



أثر تطبيق توكلنا للحد من انتشار جائحة كورونا في المملكة العربية السعودية

**The impact of Tawakkalna application to limit the spread of the Corona
pandemic in the Kingdom of Saudi Arabia**

Members of research proposal:

Leader: Njoud Bint Abdulaziz Alessa / 20223006452

Members: Hamdan Bin Bandar Alhamdan / 20223006450

Rawan Bint Adnan Babkair / 20223006470

Supervisor: Dr. Walid Sadiq

Research for Master thesis

Master of Management (MGM697-Final Project)

First Semester 2023

Table of contents		
Number	Content	Page
1	Objectives	4
2	Introduction	4
3	Research Problem Questions	5
4	The Importance of The Research	6
5	Research Problem	7
6	literature Review	7
7	Research Methodology	9
8	Research Limits	11
9	Study area/setting	11
10	Inclusion criteria	11
11	Sample size	12
12	Sampling technique	12
13	Study design	12
14	Effectiveness Study Design	13
15	Qualitative Impact Analysis	13
16	Permission Analysis	14
17	Privacy Policy Analysis	14
18	Run-Time Permission Access Analysis (Dynamic Analysis)	15
19	Test Bed for Monitoring Permission Usage	15
20	Statistical analysis	16
21	Scientific and ethics approval	17

22	Results: Descriptive statistics results	17
23	Research Structure	18
24	References	19

Table of Figures and Tables

Figure 1: Tawakkalna application color codes.....	10
Figure 2: Impact analysis	14
Figure 3: Analysis permissions	15
Figure 4: Descriptive analysis.....	17
Table: Research Structure	18

Objectives:

- Definition of "Tawakkalna "application and how it works.
- Learn about the effects of the application of "Tawakkalna" in limiting the spread of the Corona pandemic in the Kingdom of Saudi Arabia.
- Preparations and preventive preparations for another wave in the future.

Introduction

China saw the appearance of an unidentified pneumonia in December of 2019 year. Cases of pulmonary inflammation have been related to the wholesale seafood market in Huanan. Epithelial cell vaccination in Human Air City's respiratory system has resulted in a novel virus impacting the respiratory system. Genome analysis confirmed that this virus, now known as the severe acute respiratory syndrome virus, is a novel coronavirus. This points to the potential spread of the newly developing viruses from animals to humans, as well as from humans to humans. Constant alterations to the natural environment and climate increase the likelihood that such an illness may surface in the future. The prevalence of the virus poses a danger to society. On March 12, 2020, the World Health Organization declared a worldwide pandemic due to the rapid spread of the Covid -19 virus and the thousands of fatalities it has caused. As a result of the Covid -19 pandemic, governments all over the globe were compelled to take action to control the spread of Coronavirus. Due to its position in the Middle East and the fact that it hosts the biggest yearly religious gathering in the world, the Kingdom of Saudi Arabia plays a vital strategic role both domestically and internationally [3]. The Kingdom of Saudi Arabia has developed a multi -sectors plan that adopted multiple measures to limit the spread of Covid -19 since its appearance and has made efforts to combat and contain this epidemic, using all of its capabilities and resources to prevent its spread and maintain good health for individuals.

And since the world's current attempts to attain objectives, particularly in extraordinary conditions like the Covid -19 outbreak, have not before been unprecedented. The "SDAIA" organization was set up by the Saudi Data and Artificial Intelligence Authority to aid the government's anti-virus efforts via the development of the Tawakkalna app. Following and implementing protocols and preventive measures is emphasized in this application as the most effective way to combat and stop the spread of the disease, as concerted efforts are not limited to government agencies alone, but also for individuals, companies, and institutions that translate the government's efforts to make this approach and achieving its goals in line with global and national trends. In coordination with the Ministry, we developed the Tawakkalna app to facilitate the electronic issuance of permits for people, public servants, and private sector workers while they are on the road. During the enforced roaming restriction, the Ministry of Health and many other government agencies worked to contain the spread of the Coronavirus in the Kingdom, and the app helped introduce a number of useful and crucial new services that aided in this effort and made a safe return possible. This study examines the scope of the Covid -19 outbreak's effect on the health sector, the role of artificial intelligence in managing the epidemic and reducing the transmission of the virus, and preparations for a potential second wave of the disease [2].

Research Problem:

- Does the use of technology or the Tawakkalna application really reflect positively on the health of community members?
- Did the Coronavirus epidemic lead to the necessity of using technology and a change in the quality of life for the better?

