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Brain Chip Implant: Public's knowledge, Attitude, and Determinants. A Multi-Country Study, 2021

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Abstract

BACKGROUND: In August 2020, a brain chip was announced as implantation in the human brain targeted to boost brain activity without significant side effects.

AIM: The aim of this work was to examine the level of knowledge, awareness, and public concerns about the use of brain chip implants.

METHODS: An online cross-sectional survey targeted 326 adults from more than five countries in the Middle East and North Africa during the period from May 2021 to July 2021. The data were collected through a validated self-administrated questionnaire composed of five sections. The collected data were coded and analyzed using suitable tests and methods.

RESULTS: According to our results, 54.6% of the study participants mentioned that they had heard about the Brain Chip Implant; while only 6.1% stated that they knew its importance. The most common reported indication for the Brain Chip Implant was improving memory, followed by treatment of epilepsy and improving mental function. Brain Chip Implant safety seemed to be the most common public concern, as most of the participants were hesitant about using it and had concerns regarding its safety.

CONCLUSION: Medical personnel seems to be the most concerned about the use of the brain chip implant. Safety measures, confidentiality, and security procedures, respectively, are the major issues that might limit the broad use of the brain chip implant.

Introduction

Neurological research has progressed rapidly in the last decade, giving rise to the concept of a brain–machine interface [1]. A few notable achievements of this technology are implants allowing quadriplegic people to move their limbs [2], working with computers and mobile phones [3], and predicting what the person is planning to say [4].

In 2019, Elon Musk published an article about Neuralink, a high bandwidth brain–machine interface system, claimed to be able to read and modulate brain activities [5]. On August 31, 2020, an announcement was made about an updated design, a wireless microchip the size of a coin. The chip was implanted by a robot in a pig's skull and demonstrated success in reading and writing their brain activity with no reported major side effects. Moreover, it was claimed that it would be possible for these microchips to save and make a backup of humans' memories, in addition to helping people with major neurological diseases such as paralysis, Parkinson's disease, and dementia.

Many ethical concerns have been raised regarding this announcement and brain–machine interfaces in general. On the one hand, experts are concerned about the practicality and risks of these implants in both the short- and long-term. On the other hand, many ethical concerns have been raised, including the misuse of these chips in non-medical applications, the possibility of invading one's privacy, or even more unintentionally controlling their activity. All of these factors could pose a threat and cause anxiety for many people [6], [7].

Despite the massive technological advancements and the digital revolution of the last two decades, which are expected to have an impact on human psychological well-being, little is known about how the public, neurological disorder patients, and medical professionals will perceive it [8].

As little is known about the Brain Chip Implant and its effects, research change is not always perceived

positively. The longer something is thought to exist, the better it is evaluated [9]. Since the brain–machine interface is an emerging technology in healthcare for various disorders, information about the knowledge and attitude toward such intervention among the general population would be required by governments and policy for the optimal allocation of health resources.

Aim and objectives

The aims of this study was among the adult population of more than five countries in 2021, to determine the sources and level of people's knowledge and awareness regarding the Brain Chip Implant (Neuralink); study and explore the public concerns and attitudes toward this technology; identify the determinants of its use; and test the association between demographic variables and the level of depression, anxiety, and phobia.

Materials and Methods

Study design and participants

This cross-sectional survey targeted adults from more than five countries (Figure 1). The study was conducted during the period between May 2021 and July 2021. The exclusion criteria were: refusal to participate in the study, illiteracy, being under the age of 18 or over the age of 70, and having any complicated medical, mental, or psychotic disorders such as schizophrenia that might interfere with participation.

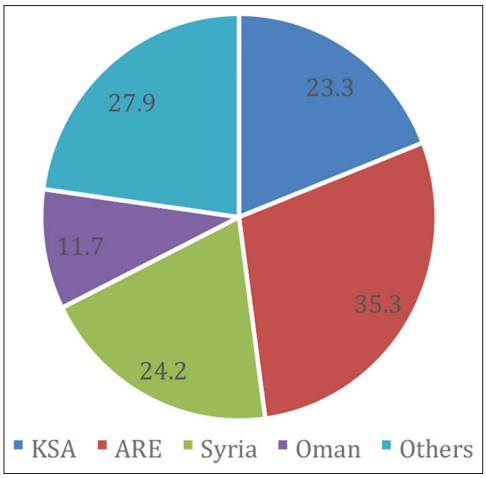

Figure 1: Distribution of participants among the countries of residence

Sample size

Sample size is estimated according to the following equation: n = Z2 p (1−p)/d2. Due to limited data about the Brain Chip Implant, we assumed that 50% of the respondents would have no knowledge at all about the Brain Chip Implant, at a 95% confidence level and 80% power of the study, so the calculated sample size was 340 participants.

