

TOOL TO SUPPORT HOME HOSPITALIZATION OF COVID PATIENTS

First Report

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Background

The VIDHA: coVID en el HogAr project consists of the design and implementation of a tool to support the operational management of home hospitalization services, with a special focus on COVID19 patients, who provide healthcare facilities for the public health network. The main functionality of the tool consists of proposing, in an automated way, decisions regarding the organization of clinical teams (made up of doctors, nurses, kinesiologists, speech pathologists, etc.) and the allocation of the agenda of home visits to these teams. These decisions are designed to maximize the care capacity of clinical teams, which is achieved by optimizing (i) the balance of workload between teams and (ii) the routes that teams must take, while respecting requirements associated with team shifts, the clinical needs of patients, and other operational and clinical requirements that may be established.

Abstract

The purpose of this report is to present the results of the simulation of scenarios associated with home care for patients from the Hospital San Juan de Dios (HSJD) suffering from COVID-19.

HSJD's home hospitalization service currently serves around 90 patients, divided into 3 groups of 30 patients on average. Each of the groups has 3 nurses and 2 physical therapists.

The VIDHA platform, developed for routing home hospitalization clinic visits, is capable of simulating eventual scenarios using typical patients who require procedures and clinical care associated with COVID-19 treatment, allowing the home hospitalization unit to visualize the requirements to satisfy the demand for this new type of patients.

Results

In meetings held with the team leading this initiative, three evaluation scenarios were established.

Scenario 1: HSJD's home hospitalization continues with the same structure, but one of its groups is dedicated exclusively to the care of COVID-19 patients. This means that the average 30 patients in the group are all infected. This requires medical visits every three days, nursing visits every day, and physical therapy visits for 15 patients a day.

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By entering this information into the platform, the algorithm is capable of delivering a solution regarding the scenario outlined in around five minutes, indicating that with the current capacity of teams it is possible to see all patients, but with conditions that are not acceptable. To solve the problem, a doctor who complies with the 10.00 am route schedule is required. at 3.00 pm. This would allow all patients to be seen without any overtime and without caps from the clinical teams in the visiting homes.

Table 1: COVID-19 Group Table proposed to solve Scenario 1

Group	Team	Start Time	End Time	Patients
C	Nurse1	10:05:00	14:57:00	9
C	Nurse2 AM	10:00:00	14:27:00	6
C	Nurse3 AM	10:05:00	14:54:00	8
C	Nurse2 PM	16:00:00	18:56:00	4
C	Nurse3 PM	16:13:00	18:45:00	3
C	PhysTher1	10:03:00	14:55:00	12
C	Phys Ther2 AM	10:00:00	14:58:00	10
C	Phys Ther2 PM	16:00:00	18:59:00	7
C	Doctor1	10:26:00	15:00:00	6

Source: Prepared by the authors of the report

Scenario 2: HSJD's home hospitalization continues with the same structure, but one of its groups is dedicated exclusively to the care of COVID-19 patients. This means that the average 30 patients in the group are all infected. This requires medical visits every two days, nursing visits every day, and physical therapy visits for 20 patients a day.

By entering this information into the platform, the result is evident. With the current number of staff members, it is not possible to make all visits. It is therefore necessary in this case to add two doctors to the COVID-19 group of patients, a doctor with a shift from 10.00 am to 3.00 pm and another with a fourth shift from 10.00 am to 7.00 pm. With these additional personnel, the unit would be able to tackle the proposed scenario.

Table 2: COVID-19 Group Table proposed to solve Scenario 2

Group	Team	Start Time	End Time	Patients
C	Nurse1	10:00:00	14:55:00	9
C	Nurse2 AM	10:00:00	14:56:00	6
C	Nurse3 AM	10:00:00	14:31:00	7
C	Nurse2 PM	16:00:00	18:54:00	4
C	Nurse3 PM	16:00:00	18:44:00	4
C	PhysTher1	10:00:00	15:01:00	12
C	PhysTher2 AM	10:00:00	14:56:00	10
C	PhysTher2 PM	16:00:00	19:07:00	7
C	Doctor1	10:00:00	14:36:00	6
C	Doctor2 AM	10:17:00	14:43:00	6
C	Doctor2 PM	16:02:00	15:55:00	2

Source: Prepared by the authors of the report

Scenario 3: HSJD's home hospitalization continues with the same structure, but the rapid growth of the pandemic in Chile means that all of its groups must be converted to serve COVID-19 patients. This means that 90 patients on average are infected. This requires of medical visits every two days, daily nursing visits, and physical therapy visits for 60 patients a day.

In order to cope with this adverse scenario, it is necessary to replicate the equipment model proposed in the previous scenario, that is to say each group should add two doctors, one with a shift from 10.00 am to 3.00 pm and another with a fourth shift from 10.00 am to 7.00 pm.

