**Tracking COVID-19 in Lebanon:** Allocating Resources and Contact Tracing with Whatsapp
**Team 83:** Fahad Beyari, Victoria Haver, Ann Hoang, Randy Maysaud, Jenny Tran
**Global Test/Tracing**

*Designing contact tracing techniques which are less labor-intensive to de-burden public health departments while facilitating COVID-19 transmission tracing [CT]*

**Problem Overview**

After speaking with a health worker in a Lebanese clinic, we determined two main problems that perpetuate community transmission of COVID-19 in Lebanon: lack of information on contact tracing and misallocation of medical resources (Appendix A). Currently, the majority of COVID-19 testing kits reside in Beirut. Because there is no database tracking viral spread in each village, NGOs are unable to allocate resources effectively. Consequently, potentially infected individuals from villages travel to the capital, increasing the spread of COVID-19.

**Proposed Solution:**

Our solution aims to address these problems in two phases. The first is to collect data on potential COVID-19 cases using a Whatsapp chat bot, and the second is visualizing this data on a live map through ArcGIS. This will provide policymakers and NGOs with the information they need to more effectively allocate medical resources to villages with critical need, thereby reducing the spread of COVID-19. Additionally, we will track the location of potentially infected individuals and those they have recently interacted with to contact-trace the virus and identify areas that may become hotspots in the future.

*Phase I: Whatsapp Chat Bot*

The Whatsapp chat bot works by having a user message a static phone number, which will initiate a conversation with the bot. Once the conversation is initiated the bot will send message questions to gain information needed to answer these five general questions:

1. Does the user display symptoms of COVID-19?
2. Has the user been in contact with anyone? If they have, what are the phone numbers of those individuals?
3. Has the user been in another village or city recently? If they have, then where? What is their current location?
4. Does the user have a health condition that puts them in a high risk category for COVID-19?
5. Does the user's current location have the adequate resources to combat COVID-19?

By answering general questions one, two, and three, the bot can gain information about the user's location history. Additionally, it will send a message to the individuals with whom they may have come in contact, stating that the individuals may be susceptible to COVID-19 and should keep an eye out for symptoms (Appendix B).

The answers to general questions one, four, and five will estimate the resources needed for the user and the resources they have available. Due to ethical concerns with creating a ranking system, we will instead simply provide this information to the necessary actors using our live map.

*Phase II: ArcGIS Live Map*

We will use ArcGIS to create a map with real time updates of data received via the chat bot. We will use Arcade and Codepen to create a rest service (Appendix C) that will update our map with data from the chat bot's SQL database. This data will be joined to an existing map layer created by the United Nations Office for the Coordination of Humanitarian Affairs (OCHA) which contains the location of villages, towns, and cities in Lebanon and their names in English and Arabic (Appendix D). This joined layer will be symbolized intuitively on two levels. The first will be locations of presumed-positive cases, where villages with higher numbers of cases and more vulnerable cases will be emphasized through point size. The second will be locations where presumed-positive cases have frequented and that may become future hotspots. We will then distribute the map to key NGOs, such as the Lebanese Red Cross, so that they may be able to make informed decisions about resource allocation.

**Use Case:**

This solution is specifically designed for Lebanon, though we believe this could be adapted for other low/middle-income countries in need. During a conference on March 21st, 2020, Prime Minister Hassan Diab stated that the Lebanese state alone cannot cope with the spread of the pandemic (LBC Group, 2020). We plan to help relieve the strain of COVID-19 by aiming our solution at two main user types: the general population of Lebanon and NGOs such as the Lebanese Red Cross. The general population will be using this chat bot to determine if they are potentially infected with COVID-19 and to alert other citizens of potential spread. The Red Cross has been instrumental in combating the virus in Lebanon (Appendix A). They will use the ArcGIS map to determine the patterns of the COVID-19 spread and to effectively allocate resources within the country. This solution will only take a couple of minutes for the general population and will be yet another resource the Lebanese Red Cross can use to make decisions. We anticipate easy incorporation to pre-existing daily routines.

**Evidence for Functionality/Efficacy:**

According to the Center for Disease Control, "Rapid identification and isolation of cases... and active monitoring of other contacts have been effective in suppressing expansion of the outbreak" in Singapore and have implications for other countries, as well (Ng et al, 2020). In Lebanon, where there is "a lack of trust in the Lebanese government" and a "serious concern about its economic capacity," it is not feasible to implement the same type of enhanced surveillance as Singapore (Chehayeb, 2020).