Data Collection

Using a snowball non-probability sampling method, the data were collected through an online self-administered, structured questionnaire. Participants completed and submitted the questionnaire after receiving approval for participation in the study (informed consent). The questionnaire was distributed through the most common platforms among the targeted countries (Facebook and WhatsApp groups). To increase the response rate, reminder messages and follow-up were used. Pilot testing was done and involved 15 participants to ensure clarity of the questionnaire, and the results of the pilot were not included in the study.

The data collection tool

The questionnaire was composed of the following sections (Appendix B):

Sociodemographic and health-related factors include age, sex, residence, educational level, occupation, marital status, smoking history, and history of chronic diseases.

- The sources of information, benefits, and uses of the brain chip implant
- The motivations for using brain chip implants and the factors that influence them.
  - Intentions toward the use of brain chip implants are based on one item. Response options were willing to use them, but they were uncertain and unwilling to use the chip.
  - The factors that affect the public use of the brain chip implant (for example, size, financial cost, country of origin)
  - Internet use, and the self-assessment of being up to date with technological progress. An assessment.
- Assessment the level of depression, anxiety, and phobia related to brain chip implant use.
  - The PHQ-2 score ranges from 0 to 6. The PHQ-2 includes the first two items of the PHQ-9 [10], to screen for depression in a "first-step" approach and inquire about the frequency of depressed mood and anhedonia over the past 2 weeks with a Likert scale (0–3) for each.
  - Anxiety (GAD 2) is a very brief and easy-to-perform initial screening tool for generalized anxiety disorder through the Likert scale (0–3) for each. The GAD-2 includes the first

two items of the GAD-7. The GAD-2 score ranges from 0 to 6 [11].

- Phobia; Social Anxiety Test (Self-Assessment) [12]. Do you feel worried and panicked in social situations by the mere thought of being in them? (If you use this Neuralink). This brief assessment is for people who experience anxiety in social situations. Take this quiz to determine if you meet the diagnostic criteria for social anxiety disorder (social phobia) [13].
- The public's attitude and opinion regarding the use of brain chip implants.

Statistical analysis

SPSS version 25 was used to analyze the data, and a level of significance was determined ($p < 0.05$). The qualitative data were presented in the form of frequency and percent, while the quantitative data were presented in the form of mean, standard deviation, median, and range and were used to test the association between categorical variables. The t-test, Analysis of Variance, and Kruskall–Wallis test were used to test the association between quantitative variables. Pearson's correlation coefficient (r) was used to test the association between two continuous variables.

Ethical issues

The study methodology was approved by the Ethics Committee of the Alexandria Faculty of Medicine (0305280), which has had FWA since 2010 and operates according to the ICH GCP guidelines and applicable local and institutional regulations and guidelines (Appendix A). All participants provided electronic informed written consent after clarification of the goals, data confidentiality, voluntary participation, and withdrawal. The questionnaire contains no sensitive questions, and the data were collected anonymously.

Results

The demographic characteristics of participants 56.4% of participants were men, and 70.9% were aged 20–40 years. Participants who attended high school or university made up 65% of the sample, while those with a postgraduate degree made up 33.1%. Working in the medical field represented the highest occupation, at 46%. The majority of the population (91%) lived in urban areas in the Middle East and North Africa (MENA) region. A total of 74% had no history of psychiatric or neurological illnesses, while 10% reported having psychiatric illnesses including anxiety, phobias, and depression. Participants living in the Arab Republic of Egypt (ARE) represented the highest group, 35.3%, followed by those living in the Kingdom of Saudi Arabia (KSA), the Syrian Arab Republic (SAR), and the Sultanate of Oman (SOO) (27.9%, 24.2%, and 11.7%), respectively (Figure 1).

