzing the social context of suicide, it is impossible to ignore the fact that human beings are influenced by their environment, in both negative and positive ways.

Durkheim explains that, although the same conditions may affect a number of people, there is insufficient evidence to affirm that, under equal social and environmental circumstances, the determining factor lies in mental illness, although it may be one of the factors that contribute to the event. He devotes a portion of his study to mental illnesses that may contribute to the causes of suicide. He repeats this statement when he mentions impulsive suicides, that is, those that occur without any apparent mental illness inherent to the individual. However, there are cases in which another type of illness, in a terminal state, may cause the person to hasten the end so as not to burden caregivers or because they are in a state of desolation in the face of certain death. Therefore, to affirm that "healthy" people do not commit suicide would be a mistake, since proving mental health is not a simple process, especially after the act has been committed.

In certain cases, there may be a medical history that could be a reason for psychiatric or psychological study, but this aspect cannot be generalized. A similar conclusion can be drawn for other types of negative collective situations, in addition to the example of war, as mentioned above. Therefore, relying solely on statistical data to establish the causes of suicide may be inaccurate.

It has been widely presupposed that clinician inherently recognize the criticality of conducting thorough assessments for suicidality, potential harm to others, and instances of abuse. Notwithstanding this supposition, or arguably as a consequence of it, there has been a paucity of empirical investigation into efficacious training methodologies for aspiring psychologists and other mental health practitioners in these comprehensive assessment skills, particularly in ways that obviate risk to actual clients—a risk often presents in conventional practicum settings (Osborn and Cash 2021).

Interindividual relationships that are transmitted from generation to generation were also observed by Durkheim, and collective tendencies are no less important than cosmic factors. In these transmitted interindividual relationships, one can observe trends in the prevalence of suicide in a certain area or population, and in which patterns of behavior reinforced by other factors, such as cosmic ones, can be repeated. This refers to the climate, the seasons of the year, or the times in which certain types of work or activities are carried out. He observed a tendency for suicides to occur more frequently at certain times of the year. This could be explained by the fact that these are the times when there is more work and more social interaction than in times when it decreases.

He also observed gender trends, in which suicide occurs more frequently in men than in women. This phenomenon could be attributed to the way men interact in society, with their role as providers and protectors being an accepted fact, which could place a greater burden on them if they fail in that role, if they fail to meet the expectations that family and society de facto attribute to them. Collective power exerts pressure on the individual, and the circumstances that trigger this pressure are taken by the larger social group, shifting its vigilance

toward the individual. In Durkheim's words, the individual succumbs to the collective, adhering to it in an ideology of progress and development. The greater the moral commitment one has to society, the greater the force that society exerts on individual behavior and decisions.

In economics, it is said that social commitment should prevail over individual decisions, thereby generating a common good, but a decision such as suicide does not adhere to this principle, that of seeking the common good above social benefit (Tirole 2016). Thus, the approach to the consequences this act generates in society must also be analyzed from a sociological perspective.

Salari et al. (2020) conducted a study on violence and deaths by homicide and suicide. In reality, research on homicide-suicide links these events to the prevailing violence in any given region or country. There is a very fine line between the thought "I am going to kill someone" and "I am going to kill myself". It is at this juncture that one might speak of a kind of protection towards others by eliminating the threat, which is oneself. This is where public prevention policies begin to fail, and the lack of public postvention policies for suicide becomes evident.

Practical Consequences in the Social Context

This study aims to ascertain the comprehensive economic and social costs attributable to individual suicide. This objective encompasses a quantification of both the direct and indirect financial repercussions, alongside a qualitative and quantitative assessment of the broader societal impacts. The investigation will seek to delineate the measurable losses in productivity, healthcare expenditures, and resource allocation, while also exploring the intangible yet profound social consequences, such as emotional distress within communities, long-term psychological impacts on bereaved individuals, and disruptions to social cohesion.

Garciandia (2013) explains that, in the face of suicide, a fracture occurs within the family, and the functions that the absent person had within the family context can be sought in a form of replacement, both in their role within the family, for example, as a provider, or as an element that complements the family unit. Therefore, the presence of that member is sought as a way to avoid losing them. Of course, an adolescent does not represent the same thing as a grandparent or a mature person such as a parent, but death by suicide creates a feeling of loss within the family unit that must be filled, since the sum of each member constitutes the total of the family unit, and a restructuring of the family is sought, with new roles and functions that are redistributed in the absence of one. Something similar happens in a broader setting, where role assignment is repeated when a person leaves, whether in a work or social context, and is required to move on to a new situation that fits into the normality (or as close to it as possible) that existed before the suicide.

Durkheim goes further and discusses the impact on society at large, stating that within the social collective, there may not be a clear determination of what is normal and what is not, and how laws operate. Homicide exists in a society, but so do the laws that punish it, so one thing may be considered normal and

the other (counterpart) as well. In the case of suicide, what laws would apply? Primarily moral ones. Feelings of melancholy and sadness, for example, observed in groups labeled as anarchists, revolutionary socialists, or mystics, are accepted by society at large but not necessarily shared by all. A group of people may be enraged by the commission of violent acts by some against others, but the commission of suicide leaves the group with little grounds for imposing punishment, much less society at large.

Since there are no clear guidelines regarding who bears the blame for suicide, as is the case with homicide, the responsibility lies with the suicidal individual and their immediate surroundings. Suicide, then, is a "sad" situation for society, but no further, Durkheim continues, since the collective is unwilling to assume responsibility for an individual decision, whatever the causes. In any case, the primary sources should be addressed from a very early stage, such as education and character development, tasks shared by society and the state. Thus, each generation should improve its educational and social systems to help strengthen people's character and avoid such tragedies, avoiding anomie. This is possible when society establishes a harmony in which individuals can feel part of it, not apart from it, since the family alone, in itself, has not been a factor in preventing deaths by suicide. Job occupations, social ties and networks, and religion (in some cases) all play an important role in the role assumed by each member of society.

In the case of occupations, Berenchtein (2014) gives his opinion on the forms of work in a capitalist system, and how these can produce stress that leads workers to suicide, and at the same time, he analyses the responsibilities of employers to guarantee a work system in which employees feel mentally safe and policies are used to help in the event of a suicidal situation or its ideation.

Durkheim also emphasizes labor issues as part of a political agenda that regulates workers' health care, if not directly, then through legislation on working hours, decent wages, and respectful treatment, as a means of preventing suicide and also of dealing with those who have survived it. The State must regulate working conditions to achieve equality of strength, not only economic but also social, and, in this way, avoid corporate selfishness and provide protection to those who depend on them, thus achieving social justice.

The World Health Organization (WHO), in its document "Suicide Prevention: A Tool at Work" (2006), analyzes various factors that can cause work-related stress due to the conditions under which these activities are carried out. This stress, they explain, can lead to suicidal thoughts and can also be caused by coworkers who commit the act, and they reaffirm the importance of having measures in place to help prevent such situations. The suicide of a coworker, the WHO continues, can result in confusing behavior, and not knowing what to say or how to act could impair work performance, as they find themselves in a state of imbalance created by the work environment.

Social justice, gender equality, education, social cohesion, and job opportunities are issues that provide unity to a group, but they can also be agents of disruption in beliefs, personal crises, and decisions that lead to suicide. The consequences of such an act on society can manifest themselves in various ways, from the

immediate environment outward, to a broader environment where it is difficult to establish action policies that do not create conflict in society at large, or to the State as the regulator of political, economic, and social balance.

The historical development of societies has transformed the relationships between individuals, starting from the original nucleus, which is the family, towards the broader components. Therefore, it is not possible to assume that the impact of suicide affects only the family surrounding the person who commits the act. Rather, its repercussions go beyond, to a greater or lesser extent, given the evolution of human beings towards broader groups, which even transcend borders and are not delimited by a marked territory.

Practical Consequences of Suicide

Previously, it was discussed the causes of suicide and the influence that various situations exert on a person's decision, such as economic, family, work, and health circumstances. Various authors have delved into this topic, and there are countless texts in the literature that attempt to explain each of the causes from different perspectives: psychological, social, and cultural. The truth is that the causes can indeed be multifactorial and found in diverse societies, with different socioeconomic situations, and in different contexts and times.

Texts on mental health emphasize mental or psychological illnesses (De Zubiría 2007), such as depression, personality disorders, loneliness, self-depreciation, inability to cope with difficult situations, and other mental health problems. Even the World Health Organization addresses the topic of mental health care and public policies for suicide prevention in numerous articles, as do the governments of many countries.

The argument for causes such as socioeconomic problems arise mainly when there is a macroeconomic crisis, such as mass unemployment, or a microeconomic crisis, such as job loss and, as a result, a decrease in income to support a family or oneself, or debt, for various reasons, which generates a personal crisis when facing the consequences of this. Generally, statistics are presented that correlate an economic crisis with an increase in the prevalence of suicide, with the ratio between men and women being relevant, indicating that men have a suicide rate of 4 to 1 compared to women. This could be explained by the role of men as providers for the household or, in other cases, by the “nature” of men not to seek help when facing difficult events or situations (Durkheim 1897, WHO 2019).

Family problems also appear as a determining factor in a teenager's decision to commit suicide. These problems can range from a poor relationship with parents, intra- or extra-familial conflicts, to separation from a partner, the end of a romantic relationship, and divorce. These situations trigger an imbalance in the person's psyche, making them unable to cope with this new state, in which rules and roles are redefined.

The use and abuse of legal and illegal substances and drugs has also been associated as one of the triggering factors for suicide. However, as mentioned

before, because this phenomenon is multifactorial, there are not enough studies to attribute suicide to a single cause. This is only possible through the analysis of individual cases and when follow-up has been conducted by health specialists or other specialists, allowing us to determine, with a certain degree of probability, the causes of suicide.

One could go on and on about the factors that can lead a person, of any age, to take their own life and succeed. Scientists who have studied this topic have written articles and books elucidating the causes that generate it. Politicians place the issue on their agenda with public policies that address suicide prevention through campaigns, sometimes directed at adult parents, sometimes at adolescents, and sometimes at society in general, through helplines, subtle advertising, and others. These measures could be compared to prevention programs for diabetes, obesity, and some types of cancer, such as maintaining a balanced and healthy diet, exercising, and receiving regular medical checkups. But, unlike programs for these aforementioned diseases, suicide prevention becomes somewhat confusing, as the causes cannot be clearly determined.

The benefits of these public policies should be reflected in the statistics presented annually, generally by public agencies. These benefits would be a reduction in the suicide rate in the medium and long term. If not, then one might think that these programs are not producing positive results, but this is also a difficult point to study because many variables change in short periods of time, such as: population size, the socioeconomic situation at the micro and macro levels, migration, social and political conflicts, and others. Thus, in addition to the statistics and their relationship to a specific era and a specific social, political, and economic situation, the data we can obtain relate precisely to that: finding a correlation or ruling it out. But what happens next? In other words, the question involves analyzing the practical consequences for the family and social environment of the person who commits suicide.

According to Garciandia (2013), the family environment is severely affected immediately. The role played by the individual (suicidal) must be redefined; the family unit tends to present it through the accommodation of new roles. If the individual is the breadwinner, another family member must assume that role, temporarily or long-term, with the consequences of facing a labor market that may present disadvantages, such as lack of experience, prolonged absence from the labor market, or lack of training. This situation varies, as it largely depends on the number of financial dependents, as well as the family's financial situation, the type of relationship between members, and the overall economic situation at the macro level.

The economic situation can change abruptly after a suicide when the individual is the sole or primary provider, or has a supplemental income, as mentioned above. Widow's pensions or life insurance may sometimes be invalid for this cause of death; this varies according to the legislation of the country and the coverage of each insurance company. And other questions arise, such as: How many people have life insurance that also covers death by suicide? Paying for insurance can be burdensome for families, and many don't. How many people have financial assets that wouldn't be affected by the death of a breadwinner? The number

also varies greatly. So, at this point, the approach will be based on the assumption that there isn't enough savings to ensure that, financially, the breadwinner's suicide wouldn't affect the family or household's finances.

Given the situation described, survival options would be weighed by family members or by the person left in charge. The macroeconomic situation is a determining factor in this regard: unemployment, inflation, current interest rates if one is paying off a mortgage or a car, to name a few. Regarding unemployment, or the employment rate, it can make it more or less difficult to find a job that suits the skills of the person who will assume the support of the household. From another perspective, the person who is entering the labor market will have to adapt to the demands of the labor market (Parkin 2015).

Entering the workforce after a period of inactivity, or after never having been in it, presents advantages and disadvantages. On the one hand, this would be the way to recover lost or decreased income, provided that job openings are available and the required qualifications are met. On the other hand, this radical change could entail additional effort coupled with a change in roles within the household. This presents other situations to address: if there are children of early school age or adults to care for, the search for a caregiver and the associated expenses would further reduce the income of the person left responsible for their support.

One option, in the immediate term, would be self-consumption, along with the development of activities such as the small-scale production of goods such as food, natural resources, and handicrafts, made in the same home, or on the plot of land, if available, for retail sale, which would achieve the goal of survival in the face of the drastic decrease in income, especially for the poorest families. Entry into the informal labor market would tend to increase, at least immediately, to earn enough daily income to compensate for the decrease in income. Social inequalities would lead to the use of various family strategies to improve and maintain economic gains that provide for the lost income (Arguello 1980).

These strategies are based on rational behavior within the household, which is compounded by the emotional situations that the breadwinner's suicide entails, to varying degrees. In this context, help from people close to the household may or may not occur, also at various levels, depending on the social and family networks available. This also depends on the geographic location, that is, the proximity to people who could assume, at a specific time, the necessary financial support, which in turn depends on the financial capacity of these networks. Survival strategies, then, contain a number of variables that may be unique to each household facing this situation.

There are other factors that can influence a family's wealth given the circumstances being studied in this research, such as those mentioned below.

1. In the case where the individual (person who committed suicide) is the primary or secondary provider:

- As previously mentioned, the sudden decrease or loss of income. Realignment of the roles of the household to achieve the recovery of income, requiring decisions such as who will provide that income, how,

how many hours per day, whether there are other family members who must provide care, where, and for how long.
- The financial situation prior to the event. Whether the household has property, bank accounts, and assets that can be immediately converted into cash to cover expenses, and to what extent these can be used, keeping in mind that financial convertibility also varies. An example would be owning a property that is for sale; the transaction may take days, weeks, or months. If the above is not available, the aforementioned survival strategies would have to be resorted to.
- Grief over the loss may lead to the need to seek health therapies to mitigate suffering. Whether or not the family has the financial resources to do so, decisions must be made that do not affect the food security of family members, or they must choose between the costs of treatment and the daily costs of support.
- Continuing with the previous point, the grieving process may include moving house or moving to a new home, especially if the death occurred in the home, they live in. In this case, a decision must also be made that does not affect their food security.

2. When the person who commits suicide is not the primary or secondary provider, income would not be affected abruptly or directly, but it could be affected indirectly, such as the costs and expenses incurred as a result of the loss of a family member. These could include the following:

- Grief therapy for members of the household, assuming they are financially able to do so. This could lead to a reduction in problems associated with the event, such as depression and anxiety, which, if left untreated, could later lead to other problems, which could, in turn, lead to irremediable visits to specialists, with the resulting costs.
- Moving and relocation, if the event occurred in the family home. Also, as noted above, depending on the individual's financial means.

3. In either case, expenses may also include the following variables:

- Funeral expenses and procedures that were not contemplated or scheduled.
- Expenses inherent to the burial of the body in the cemetery, such as rent or purchase of the grave.
- Medical treatment (with antidepressants and anti-anxiety medications, to name a few), which depends on the family's financial means.
- Beginning (or increasing) use of substances such as alcohol or legal and illegal substances, whether or not the family has the financial means to do so.
- Loss (of dependents) of rights to healthcare institutions or health insurance, if they had one.

The aforementioned costs and expenses can also vary in duration, so their quantification would also vary. For example, therapy can last for months or years, depending on the progress made in achieving emotional stability and the family's financial situation, always considering that these decisions are made taking into account the priorities of survival and consumption.

The broader impact can directly and indirectly affect a portion of society.

4. As a result of the reshuffling of roles when the individual is the primary provider, the inclusion of another family member in the workforce, whether formally or informally, entails variable consequences, depending on the individual's age, ability, skills, educational level, among others. Work productivity may be affected by the trauma experienced; that is, the performance of income-earning activities could be influenced by the reasons that motivated the sudden entry into the workforce. The same can occur even if other family members were already working at the time of the event. Work productivity could decrease due to the following factors, impacting income for the worker and for the company due to the losses incurred when the employee does not perform their job properly:

- Lack of concentration due to the trauma.
- Feelings of sadness that prevent the employee from performing work activities conscientiously.
- Depression, which requires absence from work.
- Therapy, like the previous point, can lead to absence from work.

5. It can be concluded that if work productivity decreases for the aforementioned reasons, the consequences could be directly reflected in the company, its clients, and its suppliers. Institutions, public or private, of any size, do not always have manuals, procedures, and policies that contemplate support and treatment for these types of situations. Currently, in Mexico, workplace stress monitoring has been formalized, but the surveys conducted by some companies are mainly aimed at detecting stress linked to the organizational environment, such as work hours and workload, as well as relationships with superior hierarchies, but not family situations (Government of Mexico 2019). NOM 035[1] states that the following will be addressed: “Psychosocial Risk Factors: Those that can cause non-organic anxiety disorders of the sleep-wake cycle and severe stress and adjustment, derived from the nature of the job duties, the type of work schedule, and exposure to severe traumatic events or acts of workplace violence against the worker due to the work performed”.

In relation to other members of the household, such as siblings, parents, and children, the aforementioned costs can lead to various problematic situations, such as:

[1]The Official Mexican Standard (NOM for Spanish) Nom-035-Stps-2018, talks about Psychosocial Risk Factors at Work. It is a Mexican standard regulating psychosocial risk factors in the workplace, aiming to identify, analyze, and prevent them to promote a favorable organizational environment. It was published in the Official Journal of the Federation in its web site: https://www.dof.gob.mx/nota_detalle.php?codigo=5541828&fecha=23/10/2018#gsc.tab=0.