The importance of the research:

The Kingdom of Saudi Arabia is one among the nations struggling with the effects of the ongoing Corona pandemic. The Saudi government has taken many preventative steps, such as releasing the "Tawakkalna" app, in an attempt to curb the virus's spread. The "Tawakkalna" app is one of the primary instruments chosen by the Saudi government to battle the spread of the Corona virus, and it is widely regarded as an easy and convenient way to track the illness status and check the user's health. In light of the recent global outbreak of the Corona virus, this study aims to evaluate the efficacy of implementing "Tawakkalna" in Saudi Arabia and its effects on the country's society and government. This program has the potential to be a useful tool in the fight against the pandemic and in easing the burden on the Saudi Arabian healthcare system. Examining the app's success might also reveal its flaws, which can then be worked on to make the app better in the future. Researchers in the field of pandemic control have shown that stopping the spread of the virus and protecting the population by acting swiftly and effectively is possible. Prevention efforts in nations like China, South Korea, and Singapore, according to research by the World Health Organization in 2020, helped to slow the spread of the virus. Harvard University in the United States also performed research showing that taking precautions and reducing social gatherings might greatly lessen the likelihood of the virus spreading. Apps that keep track of your activity and your health might be powerful weapons in the fight against the spread of the virus, according to research. Harvard University researchers found that health-checking apps can be useful in decreasing the transmission of the virus, while a study out of the University of Oxford found that tracing apps might help lower the spread of the infection by 15%. So, the purpose of this study is to evaluate how efficient the "Tawakkalna" application has been in preventing the spread of the Corona epidemic in the Kingdom of Saudi Arabia and to calculate its full impact on Saudi society and the government. Finally, the findings of this study

can inform policy and strategy development at the national level, as well as inform decision-makers about how best to battle the virus. Appropriate for future use against the Corona epidemic. [4]

Research problem:

Effects of the application of Tawakkalna in limiting the spread of the Corona pandemic.

literature review:

Innovations in information and communication technology over the final part of the 20th century have led to a meteoric rise in their utilization. The quality of human existence is being impacted by the exponential development of information and communication technologies, particularly in the realm of health care. Several nations have tried various approaches to combat the COVID-19 epidemic, with quarantines being the most prominent. While they have had some success, they have also had a significant negative impact on the economy and the mental health of the world's populations. As a result, several nations have resorted to creating various contact tracing programs. These applications help with pandemic management by pinpointing everyone in close proximity to a confirmed case of the virus. Non-governmental group Amnesty International released a groundbreaking privacy and security study in June of 2020. Amnesty International's Security Lab conducted an investigation into this issue, with a particular emphasis on nations in Europe, the Middle East, and North Africa. Eleven contactless application tracers were tested, coming from countries including Kuwait, Lebanon, Norway, Qatar, Tunisia, the UAE, Algeria, Bahrain, France, Iceland, and Israel. Based on how seriously they breach users' privacy, the survey ranked some of these applications poorly and others as extremely risky. On December 16, 2020, MIT released research evaluating contact monitoring apps from the perspectives of user consent, data usage limits, and potential non-public

health uses of collected information. The technology used for tracking, such as Bluetooth or a track website, was also considered, as was the length of time that data was retained before being deleted, the amount of data collected, and whether the program only collected the data it claimed it would.

There were already contact tracing applications before the COVID-19 outbreak, but their importance and popularity have skyrocketed since. To varying degrees of success, many groups have taken on the challenge of countering COVID-19.

Government officials in Australia have assured the public that the app does not collect user location data. Many were first concerned that the software would track their every move.

The Italian government unveiled its new contact-finding program, called Immune, in June of 2020. This app functions similarly to other "contact tracking" apps in that it notifies its users when they are in close proximity to another person who is also using the same app but has been flagged as potentially infected. The app's standout feature is that it operates on Bluetooth Low Energy technology, which significantly reduces power consumption. Moreover, no personally identifiable information (such as name, DOB, address, phone number, or email address) is gathered by the software. Once a person is diagnosed with the virus, the software may then monitor their prior interactions with other people who may have been exposed to it. With the patients' permission, health officials will later enter the code into the central system, which will then notify anybody who came into close contact with the infected person (using the code). The Italian usage of applications. There is no location tracking, and users merely exchange codes to find each other's phone numbers. On December 31st, 2020, every information that has been gathered and uploaded to the main server will be permanently destroyed. The goal of these technological advancements was to boost healthcare delivery and lessen the spread of viruses. Apps were developed to disseminate

information about COVID-19 on a global scale, assist in tracking exposure to and confirmed cases of the virus, facilitate the use of remote health solutions to increase access to healthcare, enforce movement restrictions during lockdown and curfew periods, promote vaccination efforts, and control international travel and access to public spaces. The majority of the recently released ICT apps featured contact tracking, self-assessment, appointment booking, result reporting, and remote access to health services [1].