The relationship between the use of brain chip implants and the demographic characteristics of the participants studied is detailed in Table 1. There was a statistically significant relationship between the use of brain chip implants and the age groups, the presence of comorbidity, and occupation. The willingness to use the Brain Chip Implant was significantly higher among participants working in the medical fields, 54 (36.0%), without comorbidity, 98 (7.7%), living in ARE 61 (45.8%), and aged 20 to <40 years (69.9%).

Table 1: The relationship between the demographic characteristics and the use of brain chip implant

	The use of brain chip implants						X_2	p
	No	%	May be	%	Yes	%		
Age (y)	133		172		20			
<20	6	42.9	4	28.6	4	28.6		
20–<40	93	40.3	127	55.0	11	4.8	13.652	0.020*
40–<60	31	40.3	41	53.2	5	6.5		
60 y and more than	3	100.0	0	0.0	0	0.0		
Gender	133		172		20			
Male	51	36.2	82	58.2	8	5.7	2.757	0.267
Female	82	44.6	90	48.9	12	6.5		
Marital status	133		172		20		3.413	0.463
Married	76	42.9	91	51.4	10	5.6		
Single	53	38.7	76	55.5	8	5.8		
Divorced/widow	4	36.4	5	45.5	2	18.2		
Education level	133		172		20		4.244	0.344
Primary or secondary	3	60.0	2	40.0	0	0.0		
Highschool or Undergraduate	86	40.6	109	51.4	17	8.0		
Postgraduate	44	40.7	61	56.5	3	2.8		
Occupation	133		172		20		13.686	0.033*
Student/Unemployed	28	46.7	27	45.0	5	8.3		
Medical field	54	36.0	92	61.3	4	2.7		
Communications and Information Technology (IT)	10	41.7	10	41.7	4	16.7		
Others	41	45.1	43	47.3	7	7.7		
Residency	133		172		20			
Urban	123	41.1	156	52.2	20	6.7	2.177	0.328
Rural	10	38.5	16	61.5	0	0.0		
Comorbidities	133		172		20		16.825	0.005 *
No	98	40.5	135	55.8	9	3.7		
Psychiatric	12	32.4	20	54.1	5	13.5		
**Neurological	2	40.0	1	20.0	2	40.0		
Others	21	51.2	16	39.0	4	9.8		
Country of residence	133		172		20		15.861	0.037*
KSA	21	37.5	32	57.1	3	5.4		
ARE	61	53.0	47	40.9	7	6.1		
ARS	25	31.6	47	59.5	7	8.9		
SOO	11	28.9	24	63.2	3	7.9		
Others	15	40.5	22	59.5	0	0.0		

*p < 0.05 there was a statistically significant difference. ARE: Arab Republic of Egypt, KSA: Kingdome of Saudi Arabia, SAR: Syrian Arab Republic, SOO: Sultanate of Oman.

The knowledge and attitude of the public toward the use of Brain Chip Implant

A total of 54.6% of participants confirmed that they had heard about the brain chip implant; however, only 6.1% stated that they knew its importance. The most common reported indication for the Brain Chip Implant was improving memory, followed by treatment of epilepsy and enhancing mental abilities. Chip safety seems to be of concern to the public (Table 2).

Most of the participants were hesitant about using it and had concerns regarding its safety (93.3%) and 55.5%, respectively. Social media and specialized

Table 2: The Public's knowledge and attitude toward the use of Brain Chip Implant

Question Item	F (%)
Did you hear about the brain chip implant?	
□Yes	178 (54.6)
□No	147 (45.4)
Do you know the importance of the brain chip implant?	
□No	200 (61.3)
□To some what	105 (32.5)
□Yes	20 (6.1)
Will you use it?	
□No	133 (40.8)
□May be	172 (53.1)
□Yes	20 (6.1)
Do you think the brain chip implant will be safe?	
□Yes	8 (2.5)
□Maybe	115 (35.3)
□Unsafe	82 (25.2)
□I don't know	120 (36.8)
What do you think the Brain Chip Implant will be used for?	
□I don't know	59 (18.2)
□Increase memory	90 (27.7)
□Increase mental abilities	77 (23.7)
□Treatment of epilepsy	88 (27.1)
□Treatment of parkinsonism	71 (21.8)
□Treatment of hemiplegia – paraplegia	49 (15.1)
□Treatment of hormonal disturbance	25 (7.8)
□Treatment of infertility	10 (3.1)
□Treatment of mental retardation	26 (8.0)
□Others	40 (12.3)

internet sites were the main sources of information for the public (Figure 2).