- Dropping out of school, which would result in various expenses such as finding another school, or even completely abandoning studies, resulting, in some cases, in a loss of human capital in the future, but not absolutely.
- Even with sufficient resources to pay for medical or alternative treatments as a form of therapy, there is often shame about the family member's act, as well as stigmatization by society. This would lead to a refusal to seek such treatment, ultimately delaying a possible return to normalcy or emotional stability for work or school activities. This could occur, especially in sectors where suicide is considered illegal, as it threatens one's life, or due to religious beliefs. The consequences could lead to difficulties in effectively reintegrating into society and the labor market.
- Suicidal thoughts that survivors may experience. Faced with the loss suffered, some members of the family or household may imitate the act in an attempt to escape reality, sadness, depression, and grief. This, in turn, implies that the attention of those in charge is required to achieve the goal of recovery, which entails time off work or school, and the outcomes analyzed above.

In general, the practical consequences of suicide are variable, significant, and significant for the immediate environment and for the social group, or for a part of it. In addition to the financial expenses of coping with a painful, unexpected, and violent situation, the emotional costs generate further expenditures for the family, schools, and workplaces. Even when the trauma is not a direct relative, but rather an external relationship, trauma can affect people beyond the direct relationship in various ways. Immersion in society is unavoidable from birth, and the relationships that are forged over time, to varying degrees, will generate empathy or a sense of guilt that generates costs, expenses, and wear and tear. Possibly, but not always, this will likely result in greater or lesser suicide size in different societies, with diverse organizations, and in unequal socioeconomic situations.

The costs to society will also depend on the time and the macroeconomic situation (crisis, unemployment, shortages), since the costs are not borne exclusively by members of the household, but also by those who make up society, such as educational, work, and health centers. Currently, public suicide prevention policies address exactly that: prevention; with various programs and campaigns, from promoting better family communication to prohibiting the use of illegal substances. However, state intervention ends when suicide occurs.

For Oswald (2020), the search for peace and security is a constant amid recurring economic crises, armed conflicts, insecurity, and government malfunctions. When applying these concepts to suicide, one cannot ignore the specific study of the practical consequences of such an event amid the structural complexities of society in all its aspects. The goal of achieving peace and security in the face of suicide generates costs. To what extent? These costs could be quantified, and in this way, it would be possible to create programs that, in addition to suicide prevention, focus on the goal of individual, family, and social recovery. The aim is not to seek the normalization of suicide, but rather to understand reality and find solutions that minimize the economic and social costs of suicide, complementing prevention programs by analyzing

these costs and their effect on the economy of the individual, family, and collective environment, and society.

Methodology

This research has a mixed exploratory/descriptive nature, combining data collection to obtain quantitative and qualitative results. In the present study, which, as mentioned, is mixed research because it contains quantitative and qualitative analysis, all aspects were included in the information collection to determine, through a quantitative analysis, the pertinent data that respond to the purpose of the research, as well as those that require a qualitative analysis to complement the study according to the data specified in chapter one.

From a quantitative perspective, all data corresponding to the economic costs families face following the suicide of one of their members were included, including income, expenses, medical or life insurance, before, during, and after the incident. This allowed us to quantify the economic costs of suicide, the impact on the finances of the families surveyed, and the economic situation they face.

From a qualitative perspective, questions were incorporated into the research instrument that represented the ages of the individuals who committed suicide, whether or not they were the breadwinners for the family, as well as aspects related to school and job dropouts, integrating all relevant topics to determine the economic and social costs of suicide.

It is important to emphasize the relevance of conducting research that brings together both quantitative and qualitative analysis, because in addition to determining the economic and social costs, the quality of life that prevails after an event such as the one mentioned and the subsequent repercussions can continue even when a period of time has passed and, although the research instrument was applied in a time frame, the implications indicate that the results obtained continue to be dynamic in some cases, and are not limited to a single moment.

To obtain the data outlined in the objectives, a survey technique was used, using a questionnaire containing a number of questions that address the stated objectives. This technique allows us to obtain information on the variables of interest to this research, with specific questions directed at the study subjects.

To carry out the sampling, the so-called Snowball method was used, which, according to Hueso and Cascant (2012), "is indicated for studies of minority, excluded or invisible populations, such as undocumented immigrants, street children, people with certain illnesses, etc. It consists of identifying the subjects of the sample as the interviews are conducted. Thus, we start with a few individuals from the population who can be accessed, and through them we can contact other subjects with similar characteristics, and so on." It is a type of non-random sampling that in this case was the way to reach people who meet the characteristics described for the study subjects, which are: being direct relatives or people very close to someone who committed suicide between the years 2016 to 2019, before the pandemic. This time range was determined because in the pilot study that was carried out, people willing to

answer the survey did so when a year or more had passed after their relative committed suicide, a stage at which they were able to answer the questionnaire questions more objectively.

The questions were divided into categories to be operational, that is, measurable and quantifiable. Thus, they were classified into different categories or dimensions to determine which ones could be grouped together to measure their impact and determine their relevance to this research.

The categories were grouped into five: first, what were the costs they incurred immediately following the suicide of their family member; second, how much did these costs amount to? Third, how much did these costs decrease family income? fourth, how did they cover these expenses? And fifth, what is their current situation regarding the event?

Additionally, semi-structured interviews were conducted with doctors from two companies who shared their experience with the suicide of employees or their family members and what the consequences have been.

Research Analysis Categories

After implementing and administering the questionnaire to the respondents, the questions were categorized.

Category 1. Income. In this section, respondents were asked how much their family income changed after the death of their family member. Questions were asked regarding: "How much did family income change as a result of the suicide of their family member?"

Category 2. Short-term expenses. This category collected data on expenses incurred by families at the time of the suicide. All costs and expenses incurred by family members were taken into account, such as administrative and bureaucratic procedures, funeral expenses, purchase or rental of a grave, inheritance processing expenses, moving, school, or work, immediate or immediate therapy expenses, and others.

Category 3. Long-term expenses. This section included data on family members who had to face expenses related to consequences that did not occur immediately following the family member's suicide. These included moving, changing jobs, changing schools, seeing specialists, purchasing medications, and others.

Category 4. Labor market entry of surviving family members. In this case, depending on their contribution to family income, data were collected for the situation before and after the event. If the person who committed suicide contributed a percentage to the family income, respondents were asked whether, as a result of this event, they had to enter the labor market, either formal or informal, as a way to cover the expenses incurred by reduced income, depending on the age group.

Category 5. Changes experienced in family dynamics after the suicide, including dropping out of school in the case of student relatives; job withdrawal in the case of working relatives; and illnesses related to the family member's suicide.

Results

Of the individuals who committed suicide during the study period, 25 percent were the primary breadwinners, and 75 percent were not, but did contribute to some extent to supplement the family income, as will be seen later in this section.

Of the 25 percent who were the primary breadwinners, the number of people who depended on the person was considered, thus encompassing the immediate impact the death had on the family's income.

In the case of the financial compensation received, only one case included a life insurance premium. It should be noted that since the cause of death was suicide, some insurance companies allow for the time elapsed since the insurance was purchased in their clauses, and in many cases, this is not considered a reason for life insurance coverage.

In the short term, all costs inherent to the period following the person's suicide are included, such as bureaucratic procedures, the purchase or rental of a cemetery space, medical consultations, the purchase of medications, and moving.

The following data were obtained: Virtually all of the people surveyed had expenses in the immediate aftermath of their relative's death, mainly related to procedures related to the death of the relative and medical consultations arising from this event, mainly grief or depression therapies, according to the people.

Among the immediate costs incurred by family members, the main ones were funeral expenses, administrative procedures inherent to the death, the purchase or rental of a cemetery space, and other directly related expenses.

In the long term, it is included costs incurred over a period of six months or more, such as medical consultations, therapies, medication purchases, job changes, school changes, and changes of residence.

This variable was included because research prior to the pilot study found a high percentage of families who left their homes, whether owned, rented, or borrowed, because a suicide had occurred there. Continued residence in the home contributed to an increase in depression, anxiety, and doctor visits, in addition to prolonging the grieving process. This decision entails moving costs, which include all expenses associated with changing homes. Of the people surveyed, 53.3 percent did not move house as, and 48.7.

Entry into the Labor Market

This variable was included to verify whether, as a result of the sudden death of a family member, any surviving relatives had to enter the formal or informal labor market, and whether the deceased person was the primary or supplementary provider of family income, and whether their income could have been reduced or diminished due to this event.

Of those surveyed, 26.6 percent have had to enter the formal or informal labor market to supplement the income reduced by the death of a family member. The decision to choose formal or informal work was based on the availability of available jobs and the hours they needed to dedicate to a job,

according to the respondents themselves. 61.7 percent did not have to enter the labor market because their deceased family member was not the primary provider or because they had adjusted to the decrease in income. 8.3 percent were unable to enter the labor market, becoming discouraged and becoming unemployed, and another 3.4 percent did not seek to enter the labor market to supplement their income.

In interviews with company occupational physicians, they were asked about the impact on productivity, absenteeism for various reasons related to stress, and time off for medical appointments and psychological therapy, as well as the frequency of requests for time off, as well as the reasons for it.

The results are presented below in three categories.

Category 1. Decreased productivity.

At this point, both interviewees commented that when a stressful situation arises, whether due to events at the plant, workload, or family or interpersonal problems, they are assessed to determine whether they should be referred to an outpatient clinic or can continue with help within the company. When asked whether these individuals can continue working normally, both responded that concentration decreases, productivity decreases, and sometimes, even when workers have not requested permission to seek outpatient care from the company, they are monitored for a review of their work performance.

Category 2. Workplace absenteeism.

As a result of visits to the company doctor's office for emotional disorders that sometimes lead to physical or psychosomatic illnesses, employees sometimes call in sick, request leave, which is always granted upon presentation of a medical certificate, or simply fail to show up.

Category 3. Economic Situation of Workers.

En las entrevistas, se les preguntó sobre la situación económica que enfrentan los trabajadores ante las ausencias, permisos o el decremento en la productividad y en las fallas al cumplir con las metas de trabajo. Employees' concerns are the negative economic impact of unpaid leave requests and the anxiety generated by the expenses they face after the death of a family member.

As discussed, the impacts experienced by employees have economic repercussions that can, in turn, lead to increased stress, decreased concentration at work, and decreased productivity.

Discussion

The main objective of this research was to determine the economic and social costs of suicide in México. Its importance lies in the fact that there is very little information about the economic consequences faced by the families of a person who dies by suicide. There is literature on the psychological consequences, emotional impacts, and the grieving process following this type

of event, but very little information about the expenses and costs faced by families and, as a result, the short- and long-term impacts.

When considering, first, how much family income decreased, 48,3 percent of families responded that it did not decrease because the person who committed suicide was not the primary or secondary economic provider, and the rest stated that family income did decrease as a result of the suicide. The percentage of almost half of families who did not see their income affected as a direct consequence may be determined by the age of the people, some between 16 and 24 years old, who had not yet entered the labor market, or by other reasons, to mention some, mental illnesses such as depression.

Even so, the remaining percentage whose income was affected to varying degrees because the family member was the primary economic provider faced situations such as searching for work, sometimes without finding one, or not always with a salary that could effectively compensate for the lost income. And although family income was measured as an independent variable, in general, real income is reduced due to the economic costs that subsequently occurred, both short and long term. Initially, these are the expenses inherent to death, such as administrative procedures, funerals, the purchase or rental of a cemetery space, and other costs that must be covered immediately and were not anticipated when the death occurs suddenly. There is no preparation time like there would be, for example, when a person is evicted, and even when health specialists can predict, with a certain margin of error, how much life a person with an illness has left.

Furthermore, these expenses can continue to be incurred in the medium and long term. This was demonstrated in the results of the corresponding category, where the survey found that, even after several years, one or more family members continue to attend therapy, purchase medications, or perform rituals, and they now factor these costs into their monthly spending budget. This represents a real decrease in their income, even if it has not decreased nominally. The prices of the services and goods they consume increase as inflation increases. During the surveys, some people stated that they "are used to these expenses".

These economic effects can be felt for many years by several family members, who may experience symptoms related to stress and depression for a long time, as well as suicide attempts or school failure. This generates other costs for the family when the years of schooling are extended, or when a person drops out temporarily or permanently and changes schools.

Suicide attempts among family members of a person who committed suicide were mentioned by some respondents, increasing the expenses they incurred for treatment and even taking time off work to "monitor" their family member, for fear of suicide. This monitoring, in turn, causes a greater economic burden when it comes to people who do not have a fixed salary, but rather one based on actual work hours, or those who do but must take time off for this and other reasons related to their family member's suicide.

For companies, the fact that some employees experience absenteeism, request psychological help, and external care through time off represents a problem, impacting work productivity, lack of concentration, and poor work performance. This situation,

although stemming from a family event, can lead to actual economic losses for companies and, ultimately, a social problem when they leave the labor market, resulting in the loss of human capital, represented by experience, years of service, and skills acquired over time.

Conclusions

Public suicide prevention policies have not proven effective, as suicide rates increase each year, and after a person dies from this cause, support from prevention programs ends immediately. However, as explained in this research, the economic and social consequences continue, and there is no program or plan, much less a public policy, to assist families financially or with clinical treatments, which include transfers, time off from work, and others. Thus, the economic costs are borne by the families themselves, if they have the resources or means to obtain them, or they are simply not able to afford them.

One of the few studies available internationally that has approximated the economic and social costs of suicide is the Center for Suicide Prevention, part of the United States Department of Health. This study also focuses on the costs of therapies, medical treatments for depression, decreased work productivity, and the consequences not only for the family environment, but also for society in general and for the nation. In the case of México, these costs have not been officially quantified, to delve deeper into the prevailing situation, which affects not only the family nucleus, but directly about six people, and indirectly 135[2]. As explained, the repercussions can affect a large portion of society, and the entire country, when it comes to redistributing national income in social spending and assistance programs, as well as in the public health budget.

Finally, it is important to highlight that, even though the costs can extend for several years, and in worse scenarios, for a lifetime, no family surveyed or interviewed reported not using a portion of their income to continue treating the aforementioned conditions. And, with these expenses lasting for extended periods of time, the economic and social costs of suicide also persist for a long time, diminishing the quality of life for those affected, as well as for their extended families and, in many cases, even friends and coworkers who face this type of event suddenly, with increasing mortality rates from this cause.

Currently, a discernible gap exists in public policy frameworks, with no evident initiatives on governmental agendas aimed at addressing the postvention needs of individuals and communities impacted by suicide, including families, colleagues, and friends.

[2]According to the WHO, on its website.

Recommendations for Further Studies

In a research project such as this one, improvements and continuity are always sought and required to further explore the objectives, expand the number of study subjects, and compare results over a subsequent period to determine existing trends.

Expanding the research to a larger number of individuals and families of those who have committed suicide will expand the information on the variables studied and provide a greater understanding of the economic and social costs that arise as a result of an event such as the one mentioned. This may be possible by establishing a broader network of inquiry, based on what has been achieved with this study. A probability random sampling method may be difficult to obtain due to the sensitivity of the topic addressed. As demonstrated in the pilot study and the survey, many people are reluctant to participate due to the pain caused by the memory, but the resulting economic and social damage is evident.

Conducting more extensive research could also open the political agenda for the creation of public policies based on the collected and validated data, since current public policies focus solely on suicide prevention, not postvention, and no state or federal policy agenda addresses the economic impact on families, businesses, and society.

Replicating this research methodology in other states across the country could lead to a unification of study methods to determine the economic and social costs and their impact on the economy over different time periods, both in the short, medium, and long term, if the analysis goes back at least five years and examines their present and future effects.

The main recommendation is to advance this research to propose public policies that contribute to improving the quality of life of family members who survived suicide.

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Athens Journal of Health & Medical Sciences – Volume 12, Issue 4, December 2025 – Pages 259-296

The Effectiveness of Interactive Digital Installation in Healthcare "Anxiety Reduction"

*By Safiya Al Farsi**

This study aimed to investigate the influence of an interactive design installation on patients' anxiety in waiting rooms. Waiting rooms are often stressful environments, which can lead to serious phobias. Therefore, it is essential to make these spaces more pleasant. It is also important to help patients reduce their anxiety and stress levels while in these waiting rooms. Interactive design installations are a behavioral distraction technique used to influence patients' thinking and refocus their attention away from anxiety. This experimental study was conducted using speculative design theory to determine how interactive installations can help reduce anxiety among patients in waiting rooms. Could it be a powerful tool that could be used in the future to improve healthcare quality, potentially replacing direct medical treatments, such as medications for anxiety, with behavioral techniques?

Keywords: *interactive design installation, patient anxiety, waiting rooms, Behavioral distraction techniques, future healthcare innovations*

Background

> "Conception of expressive processing: the possibility of creating new simulated machines, of defining new computational behaviours, as the great authoring opportunity that digital media offers" (Wardrip-Fruin 2009, p. 9).

According to Coussement (2012), interactive art plays a significant role in the acceptance of interactive media in everyday life. New media technology provides an opportunity to rethink hospital design and its potential to reduce both staff and patients' anxiety and stress, leading to better clinical outcomes (Ulrich et al. 2004, p. 2). Few studies have examined the effectiveness of aesthetically appealing waiting rooms in influencing perceived waiting time (Becker et al. 2008, p. 130). With advancements in media technology, the idea of using distraction techniques in healthcare center design has emerged, such as playing games, watching cartoons, or listening to music, all of which have a clear effect on reducing preoperative anxiety (Aytekin et al. 2016, p. 57).

This study includes a case study of an interactive digital artwork installation called "Revive," which was designed to reduce anxiety in hospital waiting rooms. The "Revive" project utilizes motion detection and interactive visuals to engage patients, encouraging physical interaction through body movements. The experiment was conducted using Processing 3.0 software, with the installation projected onto

*Assistant Lecturer, University of Technology and Applied Sciences Nizwa - UTAS, Sultanate of Oman.

large walls using Xbox and projectors, and tested with computer cameras in various settings.