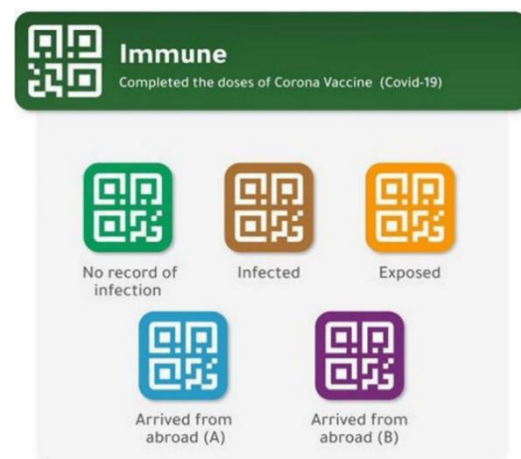
Research Methodology:

As one of the first nations to deploy a government-backed app to combat the COVID-19 pandemic, Saudi Arabia is at the forefront of the information and communication technology race to contain the spread of the virus. Tawakkalna, created by the Saudi National Information Center, is the official app sanctioned by the Ministry of Health in the Kingdom of Saudi Arabia to contain the COVID-19 virus. The number of confirmed cases of COVID-19 infections in Saudi Arabia may be tracked in real time and directly using the application. Tawakkalna allows individuals and residents to seek leave permits during periods of curfew enforced in various towns and neighbourhoods owing to the emergence of COVID-19, and it also aids in the early identification of probable cases if COVID-19 symptoms begin to develop. The Tawakkalna app notifies users if they are approaching impacted or secluded regions during curfew hours, and also tracks occurrences of evacuation requests. The software also allows users to report probable instances of COVID-19, which may speed up the process of getting medical attention for oneself or others who may be infected. In line with the Saudi leadership's concern for the health of its inhabitants and residents, the Saudi Data and Artificial Intelligence Authority (SDAIA) released the Tawakkalna application to aid government efforts in combating COVID-19. The application was made possible thanks to the contributions of the Saudi National Information Center,

which provided extensive and reliable data for its development. During the curfew period, the Tawakkalna app was originally designed to help manage the computerized permit-granting procedure. Hence, the spread of COVID-19 in Saudi Arabia was slowed. Later, when it was time to return to normal, the app released a slew of new, crucial features that helped ensure everyone got back to their homes safely when the precautions were lifted. One of the most popular services was the use of color-coded indicators of the user's health state that ensured the maximum level of confidentiality (see Figure 1). Anyone might assist with this effort by using the app to notify organizations and other entities that were disregarding safety requirements [1].

FIGURE 1: Tawakkalna application colour codes.

Orange: exposure to an infected person; green: absence of illness. Brown: contaminated with COVID-19; blue: came from a country on the Ministry of Health's list of nations with a high incidence of infection. violet: came from nations identified by the Ministry of Health as having a lower incidence of the disease. This research will



look at the Tawakkalna app from the user's point of view in order to identify its strengths and weaknesses so that it may be improved. Using social media and messaging apps, we disseminated a digital poll that has been utilized successfully in prior research. The survey components were offered in both Arabic and English, with the latter language having been translated by a professional translator, and used a five-item Likert scale. Users over the age of 18 who were randomly selected from the public were included since the app is popular in Saudi Arabia. Social media and messaging apps were used in the recruiting process to disseminate the survey link. The study used a

methodology that analyzed four primary metrics to determine the application's privacy and security: I data access permissions requests; runtime dynamic behavior in accessing resources; compliance with the guidelines of the Health Insurance Portability and Accountability Act (HIPAA) and the General Data Protection Regulation (GDPR) of Europe; and a static app-code analysis that necessitates access to the source code [1].

Research Limits:

- No inferences can be drawn about the population as a whole from this sample. It's possible that the people who completed your poll are not a representative cross-section of the population. The limitations of my research might have led to "sampling bias" or "selection bias," both of which could account for my results.
- The absence of previous research studies conducted on this topic, citing and referring to previous research studies is the basis for reviewing my research, and therefore we lack studies.