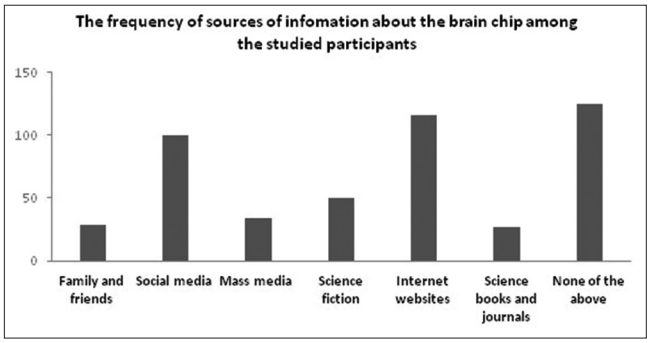

Figure 2: Sources of information about the brain chip implant

A total of 66.9% of participants strongly agreed that the confidentiality and secrecy measures of the procedure will affect the public use of the brain chip implant, while 66.4% of the participants revealed that proven safety will play a major role (Table 3).

Table 3: The factors that affect the public use of the Brain Chip Implant

Factor	Strongly agree		Agree		Indifferent	
	No	%	No	%	No	%
Small size	99	30.5	106	32.6	120	36.9
Financial cost	138	42.5	103	31.7	84	25.8
Country of origin	116	35.7	106	32.6	103	31.7
Installation is non-invasive (external use outside the body)	151	46.5	93	28.6	81	24.9
The chip is not visible externally	138	42.5	88	27.1	99	30.5
The chip is on-off (able to turn it on and off/reusable)	140	43.1	97	29.8	88	27.1
The chip is specialized	123	37.8	114	35.1	88	27.1
The chip helps with creativity	110	33.8	118	36.3	97	29.8
Possible to use more than one chip	64	19.7	90	27.7	171	52.6
Safety procedures are strict and well documented	215	66.2	57	17.5	53	16.3
Confidentiality and secrecy measures are strict and well documented	217	66.8	52	16.0	56	17.2

Only 19.5% felt that the possibility to use multiple chips would make a difference in the public's attitude toward the chip. Moreover, the usefulness of the Brain Chip has been assessed by asking the participants about the possibility of recommending the chip and if it was a useful device and technology. Almost 80% stated that they would not recommend the chip. However, the attitude toward the usefulness of the chip showed variations. About 18.4% said that it is a useful technology, 12.9% said that it is a harmful technology, and 35% said that it is neutral (Table 4).

Table 4: The public's opinion about the brain chip implant

Question Item	No. (%)
Will you recommend using the Brain Chip Implant?	
Yes	66 (20.3)
No	259 (79.7)
What's your opinion of the effects of the Brain Chip Implant as a technological leap on societies?	
Useful	60 (18.5)
Harmful	42 (12.9)
Neutral	113 (34.8)
I don't know	110 (33.8)
How would you rate the Brain Chip Implant as an evolutionary technology?	
Very interesting and useful	45 (13.8)
Interesting to some extent	47 (14.5)
Neutral	102 (31.4)
Worrying	75 (23.1)
Very worrying and terrifying	56 (17.2)

There was a direct and statistically significant ($p < 0.05$) correlation between the daily average hours of internet use and the total scores of anxiety, depression, and social phobia. In terms of self-assessment of technological progress, the majority of participants (138/42.5%) reported that they use it according to their needs (Table 5).

The assessment of the participants' mental health status is discussed in detail in Tables 6 and 7. In addition to the PHQ-2 and GAD-2, the total social phobia score toward the use of the Brain Chip Median = 8 and Range 0–24.

Discussion

The purpose of this study was to examine the level of knowledge, awareness, and public concerns about the use of the brain chip implant. The study was conducted in several countries in the Middle East, with the majority of responders being from Egypt, 35.3%, Saudi Arabia, 27.9%, Syria, 24.2%, and 11.7% from Oman. This response may be related to the number of the population, the level of education, and the internet use of the population.

According to the current results, the majority of the study participants were between 20 and 40 years of age, which is the age range of the majority of internet users according to worldwide statistics [14], [15].