However, 86% of adults in Lebanon use Whatsapp (Silver et al, 2019). This makes it a viable candidate for a Whatsapp chat bot contact-tracing mechanism. Additionally, our interview with a nurse in a Lebanese village clinic leads us to believe that implementation of our proposal would be effective (Appendix A). This implementation would work around privacy concerns of using phone data.

We have already successfully built a prototype of the Whatsapp chat bot using Twilio (see attached files for code and video demonstration). We plan on receiving and using the Whatsapp API for a reduction in expenditures. We also have access to the OCHA's map layer which we will be using when creating our rest service and live map (Appendix D). We have spoken to Professor Tyler Davis at the College of William & Mary, who is willing to lend support to our geospatial design.

**Further Design/Testing Required:**

Currently, the Whatsapp chat bot is being implemented with the support of Twilio. Twilio has a fee for each message sent; therefore to alleviate cost, we will be applying for the usage of the Whatsapp API. Whatsapp gives their API for projects on a large scale, so we will use it for implementation. With the Whatsapp chat bot mostly completed and already storing information, we will focus on designing a live map through ArcGIS that can access the bot's SQL database. Currently, the SQL database is local and we will need an online database. On the bot, we will code an autocorrect service for village names to find close matches from the database. We also plan to hash all the data and take necessary privacy and ethical considerations into account.

The primary risks involved with implementation are in the Whatsapp phase. It is difficult to get all the citizens to opt in to a COVID-19 bot and to trust its messages. However, we have contact in Lebanon with the vice mayor and mayor for the village of Warhanieh. These contacts have the ability to communicate with other mayors of villages and have trustworthy ties with their constituents. Villages are already sending important COVID-19 announcements via Whatsapp messages, so we anticipate feasibility with sending ours. With the support of the mayors, we will alleviate the risk of failure to join.

**Implementation Plan:**

We have created a timeline for converting this concept into a final solution and distributing it to our user base (Appendix E). We plan to complete our Whatsapp bot and live map by April 10th and hope to begin messaging the general public by April 24th. We will reach out to the mayor and vice-mayor of Warhanieh to get feedback on implementation strategies. We also have identified the Lebanese Red Cross and the College of William & Mary as potential partners moving forward. We plan to publish the live map publically for ease of distribution to relevant actors. We will leverage our contacts to ensure utilization.

**Resources Needed for Completion:**

We currently have the help of Adam Goodwin and Professor Tyler Davis, and we are planning to speak with Professor Carrie Dolan at the College of William & Mary. They will help us progress beyond the design stage. We will need additional guidance and mentorship for implementation. We plan to reach out to political leaders in Lebanon and local NGOs to obtain them. We will need to build an SQL server/database. We also require financial resources as outlined in our budget plan (Appendix F). We hope to receive a budget with support from our universities and other organizations aiming to combat the COVID-19 epidemic.

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Appendix A

Notes from Interview with Nurse Rifka Ghanem (clinic worker at Abey Village):

Interview notes with Rifka Ghanem nurse at Abey Village in Mount Lebanon:

- What do you do and does it relate with COVID-19?
  - A nurse that works in the only clinic in the village. She has been trained in protocols for COVID-19 cases.
- What is the current COVID-19 situation like in Lebanon?
  - It is spreading across the cities at a faster rate, but they are confirmed cases happening in the village. The village is doing well to resist the spread.
- How are you guys identifying the coronavirus?
  - People who come to the clinic, we check their symptoms such as fever. Then a specialist asks them more specific questions to determine if the patient has to get tested.
- If there seems to be a new case, what measures do you take?
  - The individual who believes they have COVID-19 will let the mayor know, the mayor will hold the person up in his house to allow the person to quarantine without sharing a living space with his family. They are currently building areas for citizens to quarantine at.
- Do you monitor traffic and hotspots of the village?
  - Each village tracks their own cases and alerts the surrounding villages. To spread news quickly they use a facebook page and a whatsapp group chat that each household in the village must be a part of. It does not seem that the overall government is tracking the case, but the mayors in the villages are doing it themselves to spread the news.
- Does this clinic have any affiliation with NGOs?
  - There are a lot of NGOs that are helping the cause, the biggest one that has helped with COVID-19 has been the Lebanese Red Cross.
- Are there any issues with tracing the corona in Lebanon?
  - Right now the citizens are doing well in coming forward and following self isolation rules to reduce the spread. There are not a lot of cases in the Mount Lebanon area, and the villages have been good at stopping the spread.
- What are the challenges dealing with Corona?
  - There are not enough resources to treat people and there are not that many test kits either. All the resources are in the city capital, Beirut. If someone wants to be tested they must drive all the way there no matter the distance. The resources are not being spread across the villages.
  - Do you have enough supplies for covid patients? Ventilators? PPE?
    - No PPE is becoming an issue as well.
- Is Whatsapp a good way to communicate with people?
  - Whatsapp is the best way to communicate with the lebanese people, everybody has whatsapp and it is free. With text messages they are charged for it. Schools have even been using whatsapp to assign homework to students. And the whole village is in a whatsapp group chat for updates.
- Is there a good way to spread news throughout a village?
  - Yes the good way has been whatsapp group message and facebook pages.