Table 3: COVID-19 Group Table proposed to solve Scenario 3

Group	Team	Start Time	End Time	Patients
A	Nurse1	10:16:00	14:54:00	8
A	Nurse2 AM	10:00:00	14:04:00	6
A	Nurse3 AM	10:00:00	14:39:00	6
A	Nurse2 PM	16:00:00	18:53:00	6
A	Nurse3 PM	16:00:00	18:51:00	5
A	PhysTher1 AM	10:00:00	14:30:00	8
A	PhysTher2 AM	10:14:00	14:50:00	8
A	PhysTher1 PM	16:00:00	18:47:00	4
A	PhysTher2 PM	16:00:00	18:15:00	4
A	Doctor1	10:06:00	13:51:00	6
A	Doctor2 AM	10:10:00	14:48:00	6
A	Doctor2 PM	16:55:00	18:49:00	4

Source: Prepared by the authors of the report

Conclusions

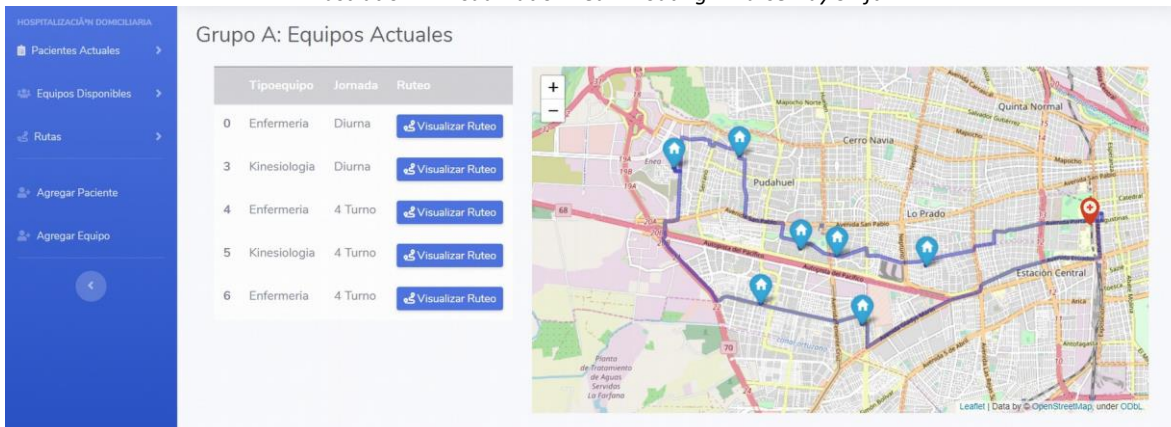
When carrying out the test of the different proposed scenarios, it is possible to see that with efficient route planning it is possible to maximize the capacity of the teams according to the needs of the patients, since it is not necessary to increase the number of nurses or physical therapists. A good allocation and a well distributed workload is enough to meet the needs of even the most pessimistic scenario, giving high value to the platform solution.

In the case of doctors, it was necessary to add at least one doctor in any of the three scenarios considered, it due to the procedures associated with this profession. However, the algorithm is able to minimize the use of the resource by optimizing its routing and giving as a result, in the pessimistic case, the incorporation of three doctors with three on day shift and three on a fourth shift as the best solution.

In parallel, another benefit is related to the time required to arm the routes. It takes, on average, one hour to prepare the route for each team. If we take the pessimistic scenario, it will take 1 hour 30 minutes, given the greater number of procedures associated with each patient. This would be avoided by the platform, taking only takes five minutes to develop routing for all three groups, reducing the time by 4 hours and 25 minutes in the most adverse case.

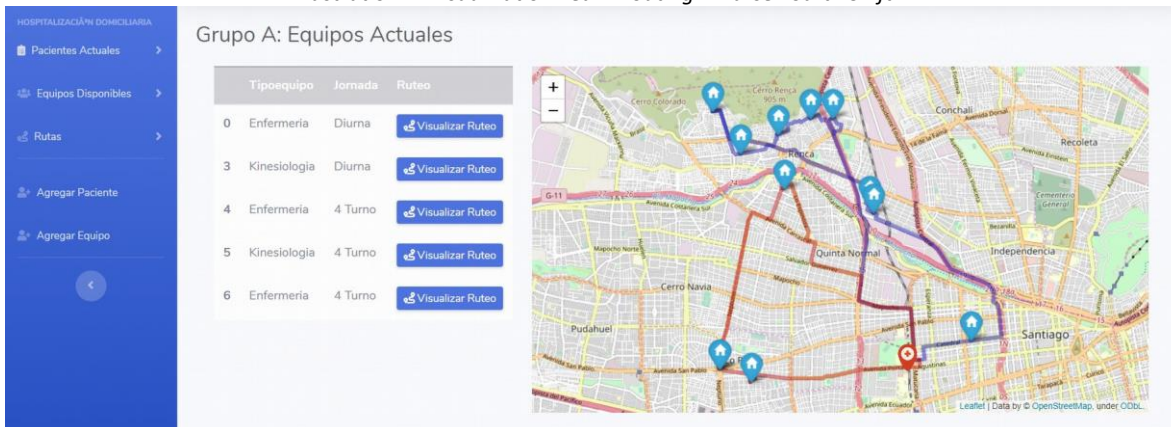
Note: Illustrations 1 and 2 show examples of the solutions obtained from the tool.

Illustration 1: Visualization Team Routing – Nurse Day Shift



Source: Prepared by the authors of the report (VIDHA platform)

Illustration 2: Visualization Team Routing – Nurse Fourth Shift



Source: Prepared by the authors of the report (VIDHA platform)