It is also noted that educated and medical personnel are the most concerned groups about the use of the brain chip implant. The fears may be explained by a lack of actual knowledge about the wide use of different devices for promoting and treating different neurological disorders. Neurostimulation of the brain and spine has been used for years, as in the

Table 5: The internet use and the individual technology self-assessment, and its correlation with the degrees of phobia, anxiety and depression regarding Brain Chip Implant use

Question Item	Total	Anxiety r (p)	Depression r (p)	Social Phobia r (p)
The daily average hours you spend on the internet (Using your smart phone or computer)	5h (6.3 ± 3.8) (21 min – 22 h)	0.3 (0.00*)	0.28 (0.00*)	0.12 (0.04*)
How far are you up to date with the technological progress?				
Not interested at all	4 (1.2)	–0.062 (0.26)	–0.05 (0.38)	–0.11 (0.04*)
According to my need	138 (42.5)			
I follow when needed	91 (27.9)			
Somewhat advanced	67 (20.6)			
Very advanced	25 (7.7)			

*p < 0.05 there was a statistically significant difference, r for Persons correlation.

case of vagal nerve stimulation, deep brain stimulation, and other devices [16], yet none of them is a direct implantable device.

Table 6: The Public's social phobia regarding the use of Brain Chip Implant

	Never F (%)	Sometimes F (%)	Often F (%)	Always F (%)	Total score
Feel anxious or paranoid	78 (24)	129 (40)	80 (24.6)	37 (11.4)	Median=8
Avoid social gatherings	110 (33.8)	114 (35.1)	63 (19.7)	37 (11.4)	(Mean ± SD)
Negative assessment	95 (29.2)	99 (30.5)	88 (27.1)	43 (13.2)	(9.7 ± 6.8)
Negative judgments	119 (36.6)	88 (27.1)	71 (21.8)	47 (14.5)	Range
People noticing the chip	102 (31.4)	95 (29.2)	81 (24.9)	47 (14.5)	0–24
Career impact	87 (26.8)	107 (32.9)	76 (23.4)	55 (16.9)	
Misuse	92 (28.3)	87 (26.8)	97 (29.8)	49 (15.1)	
Social situations	108 (33.8)	109 (33.5)	63 (19.4)	45 (13.8)	

Surprisingly, patients with chronic neurological or psychiatric disorders are more inclined to refuse the use of a brain implant; though Parkinson's disease, physical disabilities, epilepsy, and depression are the most common disorders in which neurostimulation devices may be used [17].

The sources and level of the people's knowledge and awareness regarding the brain–machine interface implant (Neuralink) are as follows:

The main sources for acquiring knowledge about the brain chip implant for the study participants were internet sites followed by social media. In light of the age group that participated, most of the young population nowadays rely on acquiring their information from social websites [18]. There is also a shift among adults to fill the knowledge gap by relying on internet sources [19].

Although 54.6% of the study participants heard about the Brain Chip, 61.3% did not know its importance. Although the concept of brain chip implants in neuroscience is not new, as it has been discussed for the past 15 years [20], it is relatively new to public ears.

The public concerns and attitudes toward brain chip implant technology are as follows

About 53.1% of the study participants mentioned that they might use it, but only 6.1% confirmed that they would use it. This might reflect the hesitance toward the brain chip implant. The hesitance might be due to concerns about the safety of the brain chip, as only 2.5% of the study participants thought it would be safe to use the brain chip implant. Regarding the functions of the chip, 90 respondents thought it might improve memory, and 88 respondents thought it would treat epilepsy.

These results are in accordance with a study on public opinion on an implantable chip in 2008, where the majority of the respondents believed that this would violate their rights to privacy and that they would not accept getting implanted with a chip [21].

The main concerns in the study are confidentiality, safety, and secrecy measures of the chip. The type of signal, the implantation site, and system components are important to explain to a public audience [22]. Some studies suggested mathematical models calculating signal strength and ideal implantation sites for implantable devices [23]. Selective electrical stimulation of target brain locations is difficult as the stimulating current density field needs to be strong enough to stimulate targeted locations but weak enough not to stimulate near-by non-targeted locations.

Moreover, the usefulness of the Brain Chip Implant has been assessed by asking the participants about the possibility of recommending 19.9% of the chip and if it is a useful device and technology. Minority showed that it would be useful 18.4% of the time.