Study area/setting

Tawakkalna users in the most populous parts of Saudi Arabia (the center and the west) were the primary focus of this study since the app was used to track for lost contacts [1].

Inclusion criteria

Adult (18+) Saudi Arabian users of the Tawakkalna app who were in the country in September 2021 were included in the study. Through tracking the app's history of development and its many service expansions from its original debut, the research analyzed two factors: users' acceptance/attitude and the app's effectiveness with respect to protecting their personal information [1].

Sample size

According to the Global Population Review of 2021, over 43 percent of the targeted population was in the cities of Riyadh and Jeddah, which were included in the study. The recommended sample size was 377, giving a 95% confidence interval and a 5% margin of error [1].

Sampling technique

It was determined that a small subset of the Saudi population meeting the inclusion/exclusion criteria could be conveniently sampled from the larger Saudi population using convenience sampling. In addition, a share function was included to facilitate dissemination and a sentence was added to the survey's conclusion requesting that participants kindly forward the survey to other eligible participants, so employing the snowball-referral sampling approach [1].

Study design

Methodology for Researching Acceptance The survey of adults over the age of 18 who volunteered to take part in the study was done online in September 2021 using a quantitative instrument for measuring acceptance and attitude that was published in August 2020 in the Journal of Medical Internet Research. The center and western parts of the Kingdom, which are home to the majority of the country's citizens, were the study's primary foci. With the intention of gaining participants' permission to continue, the survey's first section provided a high-level overview of the app's goals, features, and services without getting too deep into the nitty-gritty of the technology behind them. The second component consisted of three questions designed to gauge how well the users understood the Tawakkalna app. In the third phase, we asked several questions to gauge people's feelings about opting into mandatory installations (opt-in). Here, we looked at how ready people were to willingly install the app, how often they followed the app's suggestions, and why they did or

didn't. The final segment included a set of questions designed to gauge sentiment toward automated installation (opt-out). At the end, participants' demographic details such as age, gender, region, health condition, and nationality were presented. To draw comparisons and draw conclusions, the survey results in Saudi Arabia were compared to those in five other nations (the UK, France, Germany, Italy, and the US) [1].

Effectiveness Study Design

Hatamian et al. systematic. Assessment approach was employed to investigate the efficacy of HIPAA and GDPR rules, and this review scoped out contact tracking apps in 28 countries. The approach looked at the architecture, data use, privacy, security, and attack vulnerability of contact tracing apps as major elements [1].

Qualitative Impact Analysis

The approach of impact analysis developed by Hatamian et al. and published in science was applied. Several software engineering testing methods, including static, dynamic, and behavioral testing, served as the basis for this approach to analysis. There was a checklist that looked at how an app operates in relation to privacy, security, and risk standards, as well as how closely its rules and actions adhere to or deviate from industry norms.

Tawakkalna, a contact tracking program, performs an impact analysis as part of its privacy and security evaluation process, as shown in Figure 2.

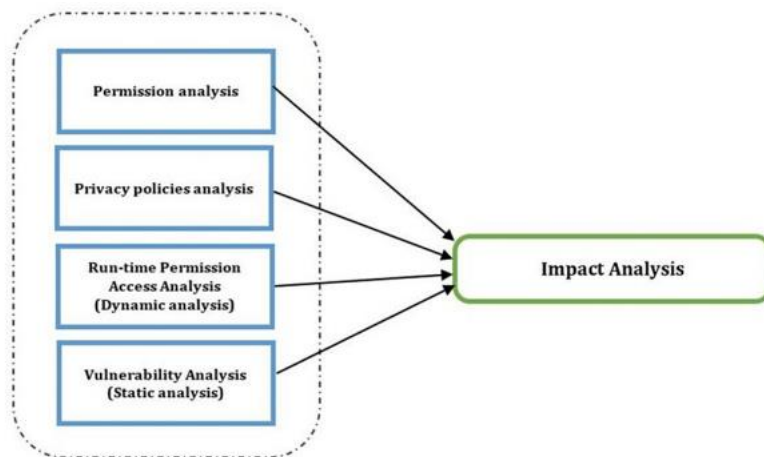


Figure 2 [1].