However, what about interactive installations with immersive engagement and participation? What makes interactive installations superior to previous techniques is that they have no side effects, and they introduce a new mode of engagement, such as body movement interactivity, the use of large high-resolution screens that make the surrounding environment more attractive, and their ability to create positive feelings and spark imagination (Lambert 2016, p. 1). These are the reasons behind the growing trend in hospital designs incorporating interactive installation walls.

Study Objectives

The aim of this study is to engage the design interface in addressing social concerns, such as adult anxiety in medical environments and waiting times. Additionally, the study examines the extent to which interactive digital design installations influence adult anxiety in waiting rooms. Adults can experience various types of anxiety, such as preoperative anxiety, which they may encounter while waiting for medical treatment. This form of anxiety is often the most distressing for adults in healthcare settings (Kain et al. 2006, p. 1). As interactive digital media designers, we are always eager to test our designs to better understand users' needs and develop suitable solutions. Furthermore, this study has several objectives:

- Identifying how interactive installation designs can affect anxiety in adults.
- Understanding the nature of interactive installations that makes them a powerful distraction technique.
- Exploring how an interactive environment can promote calmness and motivation in adults.
- Examining user engagement styles through various interaction levels in interactive design.

Study Outline

This paper is structured into five main chapters, starting with an introduction that briefly describes the concept of the work and the main objectives of the study. The second chapter focuses on the literature review, which covers key topics, beginning with the definition of waiting anxiety and then discussing art therapy and technological interventions in art therapy, such as digital media. The third section examines what makes interactive installation design a powerful distraction technique, particularly through its interactivity feature. This is followed by an explanation of user engagement with the interactive interface, focusing on body movement and other factors. The discussion then continues with the idea of encouraging digital designers to approach problem-solving within the context of art therapy. The third chapter presents the methodology, research aims, questions and hypotheses, sampling and selection, research design, data collection and analysis, and the case study. The fourth chapter presents the study's statistics,

including statistical and descriptive analyses of the previously gathered data. The final chapter summarizes the key points and analyzes the findings of the study.

Literature Review

People can spend a significant amount of time waiting in hospitals, from their arrival in the waiting room until they receive treatment (Pati & Nanda 2011, p. 124). According to Biddiss et al. (2014, p. 445), this waiting period is often long, stressful, and uneventful, with the waiting room atmosphere being a major contributor to high levels of patient anxiety. As a result, hospital waiting rooms are a significant source of anxiety for patients. The healthcare community has conducted extensive research to find alternative techniques to mitigate patients' stress and anxiety, moving beyond traditional methods. Creating positive distraction has become a new trend in healthcare art (Mommers 2014, p. 26), as it is a preferred technique for managing patients' emotions and reducing anxiety by altering unpleasant stimuli (Delbaere 2015, p. 6). This form of therapy combines technology and interactive art therapy, which is widely used in healthcare settings. It can help create a healing environment for patients through visual art, audio, video games, virtual reality, and interactive installations, all of which are commonly applied in waiting rooms to improve the atmosphere, create a more pleasurable environment, and enhance well-being.

What is Waiting Anxiety?

Waiting anxiety is a significant form of anxiety disorder. Patients in hospital waiting rooms often wait for undetermined or unexpected periods of time, whether for test results, procedures, or other health-related services, according to the waiting list order (Silva et al. 2014, p. 1695). During this waiting period, anxiety and stress can develop due to the length of time and the uncertain outcomes that may arise (Osuna 1985, p. 82). Furthermore, this anxiety can lead to increased aggressive reactions in patients, making the management of anxiety more difficult than anticipated (Biddiss et al. 2014, p. 445). Therefore, it is important for people to manage their anxiety, stress, and the range of emotions that emerge from stressful situations (Sweeny & Cavanaugh 2012, p. 150).

There are several factors contributing to waiting anxiety in hospital waiting rooms. For example, the physical environment, or what is known as environmental stimuli, plays a crucial role in shaping mood and affecting anxiety levels. This is because, in many cases, hospital waiting rooms lack distractions such as TV, magazines, relaxing scents, windows with pleasant outdoor views, or information screens and wall visuals (Yoon & Sonneveld 2010, p. 283). Consequently, anxiety can lead to more negative health outcomes, and reducing anxiety disorders is a major goal of healthcare (Biddiss et al. 2014, p. 433). Modern hospital design focuses on creating more comfortable and engaging waiting areas (Becker et al. 2008, p. 35). Emotion regulation and distraction are powerful strategies that people use to reduce waiting anxiety and stress (Sweeney & Cavanaugh 2012, p. 148).

Therefore, modern strategies that help anxious patients focus on pleasant stimuli can make the waiting time feel shorter, a realistic goal for many healthcare centers.

Art Therapy and Technological Interventions in Art Therapy

Art integration in the healthcare experience has had a significant impact on health outcomes and patients' well-being (State of the Field Committee 2009, p. 1). For a long time, creative arts have been incorporated into healthcare programs to address a wide range of health issues, including mental health, autism, stress, Alzheimer's, and various chronic diseases (State of the Field Committee 2009, p. 2). According to Staricoff (2004, p. 8), art has been widely used in mental healthcare because it can improve communication skills and foster better relationships between mental health patients and others. Therefore, the importance of design is clear, as it can create an environment that supports clinical tasks while also providing positive engagement, therapy, distraction, and expression through artworks (Lambert 2016). Several studies have shown that art interventions in healthcare settings help create a healing environment and contribute to a positive atmosphere for patients. These interventions can also support patients' mental, physical, and emotional recovery (State of the Field Committee 2009, p. 1). Most of these interventions have been used as distraction tools to reduce anxiety and stress by creating a healing environment. For instance, TV shows, relaxing music, magazines, fantasy imagery, and interior design are commonly used (Biddiss et al. 2014, p. 445). Healthcare settings often create an atmosphere where people feel out of control, stressed, and anxious, and art can be therapeutic, serving as a healing tool that provides a more relaxing environment to alleviate stress and anxiety (State of the Field Committee 2009, p. 2). However, many of these interventions, which were used in health therapy years ago, were passive distraction tools that engaged patients passively without any interaction with the environment. This approach is insufficient for drawing patients' attention away from their current emotional state in waiting rooms (Psychiatry 2002, p. 2).

Recently, art therapy has increasingly relied on the interaction between media and individuals, with art therapists exploring the best methods to simplify and support this interaction (Kaima et al. 2016, p. 8). As a result, contemporary artwork has shifted from merely producing artifacts to providing services that meet human needs, enhanced by new technology (Erika et al. 2015, p. 131). Mommers (2014, p. 26) noted in his study that, in recent years, hospitals have started incorporating state-of-the-art technology to create a healing environment in waiting rooms to help reduce anxiety. Advanced technology presents new challenges in healthcare, prompting healthcare organizations to shift their focus and operational strategies (Becker et al. 2008, pp. 35-36). Technological interventions in art therapy do not alter the essence of the artwork but instead enable greater exploration and freer expression of the medium (Kaima et al. 2016, p. 12). This technological software has played a crucial role in supporting art therapy projects in recent years, and artists are now exploring how to use technology to create new genres of life art, such as interactive digital artwork (Ahmed et al. 2010, p. 40).

According to Biddiss et al. (2014, p. 445), the development of technological interventions helps give patients more control over their waiting environment and provides them with additional activities, potentially leading to a greater reduction in anxiety. Interactive technology is arguably one of the most promising mediums for healthcare promotion (Street et al. 1997, p. x). Digital or technological interventions in art within the healthcare field offer interactive distractions and foster positive engagement with users. As Sahiner and Bal (2015, p. 2) note, distraction is an effective technique that diverts patients' attention from anxiety-inducing stimuli. Various technologies are associated with this distraction, influencing patients' emotions and mood, and reducing their stress by creating a more pleasant environment (Delbaere 2015, p. 2). Numerous active distractions have been employed in healthcare settings to reduce anxiety and enhance patients' activity skills, including video games, virtual reality, and interactive installation design. These interventions often create healing and virtual environments with interactive systems aimed at alleviating stress and anxiety (Moline 1995, p. 2).

Video games are widely used in healthcare as a distraction technique to modify patients' behaviors (Patel et al. 2006, p. 1020). They engage active attention through cognitive and visual involvement (Patel et al. 2006, p. 1025). Griffiths (1990, p. 11) also argued that video games help reduce anxiety in patients by lowering patient arousal, making them particularly effective in diverting cancer patients' attention away from unpleasant stimuli and side effects, which cause stress and increase relaxation.

However, while video games for adults may be considered enjoyable and potentially beneficial for therapy, not all games contribute to a positive healing environment (Erika et al. 2015, p. 132). Therefore, the emergence of virtual reality (VR) has become a more effective distraction tool in art therapy. VR allows healthcare organizations to assist patients in innovative ways by creating immersive virtual environments using advanced technologies (Moline 1995). This technology enables users to become fully immersed in a computer-generated environment (Schneider & Hood 2007, p. 3). Furthermore, VR helps engage multiple senses simultaneously through the use of high-resolution graphics, making it a powerful behavioral treatment tool for people with anxiety (Psychiatry 2002, p. 5).

However, the use of virtual reality in healthcare and anxiety reduction still faces limitations and potential negative side effects during immersive exposure, such as eyestrain and blurred vision. With these limitations in techniques previously used in art therapy, such as video games and VR, there is a growing need for alternative solutions and more effective techniques to treat anxiety in adults with the advent of art therapy technology.

Interactive installation artwork design has emerged in healthcare worldwide, not just as aesthetically pleasing art but also as a healing tool. What makes this installation technique a powerful feature of art therapy?

Interactivity in Interactive Digital Artwork

An interactive digital artwork installation is both interactive and digital. These are the main components, and such installations can be placed in virtual worlds or integrated into various digital devices or public spaces (Nardelli 2012, p. 1). It

encourages the audience's physical action, participation, and positive engagement with both the digital artwork and the physical environment. Street et al. (1997, p. 34) argued that interactive technology is a valuable resource, and when designed properly, it can lead to a healthier lifestyle. According to Nam (2014, p. 9), what makes it a powerful healing technique is the interactive feature, which involves bodily interaction rather than just a mouse click. The physical interface primarily consists of large screens in open spaces, with the most significant aspect being the participant's active engagement.

According to Rush (2005, p. 183), the term 'interactive' is the most comprehensive term in the art of the digital age. Nowadays, there are high expectations for interactive digital artwork installations to perform better in art therapy, as they add elements of playfulness, voluntariness, and interactivity to therapeutic practices (Lee et al. 2013, p. 110). Several studies have focused on the ideal characteristics of interactivity in installation screens, considering the audience's ability to engage their senses, such as vision, touch, hearing, movement, and speech, all of which are essential for the ideal process of interactivity and emotional engagement (Aminabadi et al. 2012, p. 118).

The notion of interaction has been widely explored from various theoretical perspectives, particularly in relation to psychology (Schneider & Hood 2007, p. 2). This interactivity in an interactive installation involves full-body interaction for patients (Nam 2014, p. 86), allowing emotional and physical transitions during their engagement with the digital installation (Nam 2014, p. 54). It enables the patient to focus more directly on the distraction task on the screen while engaging all of their physical, emotional, and perceptual senses with the installation (Erika et al. 2015, p. 132).

Additionally, interactivity employs indirect effective and emotional techniques, such as using specific characters in the design, visuals, and storytelling through interaction, as well as the aesthetic impact of colors, animations, and text (Lim et al. 2007, p. 246). Street et al. (1997, p. 21) noted that the integration of multimedia elements, such as text, video, and visuals, adds a unique feature to interactive technology that can evoke various psychological responses. These characteristics influence the patient's participation and interaction with the installation screens by affecting their emotions and mood. Some visuals, colors, and other elements have a significant impact on anxiety reduction, mental health treatment, and the creation of a healing environment (Staricoff 2004, p. 24). The interaction here pertains to both physical and emotional engagement through body movement, where there is meaning and purpose behind the interaction (Nam 2014, p. 85).

User Engagement through Body-movement Interactions

> "Speculative designs depend on dissemination and engagement with a public or expert audience and are designed to circulate".
> Dunne and Raby (2013, p. 139)

With the development of digital technology, the way people participate has changed and improved, offering patients creative activities that enable them to treat themselves rather than relying solely on direct medical treatment (Lee et al.

2013, pp. 110-111). Designing an interactive environment through interactive design installations helps explore new media aesthetics and technologies (Byers 2012, p. 165). Physical and emotional engagement has a unique feature, embodied interaction, which transforms participants from passive viewers into active performers (Nam 2014, p. 86). User engagement is critical in interactive art design, as designers must predict and understand how users experience interactive art (Batras 2008, p. 6). Interactive design installations focus on the participant's bodily aspects of interaction, aiming to stimulate imagination, consciousness, and perception (Byers 2012). This type of full-body engagement allows for a broader range of users and provides an opportunity to better understand participants' experiences with the installation. Users are fully engaged and gain enjoyment through their body movement.

Recent studies have shown that body movement plays a vital role, as it is considered the engine of change in how participants' bodies interact with the interactive environment, which, in turn, affects how they perceive it (Bianchi-Berthouze et al. 2007, p. 102). Furthermore, whole-body engagement is a powerful indicator of emotional effects. This includes the influence of new technology through varying degrees of involvement in interaction design, such as immersive engagement, presence, direct attention to the interactive environment, or involvement for enjoyment (Bianchi-Berthouze et al. 2007, pp. 103-104). The level of movement can be used as a measure of engagement (Bernhaupt 2015, p. 253), and the nature of engagement can predict how effectively the installation serves as a distraction tool that impacts patients' emotional states. Therefore, interactive design installations enhance users' presence and immersive engagement through body movement, offering a new aesthetic in digital media interaction design (Slater et al. 1998).

Designer Engagement in Problem solving and Art Therapy

> "Designers are usually seen as problem solvers" (2013)
> Anthony Dunne & Fiona Raby

Fuad-Luke (2009) emphasized the importance of transforming people's or designers' thoughts into meaningful social and environmental changes. Designers' engagement and participation in creative activities and interfaces are seen as a new method for improving the quality of a patient's life (Hoey & Zutis 2010, p. 211). Designing an interactive product primarily involves supporting users in their daily lives (Preece et al. 2015). It is an interdisciplinary field that enhances people's lives, communication, work, and interactions (Preece et al. 2015). In interaction design, we observe significant engagement between humans and digital technology, as the goal is to create pleasant and useful artifacts (Kaptelinin & Nardi 2006, p. 5). Brown (2009, p. 2) notes in his book that design thinking now creates needs as demands, and it represents a human approach to problem-solving, helping organizations and individuals across various fields to become more creative and innovative, ultimately improving the quality of patient care.

> "If we speculate more—about everything—reality will become more malleable."
> Dunne & Raby (2013)

According to Dunne and Raby (2013), design is a form of speculation, involving the thought process of envisioning how things could be in order to predict and imagine possible futures, with the goal of engaging the audience. Products are always designed for circulation (Dunne & Raby, 2013). With the integration of art in therapy and the combination of art with a solution-focused approach, therapy is evolving faster than expected, driven by the innovation of creative expressions and other interventions (Malchiodi 2003, p. 82). Interactive designers strive to enhance user experience and address current situations and issues people face (Preece et al. 2015, p. xxxiii). They identify user needs and establish useful requirements. In recent trends in interaction design, designers aim to include emotions and provide pleasure through interactive design (Kaptelinin & Nardi 2006, p. 25).

Today, designers focus on finding different methods to engage positively in social and health problem-solving through the use of technology and art installations because digital technology plays a key role in changing how we interact and engage with the various resources around us (Moggridge 2006, p. 1). Numerous modern technological artworks demonstrate how designers intervene in health problem-solving, illustrating the necessity of their contributions to healthcare transformation. For example, the interactive media wall at Boston's Children's Hospital is a digital media design featured on an interactive wall in the hospital lobby, designed to emotionally and physically engage children by allowing them to interact with the visual space around them. The goal of the digital media designers involved in the project is to create a more interactive environment that can help change children's emotions while they visit the doctor (UConn 2015). Another similar project by creative digital designers is the Kinesis Studio's discovery zone interactive wall at Nemours Dupont Hospital. They created a fantasy world called the Living Garden, designed to alleviate the stress and fear children experience due to illness, contributing to the healing process in measurable ways (Kinesis Studio 2015).

These contributions, and many others, primarily focus on children. Should we consider applying similar approaches to adult patients?

Methodology

Introduction and Proposed Aim

The main purpose of this research was to examine the extent to which interactive digital artwork design (installation) can influence adult patient anxiety in waiting areas. Through an interactive design interface, the study aims to alleviate anxiety symptoms in these waiting areas. Interactive digital artwork installations are a recent development in the digital age, but their use in the field of art therapy has not been sufficiently explored. The research purpose was further clarified through a review of previous studies on digital media design and related theories,

which guided the development of the research design. According to Kumar (2005 p. 5), research methodology is a technique used to scientifically approach research objectives, explaining the steps and processes involved in conducting the study. As digital media continues to evolve, various research methods have emerged, reflecting recent changes in the digital media field and the growing discipline of digital media research (Burgess 2013, p. 1).

This research employs a mixed-methods approach, combining both qualitative and quantitative data collection techniques. It is based on a One-Group Pre-test and Post-test experimental design. The study utilizes exploratory, descriptive, and experimental research approaches to test hypotheses and develop related theories. In the pre-test phase, participants' baseline anxiety levels were assessed, followed by the post-test phase, which measured anxiety changes after interacting with the "Revive" installation. The methodology includes a clear description of data collection and analysis methods, an explanation of the sample and participant involvement, and the use of a case study to guide the research design and hypothesis testing. Specifically, this research includes:

1. A brief description of the study's methodology.
2. An explanation of the data collection and analysis methods.
3. A description of the sample and participant involvement.
4. An explanation of the research design and the use of a case study.