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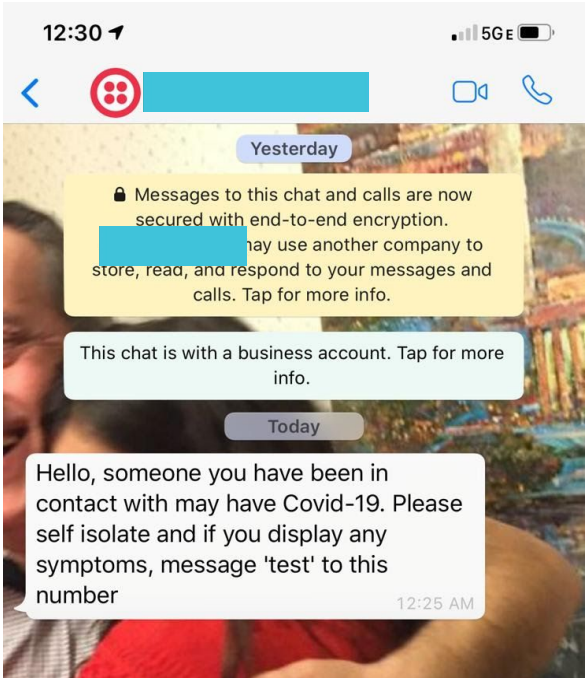
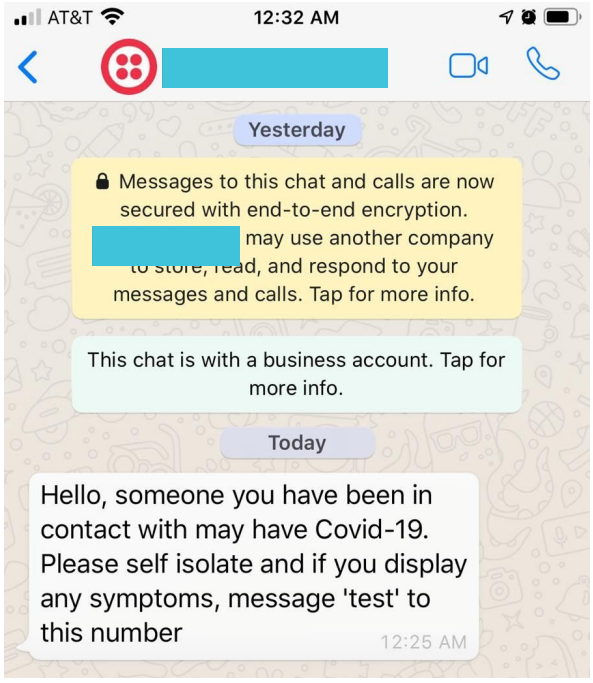
Appendix B