Determinants of the use of the brain chip implant are

Most people consider using the Brain Chip to assist the brain in data processing, to improve cognitive ability, to repair a disability, and to mimic a lost brain function, or as an alternative to drug delivery systems [24].

The result of a high level of anxiety and phobia was noted among the responders, especially those in urban regions, of a younger age and higher education. Furthermore, among countries' populations, the Egyptians showed a significantly higher level of anxiety and depression than those who spent more time surfing the internet.

According to a large systematic review on mental health in the region, the reported prevalence of depression and anxiety in Egypt is 23.7–74.5% and 14.2–72%, respectively [25]. This is in concordance with our results.

Another study conducted, in 2018, showed that widespread internet use was not associated with anxiety among adolescents [26], which may be explained by the younger age group, which does not match our study population. Another study among adults showed results in line with the current results, as prolonged internet use is associated with more anxiety in adulthood [27], [28]. This data is variable according to the culture, age, and hours of internet use, even the type of application

Table 7: Mental health status assessment through PHQ-2 and GAD-2 among the studied participants

	Not at all F (%)	Several days F (%)	More than half days F (%)	Nearly everyday F (%)	Total score Median (mean ± SD) Range
Anxiety					
Feeling nervous, anxious, or on edge	33 (10.2)	191 (58.8)	42 (12.9)	59 (18.2)	22.3 ± 1.10–6
Not being able to stop or control worrying	127 (39.1)	124 (38.2)	35 (10.8)	39 (12.0)	
Depression					
Little interest or pleasure in doing things?	79 (24.3)	131 (40.3)	60 (18.5)	55 (16.9)	22.6 ± 1.8 0–6
Feeling down, depressed, or hopeless?	77 (23.6)	146 (44.9)	47 (14.5)	55 (16.9)	

used. Specifically, regarding the brain chip, anxiety may increase due to the sense of lack of autonomy, privacy, and safety of the implant.

Implant ethics

Implant ethics are defined here as the study of ethical aspects of the lasting introduction of technological devices into the human body. Whereas technological implants relieve us of some of the ethical problems connected with transplantation, other difficulties arise that need careful analysis. More information, explanation, and legislation are required to make the use clear to the general public.

Strength

A relatively large sample size (325 adult participants) from more than five countries [ARE, KSA, SAR, SOO, and others]. To the best of our knowledge, this is the first cross-sectional survey that studied this novel and interesting topic and investigated the thoughts and beliefs about the use of brain chip implants in the MENA region through a detailed, validated questionnaire.

Study limitations

However, our study might have some limitations, such as the difficulty of interpretation of thoughts and beliefs that are associated with such a recent and not widely tested innovation. Due to a lack of enough evidence, it could only be speculated about the safety and efficacy of the proposed brain chip implant. Brain Chip Implant is still a broad term in neuroscience and needs more specification as regards the site.

Conclusion

Medical personnel seems to be the most concerned about the use of the brain chip implant. The most common reported indication for its use was improving memory, followed by treatment of epilepsy and improving mental function. Safety measures, confidentiality, and security procedures, respectively, are the major issues that might limit the broad use of the brain chip implant.

Recommendations

Further, investigations and trials are required to provide more information. Despite the concerns about safety and efficacy, much curiosity about potential treatment advancements has risen.

Declarations

Consent to publish

A written informed consent for publication was obtained from all authors.

Availability of data and materials

The datasets used and/or analyzed during the current study are available from the corresponding author on reasonable request.

Authors' contributions

RA: Developed the theory, verified the analytical methods, encouraged other coauthors to investigate multiple countries, and supervised the findings of this work. Like all authors, discussed the results, and contributed to the final manuscript. JM: Data collection, obtaining the ethical approval, writing, and final editing. KAM: Data collection and scientific writing. KT: Data collection and scientific writing. WH: Writing the study protocol and proofreading. BZA: Data collection and scientific writing. ME: Scientific writing, proofreading, and critical review. SA: Designed the data collection tool, data collection, statistical analysis, wrote the methodology, editing, and approving the manuscript.

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Appendices

Appendix (A)

The study protocol was approved by the Local Ethics Committee of Faculty of Medicine, University of Alexandria (0305280) that is conformed to the ICH GCP guidelines.