Hypothesis and Research Questions

The primary research question of this study is: **To what extent can interactive digital artwork design influence patient anxiety among adults in waiting areas?** In addition, several related questions (or arguments) are raised and discussed throughout the study:

1. What is waiting anxiety?
2. What is art therapy, and how does the combination of art and technology (digital art) enhance healthcare?
3. How do technological interventions in art therapy enhance interactivity for patients and help reduce mental health issues such as anxiety in adults? How have these interventions become powerful tools in both art therapy and healthcare?
4. How does interactive digital artwork create immersive user engagement through its interface?
5. How do interaction design and interactive designers address social concerns, integrate technology, and fulfill user needs?

Hypothesis of Research

H1: Patient anxiety is influenced by both the waiting time and the environment of the waiting room.

H2: An interactive design interface that incorporates body interaction significantly reduces anxiety in adults and enhances healthcare experiences.

Setting

This study included participants from various waiting areas while they awaited treatment. The first location for testing the first hypothesis was the University of Sussex Healthcare Center and the Royal Hospital, followed by other randomly selected health centers. These healthcare settings were ideal for recruiting participants, as they typically experience higher levels of patient anxiety due to extended waiting times. Therefore, selecting appropriate settings for the experiment was crucial to ensuring the relevance and validity of the study.

Population (Sampling and Selection)

Sampling and the selection of participants are critical decisions in ensuring the quality and validity of research. For quantitative research, purposeful sampling is commonly employed to ensure that participants are carefully chosen to meet specific criteria, which is essential for producing valid results (Suri 2011, p. 63). In this study, data were collected from a selected group of individuals based on criteria designed to yield insightful and relevant findings.

As noted by Emmel (2013), purposeful sampling is particularly well-suited for applied research, as it focuses on identifying the most relevant and insightful cases for testing hypotheses. In this context, a sample refers to the group of individuals selected for the study based on their alignment with predefined criteria, such as age, education, and limited exposure to technology.

The sampling design used in this research was non-probability-based, meaning participants were not chosen randomly but selected purposefully according to the study's objectives. The researcher applied judgment to choose participants who best fit the study's criteria (Doherty 1994). A total of 53 participants were selected, which was fewer than initially anticipated due to time constraints and the specific criteria required for the study. The sample consisted of both male and female participants, primarily from universities and colleges, with all participants over the age of 18. This age group was chosen due to ethical considerations regarding minors and because the survey questions were more suited to individuals familiar with new technologies and digital media, such as university and college students.

Research Design

This research is both exploratory and explanatory in nature. It is exploratory because it seeks to familiarize itself with the problem, offering new insights and potential solutions (Kothari 2004, p. 2). It aims to provide greater control over variables and the research environment, particularly through the case study installation project experiment (Denial & Sam 2011, p. 18). The research is also explanatory, as it involves a survey designed to gather facts from participants, providing a description of the project's state, research objectives, and the experimental situation (Kumar 2005,

p. 9; Denial & Sam 2011, p. 24). Furthermore, it is descriptive, as it includes detailed explanations of participant characteristics and reflections on previous work, theories, and conditions (Kothari 2004, p. 2).

The study employs a mixed-methods approach (qualitative and quantitative), incorporating action research aimed at solving social problems (Kumar 2008, p. 9). The applied nature of this research allows for the discovery of practical solutions, with the goal of addressing anxiety in adults through interactive design interfaces. This approach is applied through the "Revive" project, a case study designed to test and implement the proposed solution.

The qualitative approach in this research focuses on gathering in-depth, observational data to understand human behaviors, attitudes, and feelings about the "Revive" project (Kothari 2004, p. 3; Denial & Sam 2011, p. 19). This data will be collected through participant observations, noting feelings and responses to the installation. Qualitative research helps uncover the underlying motives and emotions of participants, particularly in understanding how they interact with the installation and how it impacts their anxiety levels (Kumar 2005, p. 8).

In contrast, the quantitative approach involves collecting numerical data from closed-ended survey questions to test the hypotheses and measure the effect of the "Revive" project on participant anxiety. This approach is used to summarize the data in a form that provides statistical confidence in the results (Abeyasekera 2000, p. 1). Mixed methods are frequently used in health, behavioral, and social sciences to enhance the reliability of research findings by integrating both qualitative insights and quantitative data (Creswell 2015, p. 2).

Data Collection

The data collection took place from July 15 to August 15, 2016. During this period, the digital installation was presented at various locations to test the proposed hypothesis. A survey was conducted each time the installation was shown. Participants were invited to take part in the experiment and were included upon giving their consent.

The data were primarily collected through surveys administered shortly after the installation presentation, rather than through direct observation. The survey included more than ten questions designed to capture participants' experiences. As previously mentioned, this survey was the primary method of data collection for the study. For detailed survey questions and data charts, see the Appendix.

According to Fowler (2009, p. 1), surveys are a key method for gathering data, involving questions posed to participants, and the responses are then analyzed to draw conclusions. To ensure consistency and valid results, all participants answered the same set of questions in the survey.

Survey as Primary Data Collection

Surveys are commonly used in both descriptive and experimental studies (Denial & Sam 2011, p. 24). They are a widely adopted methodology, particularly in media studies, for collecting qualitative data (Mishra 2013, p. 1). The term

"survey" generally refers to the process of gathering research information from a sample of the population (Scheuren & American Statistical Association 2004, p. 9). In this study, a survey was conducted to collect primary data for the research and experiment.

The primary purpose of using a survey was to describe the current situation, identify the problem from the participants' perspective, gather information about their feelings, and evaluate their experiences with the installation. Additionally, the survey aimed to collect feedback on related works to improve the experimental interface design and produce more pleasant outcomes. This approach is widely used in experimental studies to gather comprehensive data.

The survey utilized Likert-scale questions to assess participants' opinions on the "Revive" project. The agree-disagree scale has been a common tool for decades in fields such as opinion polling, market research, and academic studies, providing valuable insight into attitudes, opinions, and values (Johns 2010, p. 1).

The survey was distributed after participants engaged with the project. The questions were designed to align with the aims of the research, specifically to gather feedback on the interactive installation design in healthcare and understand how people prefer to interact with such installations. The rationale behind each question was carefully considered to ensure the collection of relevant data. This survey, based on Likert-scale responses, was conducted in environments that offered quiet and healing stimuli, where participants were more likely to feel relaxed and comfortable.

Figure 1. *Likert Scale*

Observation through the "Revive" Case Study

This was the second primary data collection method used in this study. The goal was to understand the relationship between the installed design and participants' behaviors, as well as the design's impact on them within the experiment's environment. Typically, a case study utilizes this strategy to gather insights from the experiment. The observation process was unobtrusive and did not distract the participants. According to Kawulich (2005, p. 1), the primary aim of the observation method is to directly observe the behavior of participants. In this study, the observation was a direct one, conducted in the field of the presentation, focusing on real-time interactions and behaviors.

Additionally, theoretical analysis as secondary data was used to discuss the topic and relate it to previous studies and theories.

Case Study "Revive"

The main case study for this research is an interactive digital artwork installation called "Revive." The "Revive" project aims to divert patients' attention from the anxiety-inducing stimuli often present in waiting areas to more engaging and pleasurable stimuli. This is achieved through an interactive wall, digital art drawings, and animations. The case study was conducted in several healthcare centers' waiting rooms, as well as other waiting areas, to assess its effect on adults and evaluate the extent to which it can serve as an effective interactive tool for anxiety reduction. As Nam (2014, p. 38) notes, interactive digital installations are valuable methods for engaging participants in meaningful activities with purposeful outcomes.

The "Revive" installation was designed to obtain reliable results from direct interaction between the artwork on the interface screen and users in their environment. This project is intended to be a safe, cost-effective distraction tool for healthcare settings. It also explores how elements such as images, colors, and interactivity can influence an individual's emotions and overall well-being (Malchiodi 2003, p. 19). In this case study, both hypotheses were tested, and the interaction between the interface and users was analyzed to answer the research question. The results of these hypotheses will be presented in the following section and discussed in the next chapter.

Data Analysis

The analysis of both quantitative and qualitative data in this study was conducted separately for each type of data. However, at the interpretative level, the results were combined, as this study uses a mixed-methods approach to data collection, which follows this strategy for analysis (Sandelowski 2000, p. 252). For the qualitative data, a content analysis method was employed, as it is the most suitable technique for analyzing behavioral data. This method helps to count, categorize, and code data using computer software, while also summarizing key findings and presenting them in a narrative form (Creswell 2015, p. 4).

For the quantitative data, statistical analysis was used to organize and clarify the data in numerical form (Creswell 2015, p. 4). This approach provides interval data, using scales such as agreement or satisfaction levels. While both methods were analyzed separately, the findings were integrated during the interpretative results discussion. To analyze the statistical data, the central tendency method was applied to determine the meaning of the data. The mean, or average, was calculated as the central value derived from the sum of all data points, providing a clear representation of the data set.

$$\text{Mean: } X=\frac{\Sigma X}{n}$$

Therefore, the average score (or mean) was calculated for each themed question to determine the central response. "Agree" and "strongly agree" responses were

interpreted as indicating a positive correlation with expectations, while "disagree" and "strongly disagree" responses were interpreted as indicating a negative correlation.

Limitations of the Study

The interactive digital installation "Revive" faced several limitations during its implementation. One of the most significant constraints was the limited time available, which prevented the inclusion of a large and diverse sample of participants from different countries. Initially, the plan was to gather opinions from people worldwide regarding digital technology and its role in healthcare interventions. Additionally, technical limitations arose with the use of the Kinect Xbox, a motion sensor that offers high-resolution body detection. However, compatibility issues with the Mac PC meant we were unable to fully utilize the Kinect's features. As a result, we had to rely on a webcam, which caused the project's performance to be slower than anticipated. Another limitation involved the difficulty in obtaining permission to access waiting areas in several healthcare centers, as some institutions did not permit such projects. Despite these challenges, the project was carried out successfully, and these limitations will provide valuable insights for future research.

Research Findings and Discussion

The primary objective of this study was to investigate how interactive digital installations influence adult anxiety in waiting areas. Based on the data presented in the previous section and the field experiments conducted, it is essential to analyze this data in relation to the research question. This chapter presents the interpretations and results of the main data findings, which were obtained through surveys and observations during the experiment, as well as through participant feedback. The data in this chapter were analyzed using statistical methods and content analysis. Additionally, this chapter discusses the findings, evaluates the validity of the data, and compares the results with previous studies.

Participants and Response Rate of the Case Study

The original sample size for this study was estimated to be over 80 participants. However, by the end of the study, only 53 participants had engaged in the experiment and completed the survey. Out of the 53 responses, only two were missing. All participants were eager to take part in the experiment and complete the survey.

Additionally, all participants had a high level of education, with most being university or college students. All participants were over the age of 18, with the majority aged between 20 and 26 years. Both male and female participants were randomly selected.

Statistical Analysis (Survey Statistics)

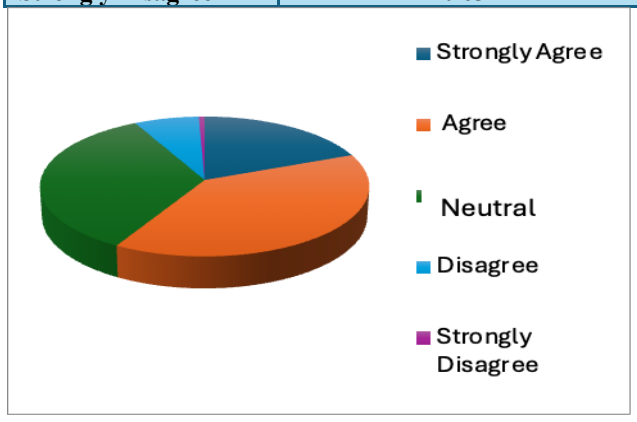
This section presents the key results and findings derived from the survey conducted during the experiment. It offers evidence for each aspect of the study, supported by relevant statistical findings. The section aims to analyze and discuss the primary themes of the research, including waiting anxiety, the effectiveness of interactive installations in reducing anxiety, and the potential impact of interactive installations on healthcare improvements. The analysis is organized into specific categories, each accompanied by relevant statistics and detailed analysis. For more details (see Figures 2-5).

Waiting Anxiety in the Hospital Waiting Rooms

Questions one, two, and six in the questionnaire were designed to examine and explore the issue of anxiety, specifically how the waiting environment and waiting time contribute to stress and anxiety in patients. The results provide insight into the extent to which people experience anxiety while waiting in hospital waiting rooms (see figure 2). As indicated by participants' responses, the highest percentage of answers were in agreement, with fewer participants selecting the disagreement option. The "agree" response had the highest mean of 39.28%, surpassing all other responses for this question. This suggests that the majority of participants feel anxious due to the waiting time and environment. These findings align with previous studies that have highlighted the impact of waiting time and environment on patient anxiety in healthcare settings. The results are summarized in Table 1 and Figure 2.

Table 1 & Figure 2. *Illustration of Participant Responses to Waiting Anxiety in Hospital Waiting Rooms*

Options	Percentage (Mean %)	Participants (Mean)
Strongly Agree	18.49	10
Agree	39.28	21
Neutral	34.21	18
Disagree	6.94	4
Strongly Disagree	0.63	0

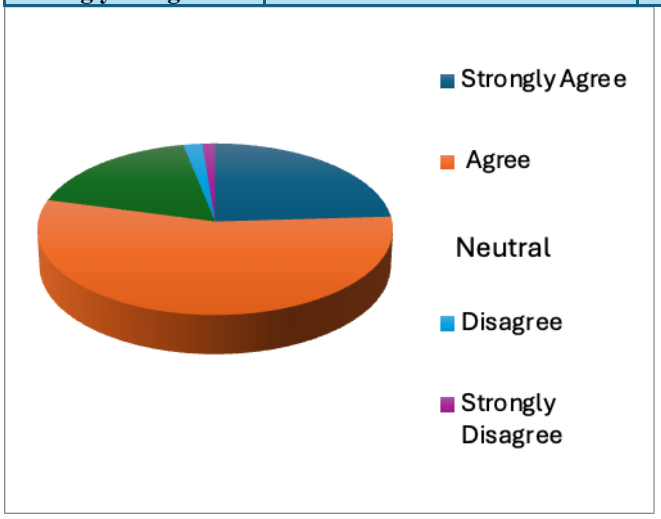


Interactive Installation Ability in Anxiety Reduction

In the following section of the questionnaire, questions were designed to assess the extent to which interactive installations can alleviate anxiety in adults in waiting areas. Participants provided multiple responses based on their opinions of the interactive screens and the type of interaction offered during the experiment. According to the statistical analysis of questions four, five, and eight, the highest percentage of participants agreed that the interactive installation was more effective at reducing anxiety than other techniques used previously in waiting rooms, with a mean percentage of 47.28%. Additionally, from question eight, 22 out of 53 participants indicated that the installation served as a valuable distraction tool, helping to reduce the discomfort often associated with medical procedures. Only a small percentage of participants disagreed (3.15%) or strongly disagreed (1.89%), suggesting that a minority did not fully support the concept, which could slightly influence the overall study's findings. Furthermore, several responses appeared to depend on the amount of time participants spent interacting with the installation during the experiment. Some participants completed the experiment quickly and did not fully engage with the different levels of interaction offered. The results are summarized in Table 2 and Figure 3.

Table 2 & Figure 3. *Illustration of Participant Responses on the Effectiveness of Interactive Installations in Reducing Anxiety*

Options	Percentage (Mean %)	Participants (Mean)
Strongly Agree	23.39	12
Agree	47.44	25
Neutral	25.39	13
Disagree	3.15	2
Strongly Disagree	0.63	0

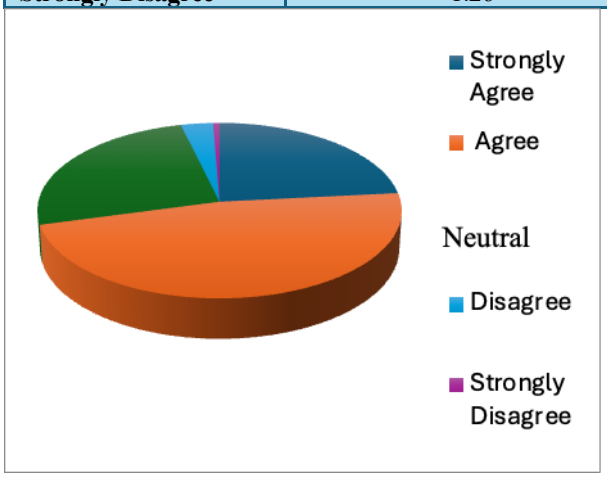


Interactive Installations Can Improve Healthcare

The survey also included questions aimed at assessing the potential of the interactive installation to facilitate and improve healthcare, motivate patients to seek treatment, and alleviate some of the efforts required by doctors to reduce patient anxiety before treatment. Questions seven, nine, and ten provided insights into participants' views on how the digital interactive installation could contribute to healthcare improvements. The responses to these questions revealed that many participants recognized the value of new technology in improving their lives. According to the data, a significant number of participants (29 individuals) agreed that the interactive installation had the potential to improve healthcare, with a mean of 55.09%, the highest mean among all options. The remaining responses were spread across various opinions, with most falling between "strongly agree" and "neutral." This variation in responses may reflect demographic differences and how individuals relate to and understand the role of digital technology and interactive installations in modern life. The results are summarized in Table 3 and Figure 4.