Permission Analysis

Typically, apps will inquire about rights to access the user's device's features and data. The mobile user must actively give their permission for each and every request for access. Examining the application's permission request pattern and the time and kind of resources it needs is the primary focus of this investigation. We may learn about the application's resource utilization and the developers' goals by looking for trends in the permissions it seeks and comparing them to those made by other programs, both European and elsewhere. This research looked at the three types of permissions that Android offers for the Tawakkalna app on Android devices. There are three types of permissions: Normal, Dangerous, and Signature. Normal rights suggest little risk during installation, whereas Dangerous permissions require access to critical resources with a high risk [1].

Privacy Policy Analysis

A privacy policy is a formal document outlining the rules by which an app's administrators will handle any information gained through the app's use. The policies need an open discussion of these procedures and a dedication to adhering to all applicable privacy and data protection laws. Users have a right to know exactly what information is being collected, shared, and otherwise processed by the application providers they use; thus these policies must be transparent and thorough. The

research aims to determine how well Tawakkalna adheres to privacy standards in comparison to similar apps created by European and non-European organizations [1].

Run-Time Permission Access Analysis (Dynamic Analysis)

The examination here centers on the issue of how the software really uses the rights it has been given when it's running. Processes, log files, gathered data, and permissions' request patterns (for example, access to sensitive data like GPS coordinates) were observed in real time using run-time monitoring tools for this investigation [1].

Test Bed for Monitoring Permission Usage

It is expected that the application will be given full permission and access to all necessary resources during this test. The application run-time processes are then examined as they occur in the background while a monitoring tool is executed. The goal is to highlight instances of unnecessary access to sensitive data as well as the gathering and processing of such data. The results of a test that analyses permissions and access at runtime are depicted in Figure 3.

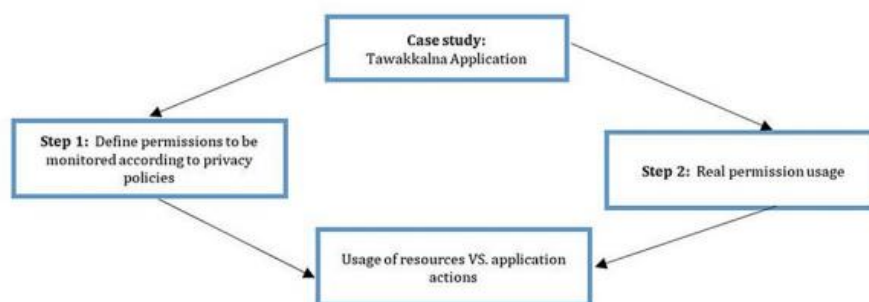


Figure 3 [1].

Step 1: The process of defining permissions that, if not closely controlled, might lead to security breaches, is a risky endeavour. The following are examples of permissions: ACCESS_FINE_LOCATION CALL_PHONE CAMERA ACTIVITY_RECOGNITION.

Step 2: Keep an eye on how people with different permissions use the software. Several devices equipped with a preconfigured data capturing tool should be used to deploy the application. The application's privacy policy should be examined if it does not follow the established guidelines. Access patterns to applications can be determined by collecting, analyzing, and interpreting logs. Analyzing Exposure to Risk (Static Analysis) In this investigation, we used Mobile Security Framework to verify the application's source code and hunt for security flaws (MobSF). MobSF can analyze static and dynamic code to find vulnerabilities and identify malicious software. Measurements are included in the reports that MobSF generates [1].

Statistical analysis

There were two primary measures of success in this research. A score of one indicated that respondents were open to downloading the Tawakkalna app. The variable is an encoding of a five-point Likert scale that expresses acceptance of the installation regime. If you plan to install, you should set this to 1, if not, set it to 0. The second factor measures how long respondents say they'll keep the app on their phones. A five-point Likert scale, represented here by binary values, stands for the ability to opt out of the installation procedure. Intentions to retain are represented by the number 1, while those to not keep are represented by the value 0. Opt-out regimes, in contrast to opt-in regimes, which include customers' active participation, involve the government mandating installation via mobile phone service providers. One method of multivariate analysis was multiple logistic regression, which was used to determine the associations between the two primary binary outcome variables and a variety of demographic and health-related factors, including but not limited to age, gender, nationality, education level, place of residence, health insurance, health problems (diabetes, high blood pressure, heart or breathing problems), sick pay, and trust in the government.