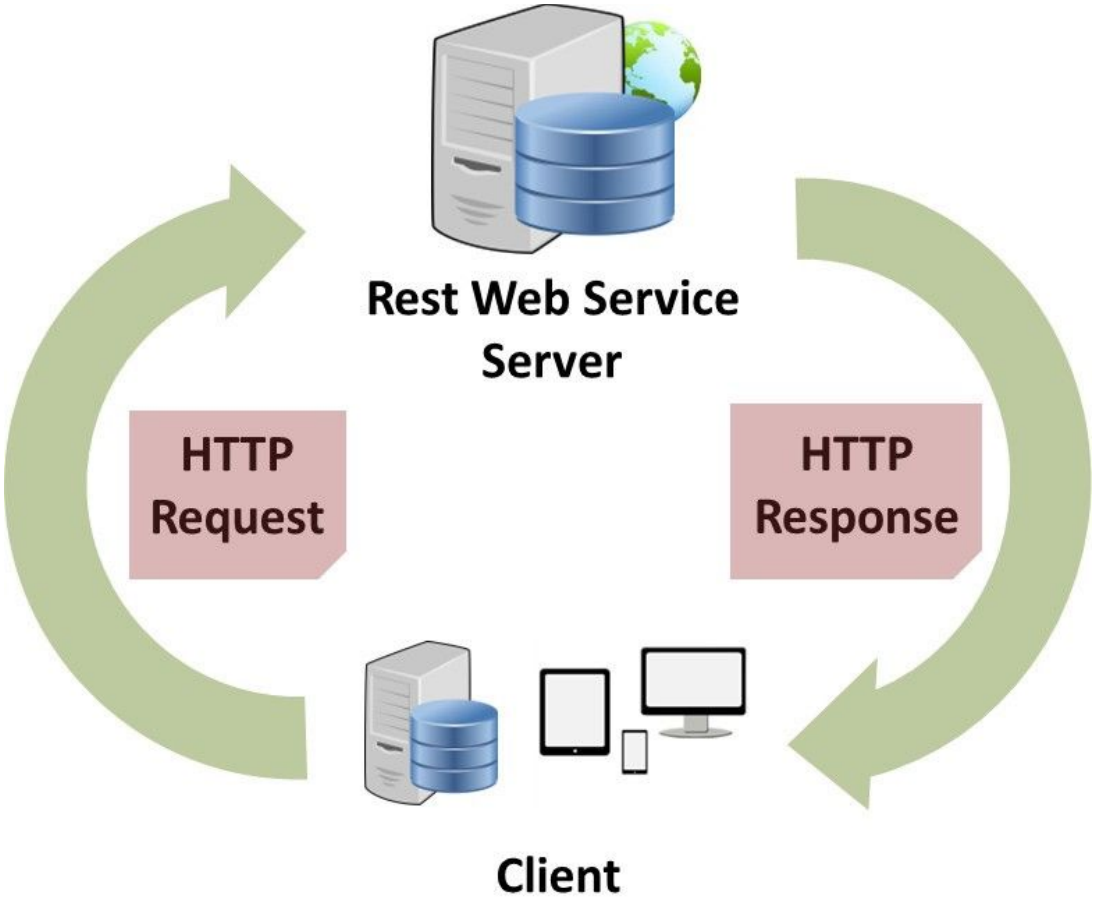
Example of text messages sent to individuals who may have come in contact with a user that is potentially positive for COVID-19.