Table 3 & Figure 4. *Participants' Views on Interactive Installations Improving Healthcare*

Options	Percentage (Mean %)	Participants (Mean)
Strongly Agree	24.07	13
Agree	55.09	29
Neutral	17.69	9
Disagree	1.89	1
Strongly Disagree	1.26	1

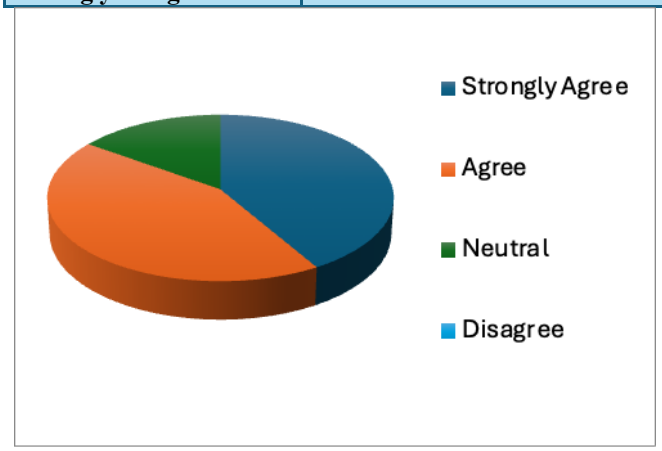


Another question in the survey aimed to determine whether people prefer interacting with still images or with interactive designs. This question sought to explore if individuals are more inclined towards traditional art or if they are drawn to the engagement offered by new digital art with interactive features. The highest percentage of responses were "agree" (43.40%), with a slight difference between "agree" and "strongly agree," while no participants chose the "disagree" option. This indicates that people are generally more engaged with the interactive features

of the installation design, as it actively involves them and creates a positive experience. The results are summarized in Table 4 and Figure 5.

Table 4 & Figure 5. *How People Prefer to Interact with Interactive Designs More than with Still Images*

Options	Percentage	Participants
Strongly Agree	41.51	22
Agree	43.40	23
Neutral	15.09	8
Disagree	0.00	0
Strongly Disagree	0.00	0



Summary

This chapter presents the main statistical data analysis of the findings. It focuses on three key points from the survey questions, analyzing them using the mean of all the results obtained.

Discussion

As discussed earlier, this section provides a deeper analysis of the research findings in relation to existing literature and the research questions. It also introduces new developments and concepts that have not yet emerged in previous studies but are essential to analyze based on the experiment's findings. In recent years, interactive media installations have become a new form of design, where designers aim to create and explore innovative experiences across various fields of human life and environments (Fischerr et al. 2007, p. 2836). These installations seek to provide social value and services by offering fresh perspectives on usage, particularly in public spaces. The creation of the "Revive" installation, in particular, is driven by the intention to express ideas and speculate on future applications, ultimately aiming to benefit society and address challenges like healthcare issues in innovative ways.

Research Questions

Through the "Revive" experience and its connection to previous findings in other studies, the research questions were answered, and new concepts emerged that require further exploration. The central question of this research was: *To what extent can interactive digital media installations influence anxiety in adults in hospital waiting rooms?* The answer aligns with previous research, which supports the idea that interactive installation design can act as a distraction tool, diverting patients' attention away from the negative stimuli of the waiting room and the anxiety caused by waiting times (Hathorn & Nanda 2008). This experimental study supports this approach, as evidenced by survey responses, where participants agreed that interactive installations could improve healthcare and function as a distraction tool in waiting rooms, allowing them to focus on more pleasant stimuli and engage positively with the installation.

To understand what makes this interactive installation effective in healthcare, we must consider each element of the design, such as color, visuals, and most importantly, the type of interaction. Various studies and literature discuss the impact of design elements like visuals, color, and music in healthcare, highlighting their potential to reduce anxiety (Staricoff et al. 2003, p. 7). In this experiment, some participants particularly enjoyed the visual elements, such as the animated designs, which contributed to feelings of happiness. We found that the choice of colors and reflective images must be carefully considered, as they can affect people differently based on their backgrounds and personal associations. Common sense tells us that certain images evoke emotions and influence our reactions (Malchiodi 2003, p. 20). For example, the blue background in this installation, typically associated with relaxation and calmness, fostered a sense of healing. Colors have coded meanings that convey sensations, feelings, and moods (Zammitto 2005, p. 1).

The interactivity of the installation further enhanced its effectiveness by engaging participants actively. Features like the motion sensor webcam, which mirrored participants' facial expressions with humorous faces, and the interactive bouncing ball game, where participants used body movements to track and manipulate the ball, encouraged engagement. These bodily interactions represent a new design aesthetic for interactive installations, where users are active participants. The dynamic interactivity employed in this design involves whole-body engagement, making users active players in the experience (Batras 2008, p. 5). Observations from the experiment, as well as participants' feedback, indicated that this dynamic interactivity was key to the success of the installation in reducing anxiety. This type of interaction supports its effectiveness in healthcare settings, offering an innovative aesthetic and approach to design.

Hypothesis

H1: The patient's anxiety is affected by the waiting time and environment in waiting rooms.

As indicated in the previous section, three of the research survey questions provided answers to the hypothesis that waiting time and the environment in waiting rooms negatively affect patients, playing a significant role in shaping their anxiety and stress. Waiting anxiety is a prevalent feeling, especially since patients are uncertain about how long they must wait for treatment, which can lead to heightened stress (Silva et al. 2014, p. 1695). Typically, waiting environments are filled with pressure and lack engaging distractions, leaving patients with little to focus on except their anxiety. According to the survey, 31 out of 53 participants strongly agreed or agreed that waiting environments and waiting times made them feel anxious and stressed. This statistic supports the first hypothesis and aligns with findings in previous studies on waiting anxiety. Therefore, waiting anxiety is a common human experience in healthcare settings, and there is an increasing trend in design to address this issue by reducing anxiety in hospital waiting rooms (Becker et al. 2008). This study has deepened our understanding of the anxiety faced by adults in waiting rooms, emphasizing the need for digital media contributions to alleviate this issue. By offering distraction techniques that engage patients and encourage active participation, the perception of waiting time can be minimized, helping to reduce anxiety.

H2: Interactive design interfaces with the features of body interaction have a great impact on anxiety reduction in adults and improving healthcare

To fully understand the findings related to this hypothesis, we must reflect on the insights gathered from participants in the "Revive" experiment and the survey responses. Based on the feedback from 53 participants in the case study, the hypothesis has been confirmed. Specifically, 39 of the participants (59.62%) agreed that the interactive installation has the potential to improve healthcare and reduce anxiety in waiting rooms. These results align with prior research discussed in the literature review, which suggests that such installations can serve as an effective distraction technique, redirecting participants' attention away from anxiety-provoking stimuli and focusing them on engaging, interactive screens.

The increasing trend of using installations in public spaces highlights the potential for integrating aesthetic elements into such projects, making them more impactful and beneficial for public needs and services. This supports the theory of speculative design, which advocates for using digital media and technology to create interactive designs that anticipate future desires. This approach encourages digital media designers to incorporate aesthetics, codes, and visuals into products that serve multiple purposes across various fields (Dunne and Raby 2013). It aims to engage participation, enhance welfare, and fulfill public interests, extending the scope of digital art beyond galleries and museums to practical applications in sectors like healthcare and education (Fischerr et al. 2007, p. 2837).

One key feature of the "Revive" installation is its incorporation of bodily movement interaction, a relatively new element in interactive design. This type of interaction encourages physical and emotional engagement, helping participants engage more deeply with the installation. It fosters creativity, imagination, and immersive experiences, which can positively impact users' emotional states,

including reducing anxiety (Byers 2012). The success of this approach in the "Revive" installation demonstrates how digital artwork can create a healing environment, offering an active and supportive atmosphere that benefits individuals' cognitive and emotional well-being.

Overall, both hypotheses and research questions were largely addressed through the experiment with the "Revive" installation. While some aspects still warrant further exploration, the findings clearly indicate that interactive installation design is an effective distraction tool. Future efforts from digital-age designers should focus on refining and implementing this concept in service-oriented products, particularly in healthcare settings.

Conclusion and Recommendations

In conclusion, this final chapter summarizes the research questions, objectives, hypotheses, and key points of the study. The primary research question of this study focused on understanding the extent to which interactive digital installations can influence anxiety in adults in hospital waiting rooms. The study aimed to assess the effectiveness of interactive installation design in reducing anxiety, improving healthcare, and facilitating human experiences, as well as contributing to problem-solving in healthcare environments. This research was grounded in interaction design and speculative design theoretical perspectives, providing an in-depth look at the factors that influence anxiety in waiting rooms and how interactive activities can create a healing environment. The interactive installation engages patients by distracting them from anxiety-inducing stimuli, offering a positive and immersive experience.

This study also focused on adults, filling a gap in existing research that often centers on children in similar contexts. Interactive installation design presents an exciting opportunity to explore human interaction with digitally mediated environments through interactive screens. It serves as a new form of distraction, engaging individuals physically and emotionally, including body movement as part of the interactivity. By encouraging active participation, the design fosters immersion and engagement. The study's hypotheses—the effect of waiting time on human health and mood, and the impact of interactive installations on healthcare improvement—were addressed through reliable data obtained from the survey responses and case study observations. The findings confirmed that interactive digital installation design plays a role in improving healthcare and reducing anxiety, with the aesthetic features of the design and the designer's intentional choices contributing to its therapeutic effects.

This study also demonstrated the speculative design perspective, as the project was conceived as a future-oriented solution to the current issue of anxiety in healthcare settings. The experiment showed that this interaction design could potentially lead to new solutions for managing healthcare-related anxiety.

Throughout the experiment, several key concepts emerged, particularly concerning the role of visuals, colors, and the nature of interaction in therapeutic environments. These elements contributed to creating healing stimuli, extending the

scope of the study and suggesting areas that require further exploration. Future research should focus on developing interactive products that cater to adults with varying levels of body movement engagement. Additionally, improving screen resolution and accessibility in healthcare settings, particularly hospitals, is an important consideration.

Finally, one critical question remains open for future exploration: How can the integration of new technologies and media provide better behavioral treatment options in healthcare, potentially reducing the reliance on conventional medical drugs?

Recommendations

This study offers several key recommendations for healthcare institutions and digital media designers:

1. **Focus on Interactive Design in Healthcare**: Healthcare centers should prioritize the integration of interactive design and digital media products to enhance the quality of service provided to patients. Interactive technologies have the potential to improve patient experiences and wellbeing in various healthcare settings.
2. **Behavioral Techniques as Treatment Alternatives**: Healthcare institutions should recognize that treatment options are not limited to medications. Behavioral techniques, such as distraction and engagement through interactive installations, should be explored and integrated as natural treatment alternatives to help reduce patient anxiety and improve overall health.
3. **Tailored Design for Healthcare Environments**: Digital media designers should give careful consideration to creating designs that have a positive impact on patient wellbeing. This includes selecting visuals and interaction features that are culturally and age-appropriate, ensuring safety, and avoiding elements that could cause harm. The design should be therapeutic and engaging while maintaining a user-friendly approach.
4. **Invest in Distraction Technologies**: Health institutions should place significant focus on the effectiveness of new technologies, such as distraction techniques, in improving patient experiences. Digital tools that help reduce anxiety, improve mood, and create a calming atmosphere in healthcare environments are essential for patient comfort.

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Appendix

Questionnaire

Introduction

Everybody worries or experiences the occasional case of butterflies in the stomach. Anxiety is a natural response that everyone encounters at some point in their life. However, some people experience constant worry and anxiety that affect their daily lives. For instance, the anxiety of waiting is a universal feeling, such as when waiting in a clinic and feeling nervous before receiving treatment or meeting the doctor. What do you think and experience?

This research aims to find several ways to use interactive design to alleviate anxiety. The project also focuses on how the interactive environment can help create a sense of calm and reduce anxiety by fostering motivation and happiness. In this experiment, we are exploring how interactive design can help reduce anxiety and create a sense of motivation. We are optimistic about the role of technology as a tool for developing strategies that explore how we can integrate interactive technology into healthcare and meet human needs.

Please take this seriously. Your response will be used for an experimental research paper.

Age:
Occupation:

No	Questions	Strongly Agree	Agree	Neutral	Disagree	Strongly Disagree
1	Anxiety interferes with your life.					
2	You often experience shortness of breath or choking feelings when you visit the health centre.					
3	People interact with animated designs more than still images as it encourages physical interactions with what is presented on the screens.					
4	Feelings of fear and anxiety reduced upon interactive content contained in such interactive screens such as colours and visuals, and body interaction.					
5	Interactive installation has a great ability to overcome anxiety, and it creates healing and interactive environment more than the atmosphere of the clinic waiting rooms.					

6	The clinic waiting room's environment and waiting time can affect you badly and make you anxious.					
7	This interactive installation gave you a greater incentive to receive treatment.					
8	Attention distraction installations are so engaging that they can also be used as a distraction tool for young people to reduce the discomfort in medical procedures and treatments.					
9	This interactive idea can ease the effort made by the doctor to reduce the anxiety of the patient before treatment.					
10	Interactive technology can facilitate and improve health care.					

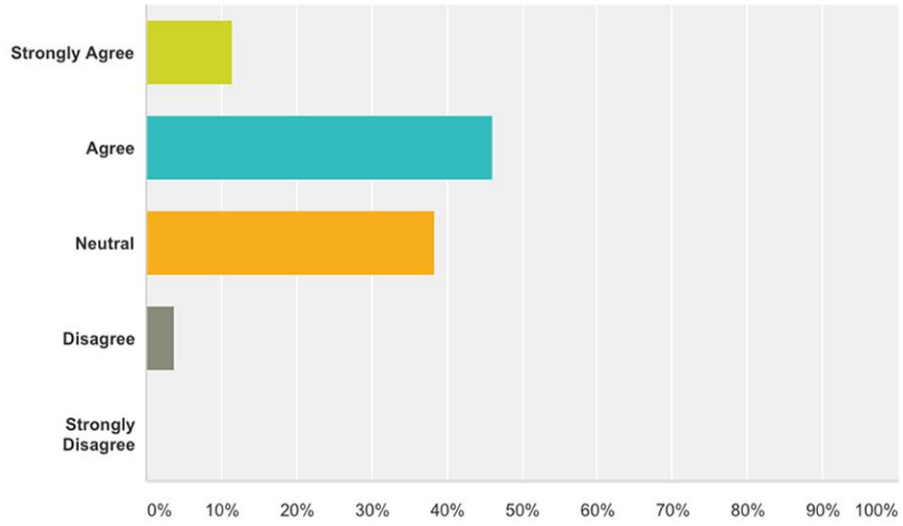
Practical Project Process and Instruments Explanations

In the first phase of the project, we began by testing a simple prototype using After Effects. This initial test was conducted with users to gather feedback and further develop the project. The main feature of the "Revive" project is motion detection and the screen representation of human movement. To implement this, we used a webcam with an Apple desktop, featuring a high-resolution display (1920 x 1080) on a 21.5-inch screen. The webcam served as the motion sensor to detect the individual's movements. Additionally, Illustrator CC 2015 was used to create smiley and funny faces, as well as butterflies. These drawings were then processed through Processing 3.1 to create the different phases of the interface and incorporate the images. Markup language (code) was used in Processing 3.1 to provide the necessary commands and instructions, enabling the processing software to perform the intended actions. Later stages of the project included the presentation of "Revive" in public spaces, utilizing a projector to display images on a wall. The webcam was used as the input, while the PC screen and projector served as the output.

All Data Charts: (Tables and Figures of Each Question Separately)

All the result figures for each survey question have been analyzed. The "n" represents the total number of participants in the experiment. All questions are multiple-choice, using interval data (Likert Scale). All figures and tables are provided here as evidence of the accuracy of the findings, as discussed earlier.

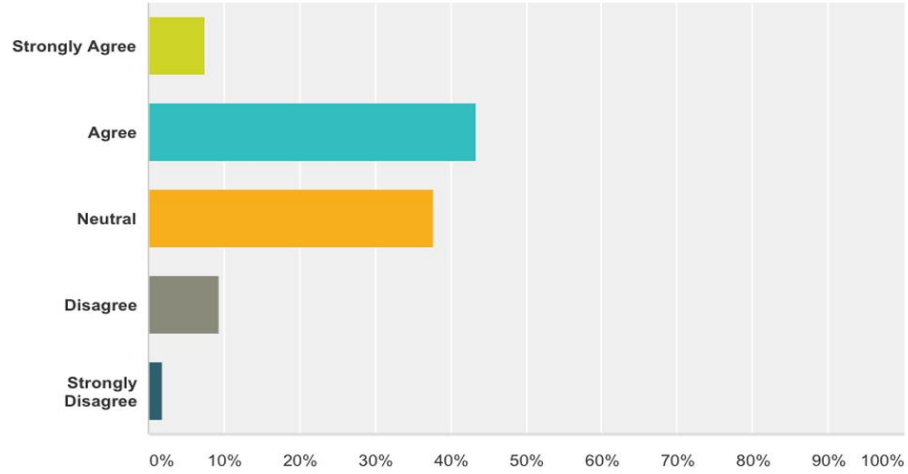
Figure 1. *Anxiety Level*



Answer Choices	Responses	
Strongly Agree	**11.54%**	6
Agree	**46.15%**	24
Neutral	**38.46%**	20
Disagree	**3.85%**	2
Strongly Disagree	**0.00%**	0
Total		52

The first question is: Is anxiety interfering with your life? The highest answer is agreed, so many people feel that anxiety is interfering with their daily lives. See (*figure 1*) (*n* = total 53). This question was skipped by one person, so *n*=52.

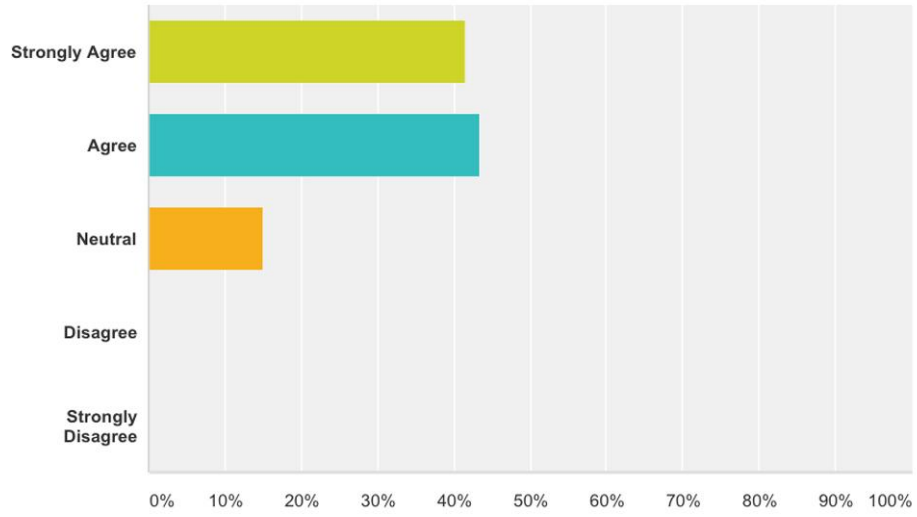
Figure 2. *Anxiety Experience*



Answer Choices	Responses	
Strongly Agree	**7.55%**	4
Agree	**43.40%**	23
Neutral	**37.74%**	20
Disagree	**9.43%**	5
Strongly Disagree	**1.89%**	1
Total		53

The second question is: Do people often experience short breathing or choking feelings when visiting doctors and health centers? The highest percentage is agreed in this question with little differences with neutral. See (*figure 2*) / *n*=53.