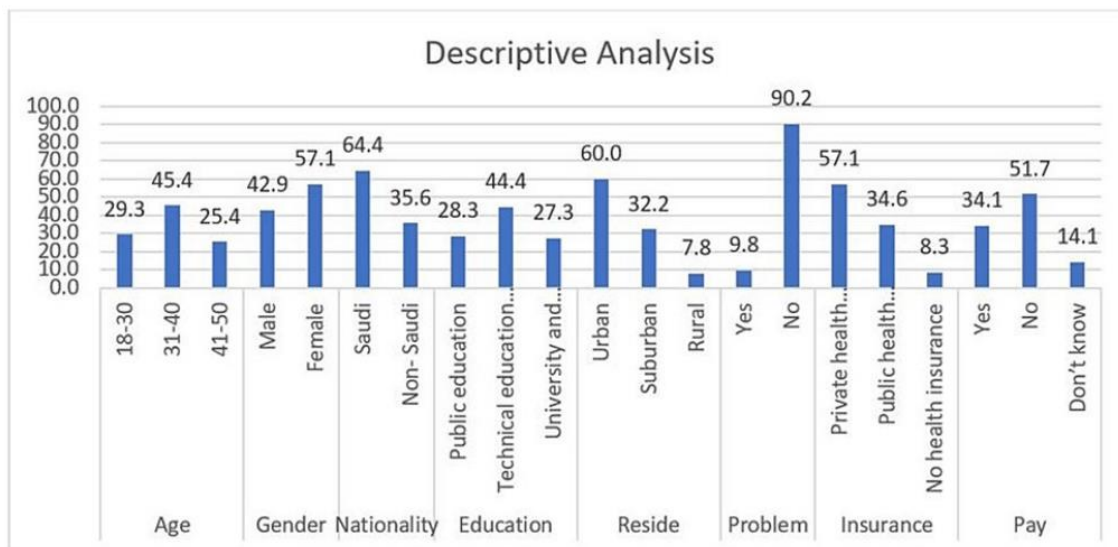
Possible correlations between the study's variables were displayed using the chi-square test. We ran our stats in SPSS 26 (IBM Corp., Armonk, NY, USA) [1].

Scientific and ethics approval

It was made clear in the online survey's introduction that it was intended to ensure anonymity. Before beginning the poll, we asked all participants to verify their agreement to take part. This work was approved by the King Saud bin Abdulaziz University for Health Sciences' research review board, which means it follows all the rules for doing research responsibly [1].

Results: Descriptive statistics results

A total of 205 individuals were included in this study after removing incomplete replies. Age, gender, nationality, education, residency, health issues, insurance type, and access to sick pay are only some of the characteristics of the sample that are summarized in Figure 4 [1].



Around 45.4% of the participants were between the ages of 31 and 40. There were more women than men in this study (57.1%). 64.4% of those that took part were Saudis. In terms of education, 44.4% of those included had some sort of degree in technical or vocational education. Sixty percent of those polled lived in urban area [1].

Research Structure:

Research phase	Objectives	Duration	Deadline, January 2023, April 2023 for 4 months.			
			January	February	March	April
1. Background research and literature review	- Initial conversation with supervisor during meeting. - Reading and evaluating pertinent literature. - Refine research questions considering fresh information.	1 Month				
2. Research design	- Design questionnaires.	1 Month				
3. Data collection and preparation	- Find people to fill out the questionnaire. - Interview chosen participants in semi-structured interviews. - Data cleansing.	2 Months				
4. Data analysis	- Statistically analyze survey data.	2 Months				
5. Writing	- To complete the thesis draft. - Discuss with the supervisor for the revisions and feedback.	1 Month				
6. Revision	- To complete the second draft after feedback. - Take the confirmation from the supervisor for the final draft. - Proofread. - Print and bind final work.	1 Month				
Total: 4 Months						

List of references:

1. Dawood, S., & Alkadi, K. (2023). Acceptability and Effectiveness of COVID-19 Contact Tracing Applications: A Case Study in Saudi Arabia of the Tawakkalna Application. *Cureus*. <https://doi.org/10.7759/cureus.35041>
2. Mukatafa, M. (2021). *The comprehensive guide to applying preventive protocols to contain the spread of Covid-19*. Mukatafa.
3. Ciotti, M., Ciccozzi, M., Terrinoni, A., Jiang, W. C., Wang, C. B., & Bernardini, S. (2020). The COVID-19 pandemic. *Critical Reviews in Clinical Laboratory Sciences*. [https://doi.org/Volume 57, 2020 - Issue 6](https://doi.org/Volume%2057,%202020-%20Issue%206)
4. ZHANG, J., & LITVINOVA, M. (n.d.). *Changes in contact patterns shape the dynamics of the COVID-19 outbreak in China*. Science Org. <https://www.science.org/doi/10.1126/science.abb8001>