Appendix (B)

Part 1: The sociodemographic characteristics

1. Nationality:
   - Egypt
   - Saudi Arabia
   - Oman
   - Jordan
   - Sudan
   - Syria
   - Palestine
   - Somalia
   - Other
2. Age:
   - <20 year
   - 20–40 year
   - 40–60 year
   - More than 60 year
3. Gender:
   - Male
   - Female
4. Marital status:
   - Single
   - Married
   - Divorced/widowed
5. Education:
   - Primary or secondary
   - Highschool or Undergraduate
   - Postgraduate
6. Occupation:
   - Student/Unemployed
   - Medical field
   - Communications and IT
   - Other
7. Residency:
   - Rural
   - Urban
8. Comorbidities:
   - None
   - Psychotic disease (anxiety, phobia, depression)
   - Neurologic disease (paralysis, epilepsy)
   - Other
9. Frequency of:

	Not at all	Several days	More than half days	Nearly everyday
Feeling nervous, anxious, or on edge				
Not being able to control anxiety				
Little interest or pleasure in doing things				
Feeling down, depressed, or hopeless				

Part 2: Internet, smart phone and computer usage

10. Average number of hours you spend online (using mobile or computer)
11. How far are you keeping up with the technological development?
    - Very much (ensure to keep up with or obtain the latest releases of devices)
    - To an extent (follow up with the technological development and wait for the reviews)
    - When needed, obtain the best available
    - Obtain what I need or can afford
    - Not interested
12. Frequency of using:

	Rarely (once or less a week)	Sometimes (2–3 days a week)	Often (4–5 days a week	Daily
Internet				
Smart phone				
Computer				

13. Importance of using them for:

Part 3: The sources and level of public's knowledge regarding the brain chip implant

14. Did you hear about the brain chip implant?
    - Yes
    - No
15. Do you know the importance of the brain chip implant?
    - No
    - To some extent
    - Yes
16. Where have you heard about the brain chip implant (multiselect)
    - Sci-fi films and series
    - Internet websites and specialized pages
    - TV and radio
    - Science books and journals
    - Social media
    - Experts
    - Family and friends
    - Other
    - None
17. What do you think the brain chip implant will be used for?
    - I don't know
    - Increase memory

	Rarely (once or less a week)	Sometimes (2–3 days a week)	Often (4–5 days a week	Always (6–7 days a week)
Work				
Social networking				
Entertainment (dating- chatting)				
Academic development				
Updates on the latest news locally and worldwide				

- Increase mental abilities
- Treatment of epilepsy
- Treatment of parkinsonism
- Treatment of hemiplegia – paraplegia
- Treatment of hormonal disturbance
- Treatment of infertility
- Treatment of mental retardation
- Other

Part 4: The factors that affect the public's use of the brain chip implant

18. If the brain chip became available, would you use it?
    - No
    - Maybe
    - Yes

19. In your opinion, what will affect your usage of the brain chip implant

	Strongly agree	Agree	Indifferent
Small size			
Financial cost			
Country of origin			
Installation is non-invasive (external use outside the body)			
The chip is not visible externally			
The chip is on-off (able to turn it on and off/reusable)			
The chip is specialized			
The chip helps with creativity			
Possible to use more than one chip			
Safety procedures are strict and well documented			
Confidentiality and secrecy measures are strict and well documented			

20. How would you rate the brain chip implant as an evolutionary technology?
    - Very interesting and useful
    - Interesting to some extent
    - Neutral
    - Worrying
    - Very worrying and terrifying

21. Do you think the brain chip implant will be safe?
    - Yes
    - Maybe
    - Unsafe
    - I don't know

22. Would you recommend using the brain chip implant?
    - Yes
    - No

23. What's your opinion of the effects of the brain chip implant as a technological leap on societies?
    - Useful
    - Harmful
    - Neutral
    - I don't know

24. If you use the brain chip implant, you will:

	Never	Sometimes	Often	Always
Feel anxious or paranoid before social gatherings				
Be afraid of negative judgments from others in social gatherings				
Avoid social gatherings out of fear or anxiety				
Think you will be seen as anxious, weak, crazy, dumb, boring, terrifying, dirty, or unwanted in social gatherings				
Be worried that people will notice your chip because of your anxiety symptoms like blushing, shaking, sweating, stuttering or staring				
Be completely aware of your actions around others because you are afraid of being offensive or rejected				
Be concerned about being in certain social situations				
Be affected in your career, home or/and social life and your relationships because of your anxiety				