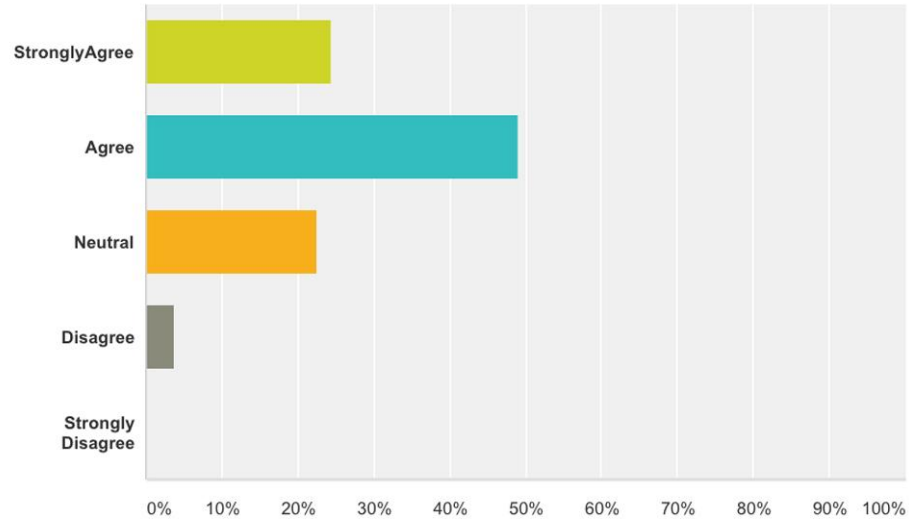
Figure 3. *Comparison of Interactive Design and Still Images*



Answer Choices	Responses	
Strongly Agree	**41.51%**	22
Agree	**43.40%**	23
Neutral	**15.09%**	8
Disagree	**0.00%**	0
Strongly Disagree	**0.00%**	0
Total		53

The third question is: Do people interact with animated designs more than still images as they encourage physical interactions with what is presented on the screen? The highest percentage is agreed, and small differences are strongly agreed. See (*figure 3*) / *n*=53.

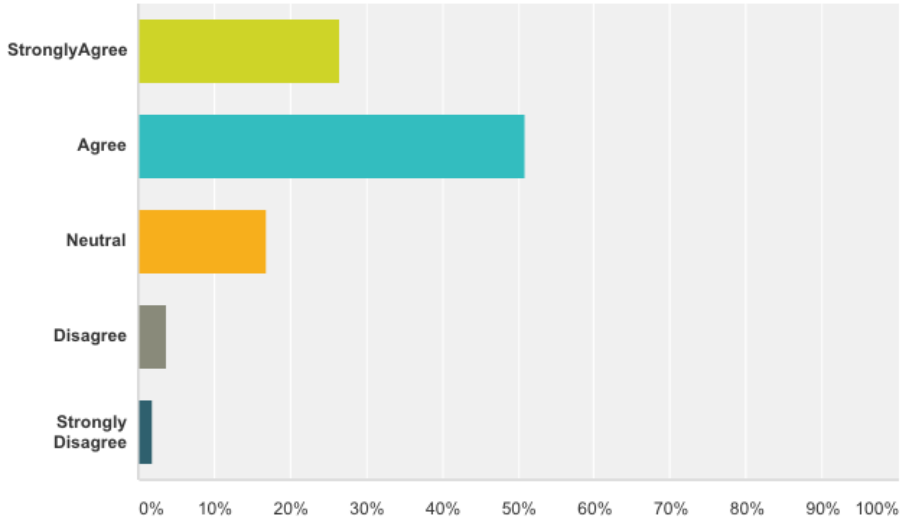
Figure 4. *Anxiety Reduction Using Interactive Screens*



Answer Choices	Responses	
StronglyAgree	**24.53%**	13
Agree	**49.06%**	26
Neutral	**22.64%**	12
Disagree	**3.77%**	2
Strongly Disagree	**0.00%**	0
Total		53

The fourth question is: Did feelings of fear and anxiety reduce upon witnessing interactive content on such interactive screens, such as colors and visuals and whole-body interaction? The highest percentage is agreed, and few people disagree in this question. See (*figure 4*) / *n*=53.

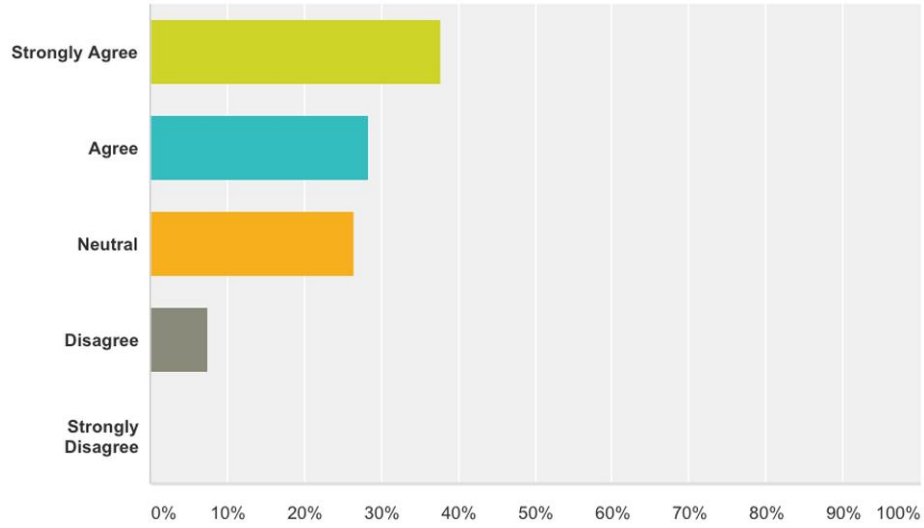
Figure 5. *Interactive Installation Influences Anxiety*



Answer Choices	Responses	
StronglyAgree	26.42%	14
Agree	50.94%	27
Neutral	16.98%	9
Disagree	3.77%	2
Strongly Disagree	1.89%	1
Total		53

The fifth question is: Interactive installation has a great ability to overcome anxiety, and it creates a healing and interactive environment more than the atmosphere of the clinic waiting rooms. The highest percentage is agreed with good correlation with strongly agree. While disagree and strongly disagree which is negative correlation is low. See (*figure 5*) / *n*=53.

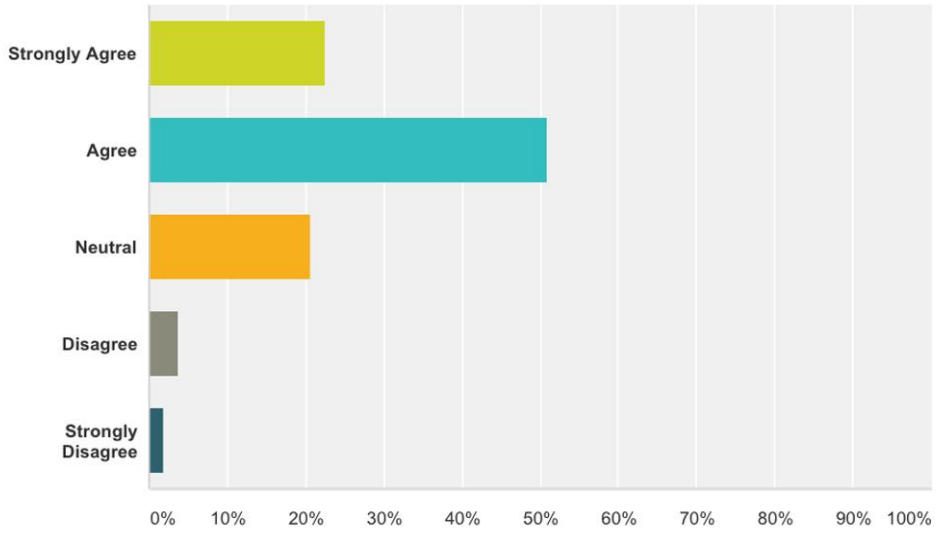
Figure 6. *Clinical Environment Effects on People*



Answer Choices	Responses	
Strongly Agree	**37.74%**	20
Agree	**28.30%**	15
Neutral	**26.42%**	14
Disagree	**7.55%**	4
Strongly Disagree	**0.00%**	0
Total		53

The sixth question is: Can the clinical environment affect you badly (negatively)? The highest percentage is strongly agreed, and a few people disagree with this question with no strongly disagree percentage. See (*figure 6*) / *n*=53.

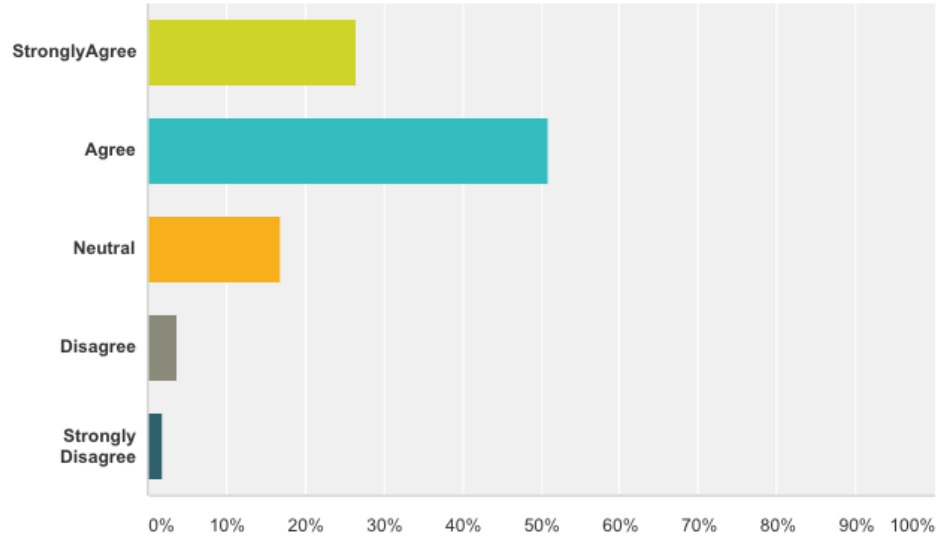
Figure 2. *Interactive Installation Provides Incentive to Receive Treatment*



Answer Choices	Responses	
Strongly Agree	**22.64%**	12
Agree	**50.94%**	27
Neutral	**20.75%**	11
Disagree	**3.77%**	2
Strongly Disagree	**1.89%**	1
Total		53

The seventh question is: Did the interactive installation give you a great incentive to receive treatment? The highest percentage is agreed and there are strongly disagree percentages this time. See (*figure 7*) / *n*=53.

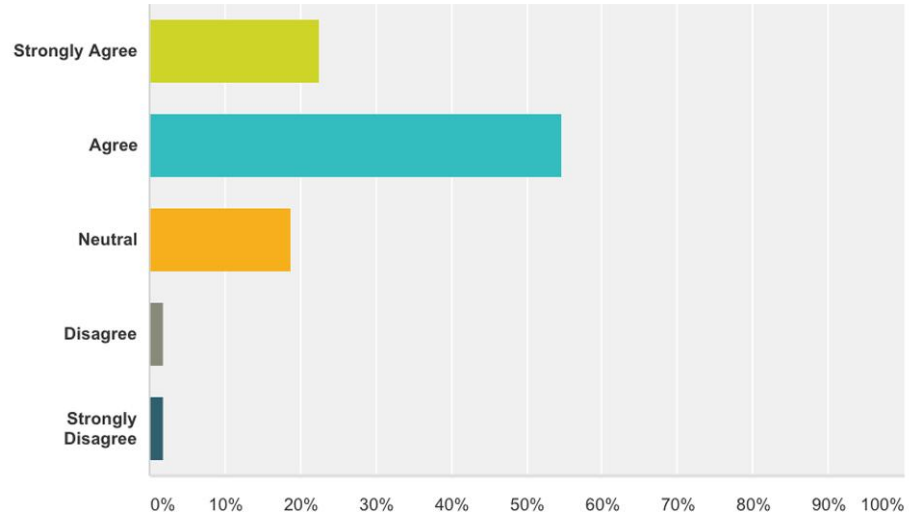
Figure 8. *Interactive Installation as Distraction Tool*



Answer Choices	Responses	
StronglyAgree	**26.42%**	14
Agree	**50.94%**	27
Neutral	**16.98%**	9
Disagree	**3.77%**	2
Strongly Disagree	**1.89%**	1
Total		53

The eighth question is: Attention distraction installations are so engaging that they can also be used as a distraction tool for young people to reduce the discomfort in medical procedures and treatments. The high score came in the agreed and neutral with few differences between the strongly agreed. One answer is skipped by one of our participants. See (*Figure 8*) / *n*=52.

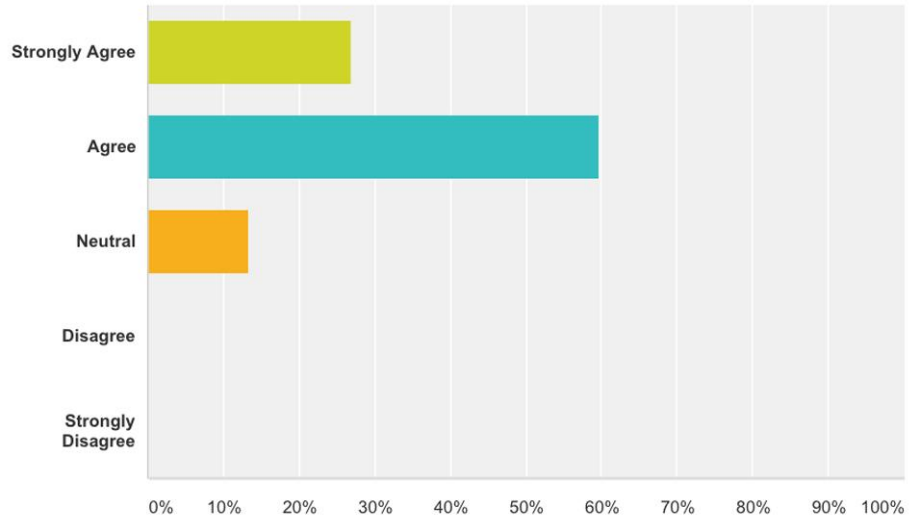
Figure 9. *Interactive Installation Reduce the Doctor Effort with his Patients*



Answer Choices	Responses	
Strongly Agree	**22.64%**	12
Agree	**54.72%**	29
Neutral	**18.87%**	10
Disagree	**1.89%**	1
Strongly Disagree	**1.89%**	1
Total		53

The ninth question is: Can interactive installations ease the effort made by the doctor to reduce the anxiety of patients before receiving treatment? The highest percentage is agreed, and few people disagree in this time. See (*figure 6*) / *n*=53.

Figure 10. *Interactive Installation Improve Healthcare*



Answer Choices	Responses	
Strongly Agree	**26.92%**	14
Agree	**59.62%**	31
Neutral	**13.46%**	7
Disagree	**0.00%**	0
Strongly Disagree	**0.00%**	0
Total		52

The last question is: *Can interactive installation facilitate and improve healthcare?* The highest percentage of participants agreed, with no disagreement or strong disagreement. See (*figure 10*) / *n*=52, one participant skipped this question.

These are the key figures that provide valid information and data for this research. The remaining figures and tables can be found in the Appendix. Further discussions and analyses of the results will be presented in the next chapter, as mentioned earlier.

Athens Journal of Health & Medical Sciences – Volume 12, Issue 4, December 2025 – Pages 297-314

Impact of the COVID-19 Pandemic on Digital Solutions of Healthcare in Hungary

*By Annamaria Uzzoli**

The aim of this paper is to provide an overview of the short-, medium- and long-term impacts of the COVID-19 pandemic on digitalization processes, primarily through the example of the Hungarian healthcare. The main task was to explore how the pandemic affected the Hungarian healthcare services both of public (state) and private providers and what role healthcare digitalization played in this. The investigation contained a questionnaire survey which was conducted among private healthcare providers in 2024. The findings were supplemented by statistical analysis, literature review, document analysis and interviewing. Among the results, it can be mentioned that the pandemic accelerated the rapid and widespread spread of telemedicine in Hungary, and also resulted in the effective interaction of public and private healthcare, and thirdly, through private investments, serious developments were made in the application of telemedicine even before the pandemic which were also strengthened by the effects of the coronavirus epidemic. In addition to private investments, the Hungarian public – state – healthcare has also made significant developments in the application of telemedicine. All of these interventions in the digitalization processes of healthcare are still noticeable today due to the impact of the pandemic and will stay with us in the long-term.

Keywords: *COVID-19 pandemic, delivery of healthcare, digitalization, telemedicine, Hungary*

Introduction

The novel coronavirus pandemic has had a variety of impacts on countries' healthcare systems in recent years. These impacts have varied over time and space, but one of the most striking consequences of all has been the digitalization process. Since the spring of 2020, national healthcare systems, including Hungary's, have faced numerous challenges, which required rapid and effective responses to protect the population. The new situation has required new solutions from healthcare actors in the short-, medium- and long-term. The problems and challenges associated with the pandemic have arisen in both public and private healthcare, as well as in the healthcare background sector, the healthcare industry. Healthcare digitalization has played an important role in developing an effective adaptation strategy and achieving appropriate resilience.