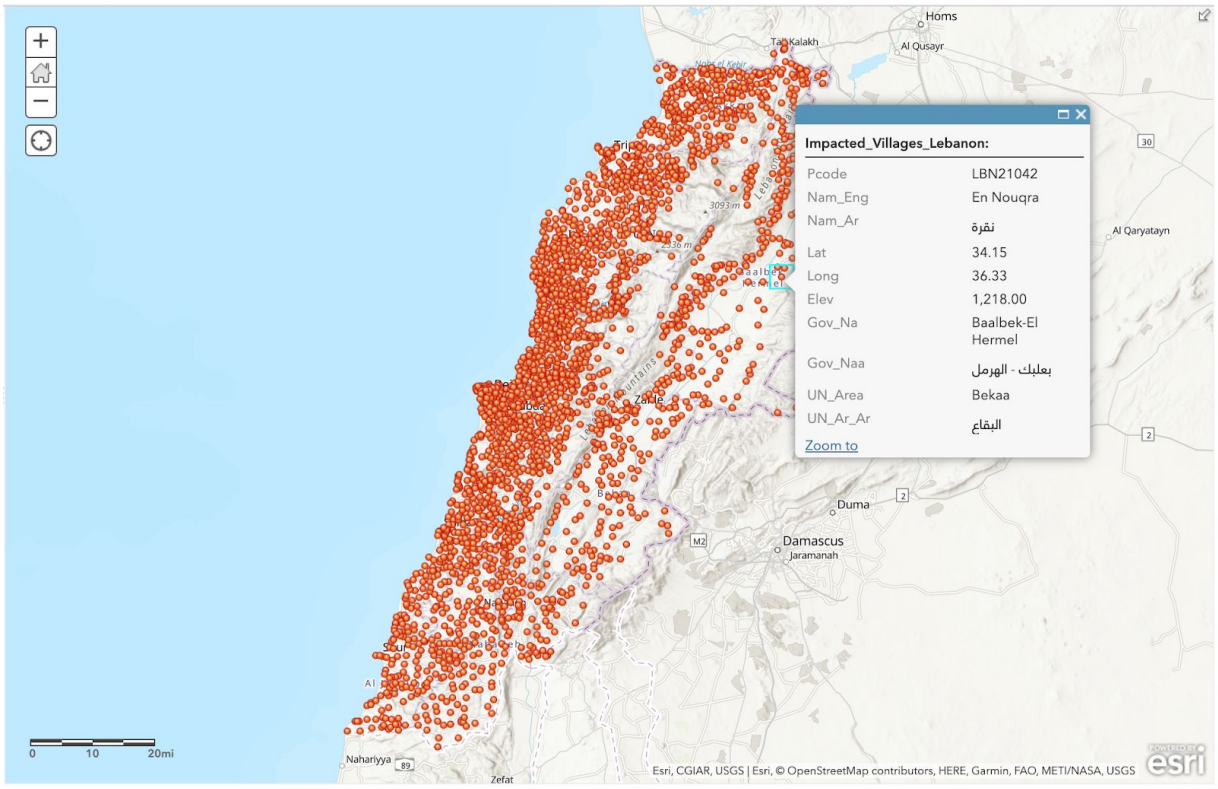
Appendix C

Diagram depicting the process of using a rest service.



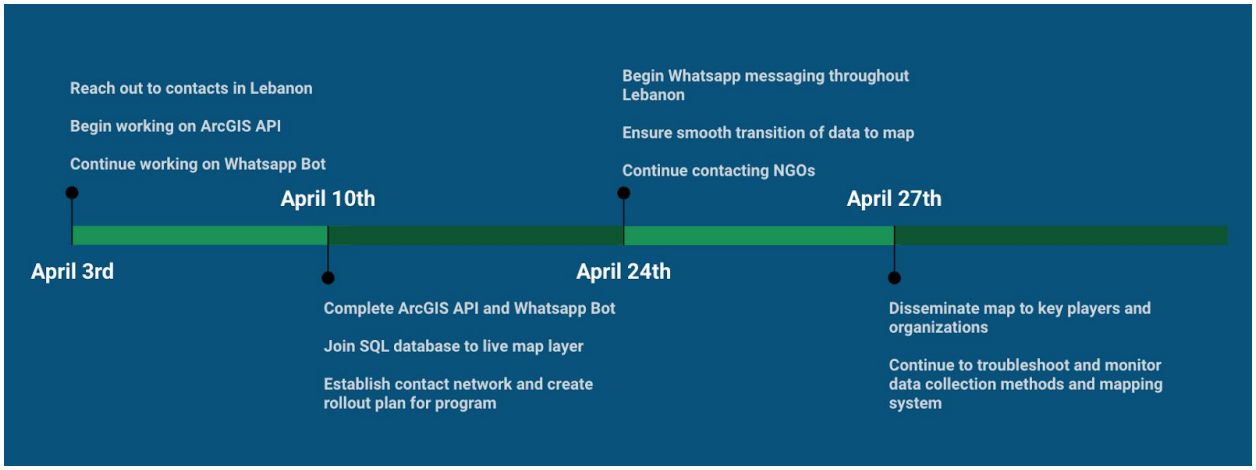
Appendix D

Screenshot of OCHA map layer for use by humanitarian actors. This is a feature point layer that contains villages, towns, and cities in Lebanon with names collected per UNICEF and UNHCR IM joint work.



Appendix E

Timeline for program implementation, from program-building to distribution.



Appendix F

Budget plan for implementation.

| Line-Item | Cost |
|---|---|
| Rented Server to Host Whatsapp API | $450 (for 3 months) |
| Phone with Whatsapp Capability | $25 |
| Sim Card with Unlimited Texting | $20 (for 3 months) |

**Total: $495 for 3 months**

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