However, it should also be mentioned that the development of the e-health sector (telemedicine) had already begun before the pandemic and was an advanced process in Hungary. State interventions, partly European Union (EU) subsidies,

*Senior Research Fellow, HUN-REN Research Centre for Astronomy and Earth Sciences, Geographical Institute at Budapest, Hungary.

and partly private investments brought serious results in the use of domestic telemedicine before 2020. Namely, digitalization in healthcare was already a prominent feature of the EU's development policy before the pandemic, which led to the widespread availability of e-health to healthcare providers and the general public. The COVID-19 epidemic transformed the consumer needs (patients), the forms of healthcare use, and because of these, existing digital solutions, e-health applications under development, and newly introduced telemedicine services resulted in previously unexperienced phenomena in healthcare digitalization.

The overall aim of the paper is to analyze the direct and the indirect long-term effects of the coronavirus pandemic on Hungarian healthcare, but the specific research task is to interpret the consequences of digitalization in this context. The other important task is to explore how the pandemic affected the Hungarian healthcare services both of public and private providers and what role health care digitalization played in this.

The paper consists of the following sections. The section of the literature review summarizes the most relevant international and domestic antecedents on that topic how digitalization could be widespread in healthcare regarding the effects of the COVID-19 pandemic. The section based on the methodology describes the quantitative and qualitative methods that were applied to answer the research questions. The section of the results is based on three subchapters to present them in the light of applied methods. The section of discussion examines the primary findings in the context of the antecedents. The final section of the paper integrates clear conclusions.

Literature Review

Since the coronavirus pandemic became global – from March 2020 – countless scientific publications have addressed the conditions of its emergence and spread, or its effects and consequences on healthcare and health status, and the possible forms of health response measures (Antonietti et al. 2021, Boutsioli et al. 2022, Buzhenitsa et al. 2024, Cheng 2024, Galea et al. 2022, Madewell et al. 2020, Perera et al. 2020, Wang et al. 2020, Wang et al. 2021). Among the scientific publications, various global organizations were prominently featured, drawing attention to the possible complex health and other socio-economic effects of the pandemic (The Global Risks Report 2021, UNDP 2020a, 2020b, WHO 2020). The processing, compilation and synthesis of international and domestic literature review covers the period between spring 2020 and the end of 2024. The aim was to explore the aspects from which the antecedents assessed the relationship between healthcare digitalization and the pandemic and what main results they reached. Based on the content of the reviewed international and domestic publications, four main groups of antecedents can be distinguished that examine the relationship between the epidemic, health and healthcare using different aspects and different methods during the period under review. It is important to note that this distinction should be handled flexibly in the thematic focus, because these research topics are not sharply separated from each other, and there is a lot of overlap between them

within a single literature source or research. However, it is a fact that the interpretation of healthcare digitalization and the development of telemedicine in connection with the epidemic featured prominently in the literature.

These are the main thematic groups of major international papers on the health consequences of the COVID-19 pandemic:

1. Examination of the epidemiological emergency situation itself: research topics are e.g. novel challenges in healthcare, spread of infectious diseases, prevention of mortality, effects of lockdowns (Amdaoud et al. 2021, Filip et al. 2022). In this thematic group, the study of digitalization was implemented in two ways. On the one hand, the focus was on examination the novel role of telemedicine during the lockdowns and its long-term effects on using healthcare services (Ferwana & Varshney 2024, Moynihan et al. 2020). On the other hand, a special examination focus appeared among the antecedents on how new tech gadgets and smart devices became widespread across telemedicine regarding the pandemic management (Albanese & Senesi 2023, Channa et al. 2021).
2. Examination on the healthcare of the non-communicable diseases during the pandemic: research topics are e.g. effects of the pandemic on the healthcare of non-communicable disease, barriers in access to healthcare during the lockdowns, post-acute COVID-19 syndrome etc. In this thematic group, the study of digitalization appeared through the following research topics: e.g. novel application of telemedicine in the treatment of chronic diseases, possibilities of telemedicine services without physical contact, adapting to the changing needs of patients in the development of telemedicine (Aihaz et al. 2024, Ricci et al. 2020).
3. Examination the health inequalities and their spatial distribution regarding the pandemic: research topics are e.g. effects of the pandemic on health inequalities and their socio-spatial inequalities, changing quality of life regarding the pandemic, socio-economic aspects of health inequalities due to the pandemic etc. In this thematic group, the study of digitalization especially appeared in that way how digital inequalities and 'digital gap' influenced access to healthcare during the pandemic (Giansanti & Veltro 2021, Frey et al. 2024a, 2024b).
4. Examination the effects of the pandemic on healthcare industry: research topics are e.g. transformation of supply and demand in healthcare industry, supply and logistic disruptions during the lockdowns, stock shortage during the pandemic etc. In this thematic group, the study of digitalization the role of Industry 4.0 technologies in the healthcare industry due to the pandemic, novel digital solutions in healthcare industry regarding the pandemic etc. (Kiss & Uzzoli 2024, Paranitharan et al. 2022, Quadri et al. 2020).

The literature review of the domestic antecedents was accompanied by the following experiences. Hungarian researches on pandemic-related healthcare digitalization separately address the results achieved in public healthcare and private healthcare (Girasek et al. 2022). While the former primarily emphasizes the role of

public developments in healthcare digitalization, the latter mainly highlights the importance of private capital in digitalization-based investments. The National eHealth Infrastructure and its professional modules were implemented with the support of the European Union co-funded by the Hungarian state in 2017 (eeszt.gov.hu). The marked further improvement of this National eHealth Infrastructure (in Hungarian: EESZT) was introduced in 2020 which was a direct consequence of the epidemiological measures and resulted in 100% spread of e-presciptions in Hungary (Szabó 2020). The Hungarian e-Health Infrastructure helped organize Covid vaccinations in the spring of 2021 and it also became the electronic platform for the EU digital Covid card (Paragi 2022). On the other hand, this e-Health Care Cloud Hosting was also applied by private healthcare providers, so one of public digital developments became the part of private healthcare too. Essentially, the digitalization of state-owned healthcare services emerged in connection with the pandemic through the possibilities of telemedicine (Paulikné 2021). At the same time, it was also observed from spring 2020 that 'consumer' demands increased the value of digital tools, but the public healthcare sector reacted only belatedly (PWC 2021). Furthermore, based on the experiences of the literature analysis, contradictory factors determined the digitalization processes in private healthcare in the first two years of the pandemic. On the one hand, there was an accelerated growth in sales during the epidemic compared to the years before the pandemic, but with decreasing profits (Portfolio 2021a, 2021b). On the other hand, due to the pandemic, more and more investments were made – including modernization developments – but these further reduced profits by employing increasingly expensive labor. In addition, it was observed that new demands in private healthcare emerged from patients regarding COVID-19 testing, treatment of complications caused by the disease, and the availability of telemedicine services (Csiki 2020). In essence, the responses of private healthcaree providers to the effects of the pandemic have been realized in new investments, broadening the range of services, launching new specialist orders, switching to COVID-19 testing, introducing COVID-19 screening packages and developing digital solutions (Csiki 2021).

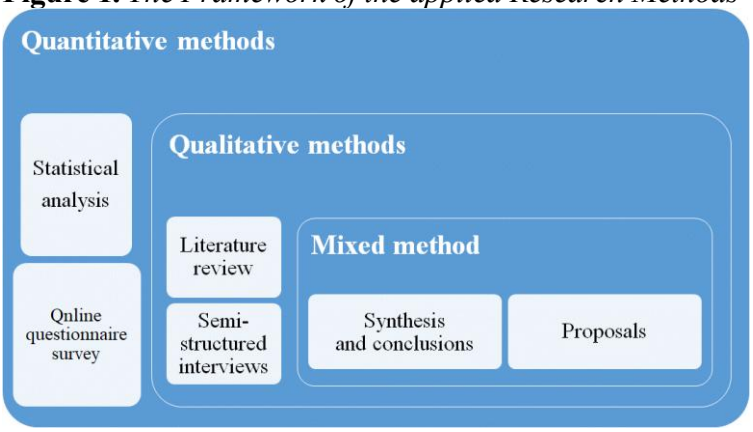
Data and Methods

The effects of the pandemic in healthcare have had a significant impact on digitalization processes. This was explored using various research methods, which also helped to answer the following key questions.

- What responses have healthcare providers given to the challenges caused by the COVID-19 pandemic? What role did digital solutions play in these?
- What novel digital solutions have emerged in healthcare as a result of the pandemic compared to those that already existed?
- Is there a difference in how public and private healthcare providers responded to the effects of the pandemic through the application of digitalization solutions?
- How can the digitalization solutions that emerged in connection with the pandemic be defined in the short-, medium- and long-term?

The implementation of the research aims and the answering of the key questions were based on a mixed methodology, i.e. the combined use of quantitative and qualitative research techniques (Tariq & Woodman 2013, Wisdom & Creswell 2013), primarily through the application of the so-called parallel or concurrent structure (Beharie et al. 2020) (Figure 1). The essence of this is that the results of quantitative and qualitative data collection and analysis were only combined in the final comparison and interpretation of the relationships. Thus, the experiences gained separately and independently complemented each other and provided a more complex picture of the topic under study.

Figure 1. *The Framework of the applied Research Methods*



Statistical analysis was extremely limited due to the lack of telemedicine data in Hungary. There are no public databases, there are only secondary sources from which one can indirectly draw conclusions about digitalization processes in healthcare. Primarily summary statistics are available, from which conclusions could be drawn about digital healthcare data. The used statistical data in all cases came from official data sources. The applied statistical data are therefore only very limitedly suitable for presenting healthcare digitalization, and data gaps must be taken into account in their interpretation. Due to the limitations of statistical analysis, this research obtained additional information from the questionnaire survey and interviews.

An online questionnaire survey was conducted among the Hungarian private healthcare providers in July of 2024. The sample of the questionnaire was generated by Google Online Form Creator. The survey questions were related to the following main topics:

- General data on the private healthcare provider,
- Challenges caused by the pandemic and the responses to them,
- Role of the pandemic in the digatalization developments.

The questionnaires were sent to 55 private healthcare providers, and to increase the response rate, the direct inquiries (by email) were repeated several times. In spite of this, only 11 providers (20%) answered the questions (N=11). Although the sample size is too small and it does not form a representative one, but

it can be considered appropriate because there is many useful information on the examined topic which is mostly not available from other sources.

The experiences with the questionnaire greatly contributed to the compilation of the questions for semi-structured interviews with various stakeholders in private healthcare.

Interview questions can be classified into the following groups:

- General information on the private healthcare provider,
- Pandemic-related crisis factors and their temporality,
- Digital solutions before and after the pandemic,
- The impact of public healthcare on digitalization in private healthcare.

A total of 12 requests for interviews were made, of which 7 interviews were conducted with private healthcare stakeholders during November and December 2024 (N=7). Six of the interviews were conducted online and one was conducted over the phone, and they generally lasted 40 minutes (the shortest lasted 25 minutes, the longest 54 minutes). All interviews were audio recorded according to the GDPR regulations. The interviewees were private healthcare stakeholders who were affiliated with the given private healthcare provider in a leadership, ownership, research or management status. The main aspects of the content analysis of the transcripts from the audio recordings were the following:

- Exploring the local catchment area of the private healthcaree provider,
- Identifying the challenges caused by the pandemic in relation to the epidemic waves,
- Interpreting the reasons of digital solutions before the pandemic,
- Defining pandemic-induced digital solutions,
- Learning about the possibilities of artificial intelligence in digital solutions,
- Defining the challenges of public healthcare through the perception of private healthcare providers,
- Knowing about the developments and spatial expansions that have taken place at private healthcare providers.

Among the applied methods, the literature review focused on the summary of international and domestic antecedents. This was complemented by document analysis, which was based on the evaluation of Hungarian policy strategic and development documents after 2010.

The results and experiences obtained during the studies are summarized through a discussion of the literature background, and the conclusions drawn in this way are suitable for developing proposals to support policy decision-making.

It is worth mentioning that the research was not addressed to analyse the role of Internet or social media in healthcare digitalization at all (De la Cruz 2024).

Results

The main results of the research are presented in the light of applied methods. The development of healthcare digitalization related to the pandemic is described based on a literature review as it could be seen in the previous chapter. The examination of the emergence of healthcare digitalization in the Hungarian development strategies is carried out through document analysis. The main characteristics of the spread of telemedicine during the pandemic are presented in light of the available statistical data. The presentation of the pandemic impacts and the responses to them, as well as the digital solutions emerging in all of this, is presented in the light of the questionnaire survey and interviews based on the experiences of private healthcare providers.

The Emergence of Healthcare Digitalization in the Development Strategies in Hungary after 2010

Domestic development policy documents (sector strategies, development programs, guidelines and plans) published in the last 15 years were divided into three groups and the content analysis was carried out in this way:

1. Sectoral strategic development documents in healthcare: e.g. Semmelweis Plan (2010), Healthy Hungary 2014-2021 Sectoral Strategy (2015), Healthcare Industry Support Program (2020), Healthy Hungary 2014-2021 Sectoral Strategy (2021).
2. Economic and competitiveness development documents: e.g. New Szechenyi Plan (2011), Szechenyi 2014-2020 Program (2014), Szechenyi Plan Plus 2021-2027 (2021), National Development and Territorial Development Concept (2013), Competitivness Strategy for Hungary 2024-2030 (2024).
3. Development documents on digitalization: e.g. Natioanl Infocommunication Strategy 2014-2020 (2014), National Smart Specialization Strategy (2014), Development Strategy for Digital Healthcare Industry (2017), National Strategy for Digitalization (2014, 2022).

The aim of the content analysis was to explore the opportunities that healthcare digitalization has presented in the development policy in Hungary after 2010. Although the development documents examined are aimed at decision-making and interventions that can be implemented at the state level, their review and evaluation can also provide useful information regarding the Hungarian private healthcare sector. This is because domestic private healthcare providers need to implement their investments and ventures in a macroeconomic framework in which the current government strategies and measures are essentially implemented.

In general, it can be stated that healthcare digitalization has been a defining development direction in Hungary over the past decade and a half. E-health as the synonymous of healthcare digitalization or telemedicine has come into focus in domestic sectoral and digitalization strategies primarily through the development of data-driven healthcare and the technological development of the healthcare

industry. This has come to the fore in policy decision-making in the form of development goals and plans aimed partly at infrastructure investments and partly at research, development and innovation (R & D & I). Over the 15-year period under review (between 2010 and 2025), a fine-tuned transformation of strategic directions can be observed, primarily in response to the digital challenges caused by the COVID-19 pandemic. Before the pandemic, the development of e-health in Hungary served more as an infrastructure investment to reduce the overload of healthcare (e.g. the creation of eeszt.gov.hu). However, after the pandemic, it has become increasingly important to develop a practical model of artificial intelligence and to apply digital solutions in everyday life in response to changing consumer needs (e.g. smart swatch for elderly people).

It should be emphasized that domestic efforts towards healthcare digitalization are in line with the 'Smarter Europe' investment priority, one of the central objectives of the European Union's regional and cohesion policy for the period 2021-2027, which actually puts the importance of digitalization on an equal footing with the thematic areas of innovation and the development of small and medium-sized enterprises. The primary EU document in the field of digitalization is the Digital Compass (Roadmap to a Digital Decade) policy program until 2030, which sets out the digital transformation of enterprises, the digitization of public services, secure and sustainable digital infrastructures and the development of digital skills (European Council 2022). These guidelines also serve as a guide for private healthcare providers in Hungary, who can essentially directly exploit the beneficial effects of public developments and digital investments.

Overall, Hungary enacted several legislative measures to support digital health solutions during the pandemic (Döbrössy et al. 2024). These included regulations on telemedicine practices, reimbursement policies, and data protection. The National Health Informatics Strategy, introduced in July 2021, outlined a long-term vision for integrated, people-centered digital healthcare, ensuring the sustainability of digital solutions beyond the pandemic.

The Healthcare Digitalization in the Light of some Statistical Data

The Ministry of the Interior is responsible for managing and implementing digital health projects. Telemedicine is regulated by Directive 2020/559/HU, which covers the reimbursement of online prescriptions, treatments and therapies (mandatory prerequisites: identification, data protection and suitable equipment). The Hungarian government has already initiated the digitization of the healthcare system through its digital patient record in 2017. This record is now accessible via the National e-Health Infrastructure (EESZT). This is a central IT system that ensures communication between all healthcare providers. The EESZT is in number (https://www.eszfk.hu/, 2024):

- more than 3.5 billion health records
- over 700 million care events
- about 800 thousand e-prescriptions per a day
- 40-60 thousand logins to the Citizen Portal Site of EESZT per a day
- 27 thousand connected healthcare providers

- 6 thousand connected GP practices
- 12 thousand connected healthcare providers
- over 3200 connected pharmacies
- 300 connected out-patient providers
- 250 connected rescue stations
- more than 100 connected in-patient providers

In 2021, 43% of the adult population in Hungary were in fact active EESZT users and only 24% were unaware of its existence and the rate of e-prescriptions was over 90% in 2021 (Rosta et al. 2023).

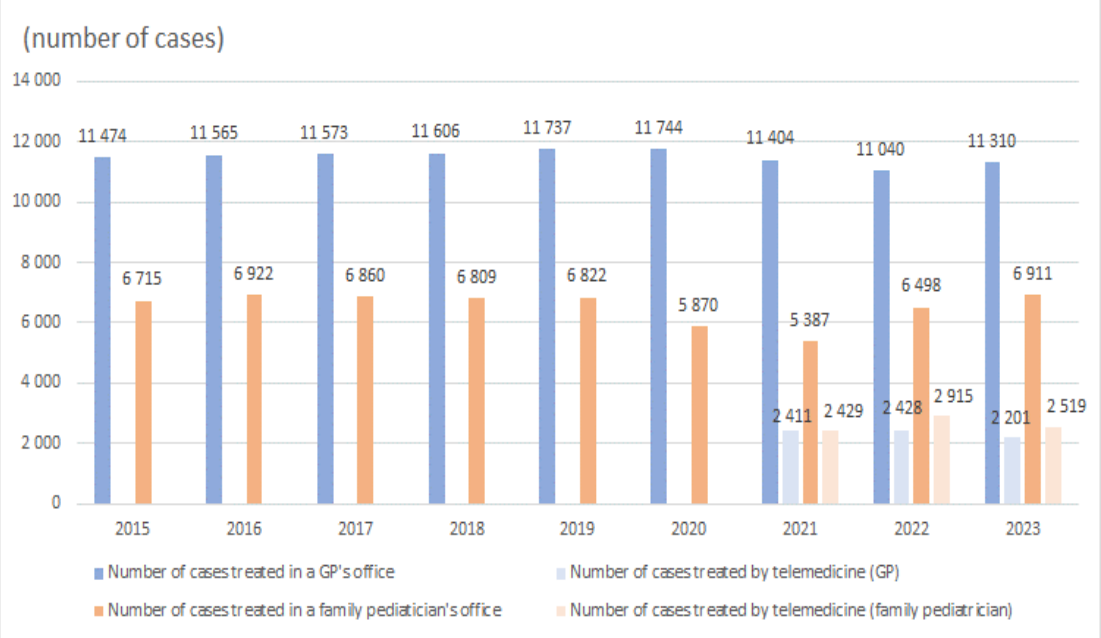
During the pandemic, On April 30, 2020, the Hungarian government issued Government Decree no. 157/2020 (IV. 29.), known as the Telemedicine Decree. This decree mandated healthcare facilities to provide teleconsultations, outlining criteria and objectives for telemedicine services. This was the regulatory framework of the Hungarian healthcare digitalization regarding the COVID-19 epidemic.

As a result of the legislation, the number of telemedicine services in general practice care has been statistically demonstrable since 2021 (Figure 2). In general, the number of care provided by family doctors has decreased during the pandemic compared to the years before the pandemic. Except for the first year of the pandemic, 2020, when the increase was caused by the fact that during the lockdowns, essentially only primary health care – mainly GP's care – was available in Hungary. Since 2021, the rate of cases treated by telemedicine was about 21-22% compared to the total number of cases treated in GP's office. The rate of telemedicine services in family pediatrician care was twice as high as in family doctor care in 2021 and 2022. In 2023, the number of cases treated by telemedicine has already visibly decreased, meaning that the system based on personal doctor-patient contacts is slowly starting to recover. However, it is expected that telemedicine services will remain with us in the future in primary health care.

Hungarian family doctor's care (GP) is also an important achievement in the healthcare digitalization e from other perspectives. In 2013, a family doctor patient management system was established with private healthcare investment. This management system (erodium.hu) helps GP services and provides an integrated patient management and online appointment booking service. During the pandemic, many family doctors joined the system on their own capital (out-of-pocket) and, for example, the Covid-19 vaccination was already organized with this. Here are some relevant data on this Hungarian patient management system in primary healthcare from March 2025:

- 299 connected GP providers
- 87,542 patients called for primary healthcare
- 35,098 submit online applications
- 16,359 serviced phone calls

Figure 2. *Number of Cases treated by Telemedicine in Primary Healthcare in Hungary, 2021-2023*



Source: https://www.ksh.hu/stadat_files/ege/hu/ege0007.html

The Effects of the Pandemic and the Responses to them in the Light of Digitalization Developments – A Case Study among Hungarian Private Healthcare Providers

A questionnaire survey was conducted with private healthcare providers in July 2024, with a response rate of 20% (N=11). Therefore, the survey results are not representative, but they provide a lot of relevant information about the effects of the pandemic and digitalization developments. The results of the survey are complemented by the experiences of semi-structured interviews (N=7) conducted with private healthcare stakeholders, therefore the results of the questionnaire survey and the interviews are presented simultaneously. More healthcare private providers from the capital city Budapest participated in the questionnaire survey (82% from the capital), therefore there were more rural stakeholders among the interviewees (57% rural). 5 out of 7 interviewees work not only in the private sector, but also partly in the public sector, so they had insight into state healthcare. Of the private healthcare providers participated in the questionnaire survey, 5 had a workforce of 21–49 people, 4 had a workforce of 50–249 people, and 2 had a workforce of less than 20 people, so the majority of the companies included in the study were medium-sized. Anyway, the majority of the Hungarian private healthcare providers are located in the capital city Budapest or its agglomeration: based on their geographical location within the capital city, they are concentrated in the city center, the prestigious Buda hills, the larger junctions and larger office buildings (Pál & Uzzoli 2024).

According to the survey, the COVID-19 pandemic has had a variety of impacts on the private healthcare providers. These were the following: partial or complete shutdown of healthcare services, supply disruptions in medical devices, transformed demand needs, decreasing in use of healthcare services and proceeds,

human resource shortage. However, most and the biggest challenges have been more short-term, occurring mainly during the first and second epidemic waves in 2020. '*Unplanned operation*' (interviewee 1), '*high degree of uncertainty*' (Interviewee 8), '*the period of uncertainty was about a month*' (interviewee 2). However, it is a fact that from the beginning of the epidemic, it became clear that patients' needs also quickly changed, firstly towards reducing physical contact in healthcare, secondly towards performing COVID-19 tests, and thirdly towards making up for missed diagnoses during the lockdowns.

Both the questionnaire survey and the interviews confirmed that the coronavirus pandemic had not only negative, but also positive effects. Among the direct and indirect positive consequences of the epidemic, the following were mentioned: e.g. increasing of the use of private healthcare services and sales revenue in the medium-term, expansion of the existing healthcare services, introduction of new healthcare services, capacity and employment expansion, digitalization development. These positive effects primarily occurred in the medium-term, from the second half of 2020. Due to the transformed the consumer needs, i.e. the novel needs of patients, newly introduced healthcare services appeared at private healthcare providers in 2020 or later, most of which were related to outpatient clinics, pediatrics, diagnostics and laboratory tests.

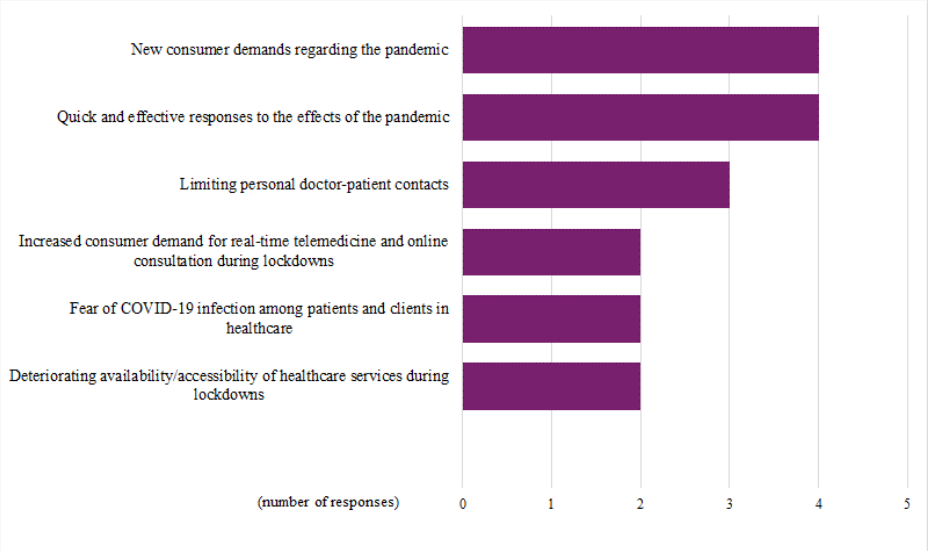
However, the interviews also drew attention to the fact that the introduction of new outpatient clinics after 2020 was not only due to the pandemic, but also due to the growing waiting lists in the state healthcare system (Interviewee 2, 4, 7). One of the main reasons for this was that the pandemic had an exponential impact on state or public healthcare: '… *public healthcare was practically inaccessible at the outpatient level for a year or a year and a half*' (Interviewee 7). Due to delayed diagnoses and missed treatments, a large number of patients began to use public healthcare services, which undoubtedly led to further overloading of the system. These factors then in many cases led patients to seek private healthcare.

There were different responses to the negative effects of the pandemic by private healthcare providers, which were as follows: e.g. introduction of new health services that were directly related to the pandemic, searching for new supplier relationships, preparing a risk management plan, part-time employment. Among these responses, development of telemedicine services had a prioritized task. It means the development of existing digital solutions and the introduction new ones. It is worth mentioning that the use of various digital solutions was already widespread in the operations of the Hungarian private healthcare providers even before the COVID-19 pandemic. The main reasons for their introduction before 2020 were the following: organizing more efficient patient way, further development of existing technologies in healthcare, the expansion of digital technologies in healthcare, or the needs of patients.

The digitalization developments related to the COVID-19 pandemic were mainly due to new consumer demands, quick and effective responses to the effects of the pandemic, and epidemiological restrictions (decreased doctor-patient contacts) (Figure 3). The digital solutions newly introduced or developed as a result of the epidemic were, according to the majority of questionnaire responses, the following (Figure 4): online consultation, e-prescription, online organizing patient way,

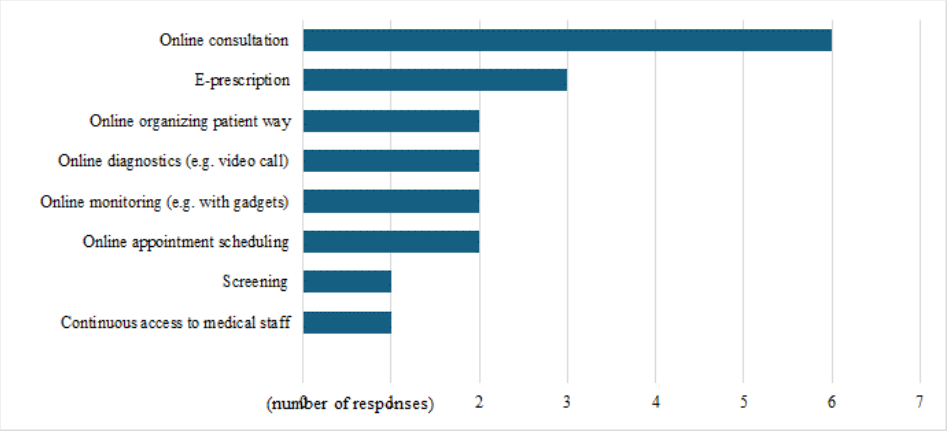
online diagnostics, online monitoring, online appointment scheduling. Based on the results of the questionnaire survey, the following activities were the most digitalized in the Hungarian private healthcare providers due to investments made before and after the pandemic: appointment scheduling, patient way organization, administration of healthcare documents, online doctor-patient contacts, and contact with clients. All of these results were also supported by the semi-structured interviews (e.g. Interviewee 5 and 7).

Figure 3. *The Main Reasons for Introducing Digital Solutions on the Short- and Medium-term Impacts of the COVID-19 Pandemic in Hungarian Private Healthcare Providers*



Source: own questionnaire survey, 2024.

Figure 4. *Digital Solutions introduced by Hungarian Private Healthcare Providers to address the Short- and Medium-term Impacts of the COVID-19 Pandemic*



Source: own questionnaire survey, 2024.

It is important to mention that the private healthcare stakeholders participating in the questionnaire survey and in the interviews were unanimous in their opinion that the most visible digital result of the novel coronavirus epidemic was the

widespread use of e-prescriptions in HuUngary, which have remained with us for a long time after the pandemic. However, this is fundamentally based on a state healthcare service (EESZT), which has been further developed since the very beginning of the pandemic and the appropriate regulatory environment for its widespread use has been continuously shaped by decision-making.

According to the questionnaire and interview experiences, the development of telemedicine on the short- and medium-term effects of the coronavirus epidemic was observed mainly in diagnostic professions (e.g. teleradiology, telepathology), which are most closely related to medical imaging and diagnosis (telediagnosis) (e.g. Interviewee 1). '*Data-driven healthcare is the healthcare of the future*' (Interviewee 3). A novel opportunity in data-driven healthcare that has emerged in the past several years is the use of artificial intelligence (AI), currently mainly in the evaluation of findings, but the future holds many new applications (Interviewee 1 and 5). Further effective spread of telemedicine was also experienced in the areas of internal medicine and cardiology during the pandemic, which can be linked to the remote monitoring of certain health parameters (e.g. blood pressure, blood sugar) (remote surveillance). However, remote consultation has not been able to successfully replace the doctor-patient meeting based on physical contact in all medical professions, and its frequent use in the long term has remained primarily in psychology/ psychiatry (e.g. Interviewee 2 and 7). It can also be deduced from the responses and opinions that in those areas and cases where the presence of a doctor and quick decision-making are absolutely necessary (e.g. emergency care), i.e. when the care involves a specific medical examination or intervention and is not limited to sending and evaluating images and other health data, the possibilities offered by telemedicine cannot be used or can only be used to a limited extent (e.g. Interviewee 5 and 6).

Discussion

My own examinations have diverse findings regarding how the COVID-19 pandemic has affected digitalization processes in the Hungarian healthcare system. Based on all of this, some contradictory results have been obtained. These results will present by answering the research questions too.

Healthcare digitalization is not a new phenomenon, neither in public nor private care, but the impact of the pandemic is clear in its development and widespread spread (Girasek et al. 2022). The acceleration of digitalization processes was mainly experienced in 2020 and 2021 as a direct consequence of the COVID-19 pandemic, but from 2022, other crises (energy crisis, inflation) also had an impact. That is, the short-, medium- and long-term effects of the pandemic in digitalization are influenced by different determinative factors. The development of National eHealth Infrastructure (EESZT) among Hungarian healthcare providers was a direct consequence of the epidemiological measures (see e-prescription), which contributed to the spread of telemedicine nationwide (Paulikné 2021, Szabó 2020). Ultimately, the organization of the COVID-19 vaccination as a relevant task in the fight against the epidemic was already taking place on a digital basis, which was the

result of a state digital development. This state digital development also made it possible to use the EU Digital Covid Certificate in Hungary, which was applied in all member states of the European Union (Paragi 2022).

Similar to public healthcare, the acceleration of digitalization in private healthcare was also due to the effects of the pandemic in Hungary, but in contrast to public healthcare, it was based on a self-developed project and a quick response to transformed consumer needs (Uzzoli 2025). Furthermore, private healthcare providers partially took advantage of the benefits of state digital developments in its own digital developments, so using EESZT also helped them offset the effects of the pandemic.

My own research results, in line with the most important antecedents, confirmed that the most telemedicine developments in Hungary in the following segments, in connection with the short-, medium- and long-term effects of the coronavirus epidemic:

- online appointment scheduling,
- online organizing patient way,
- real-time telemedicine services,
- using e-prescption.

Conclusions

Healthcare digitalization was already a prominent feature of Hungary's development policy before the COVID-19 pandemic, with telemedicine becoming increasingly accessible to healthcare providers and the public. However, this process was accelerated by the pandemic and was accompanied by the emergence of novel phenomena that have been observed in both public and private healthcare services in recent years.

During the COVID-19 pandemic, both public and private healthcare providers in Hungary adopted digital solutions, but there were key differences in focus, flexibility, and innovation between the two sectors (Table 1).

Standardized and nationwide systems in public (state) healthcare were designed for universal access, sometimes at the cost of user experience or speed of innovation. Digital tools and services had to conform to national standards and protocols. Their rollout was slower due to infrastructure limitations and regulatory hurdles, but coverage was widespread. Decrees allowed teleconsultations in public healthcare, especially for general practitioners and chronic care. The National eHealth Infrastructure (EESZT) was the backbone of digital public healthcare. It offered e-prescriptions, referral tracking, COVID-19 test and vaccine records, and hospital data exchange. It was expanded to support vaccination scheduling, test result access, and digital vaccine passports during the first two years of the pandemic.

Table 1. *Some Features of Digital Solutions in Hungary's Healthcare Hungary regarding the Impacts of COVID-19 Pandemic*

Feature	Public (state) healthcare	Private healthcare
System integration	national, standardized	costum-built, flexible
Telemedicine	legalized during pandemic	fast adoption, smoother experience
EHR and patient access	mainly through National eHealth Infrastructure (EESZT)	dedicated portals and mobile apps, but through EESZT too
AI and innovation	minimal use	advanced tools (e.g. symptom checkers)
Payment model	publicly funded and free	out-of-pocket or private insurance
Speed of implementation	slower, bureaucratic	market-driven, costumer needs

Hungarian private healthcare providers often offered the following during the pandemic: patient portals, mobile apps with integrated appointments and lab results, online payment systems, real-time chatbots and remote diagnostics. These services were usually fee-based, attracting those who wanted faster and more personalized care. Private healthcare clinics quickly adopted AI tools, smart triage systems, and integrated telehealth platforms. Less burdened by bureaucracy, these private clinics could innovate and scale digital solutions faster.

Overall, the direct and indirect effects of the COVID-19 pandemic influenced public and private healthcare in different ways (Győrffy et al. 2020). The main reason for these different ways can also be found in consumer behavior, as the use of the two forms of healthcare (public and private) is different (Szigeti 2023). On the one hand, the impacts of the epidemic led to the further development of digital solutions that already existed before 2020 and the introduction of new ones in private healthcare providers. On the other hand, in public healthcare developments, digital solutions that can be implemented on a national scale and that can also be used by private healthcare providers had to be prioritized. Among the public digital solutions, the National eHealth Infrastructure (EESZT) became a central platform for healthcare data exchange. It enabled electronic prescriptions (e-prescriptions), electronic referrals, and access to medical records. During the COVID-19 pandemic, EESZT was enhanced to support vaccination appointment bookings, digital vaccination certificates, and COVID-19 test result tracking.

Acknowledgement

The paper is part of two projects (K146833 and K147032) which have been implemented with the support provided by the Ministry of Culture and Innovation of Hungary from the NRDI Fund.

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