
Optimizing the care capacity of critical intensive care personnel

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THE PROBLEM

The COVID-19 pandemic has created a challenge of unprecedented proportions for which an optimal operation of Intensive Care beds is paramount.

The availability of beds and respirators is relevant, but just as important is the availability of medical personnel trained in their operation and the providing of adequate treatment to patients.

Facing a global scarcity of personal protective equipment (PPE) and a high flow of patients, high rates of infection have been shown among medical staff in countries such as Italy, Spain, and the USA, which has a significant negative impact on care, in particular to those in a critical condition.

Chile is no exception...



CRITICAL RESOURCES

ICU, ITU, Respirators, Trained medical personnel.

PROBLEM

High rates of infection among medical staff hinder the actual capacity to treat critical patients.

SITUATION EN CHILE

“We have today 1,567 people in the public health system infected and quarantined. In the private system the number is 672”.

“Since March, the Society of Critical Care Medicine has trained over 30,000 people, nurses, physical therapists, and doctors of internal medicine or surgery in order to offer assistance to these units”.

Subsecretary of Assistential Networks
La Tercera newspaper, 23 May 2020



Intervention proposed by ISCI for care capacity.

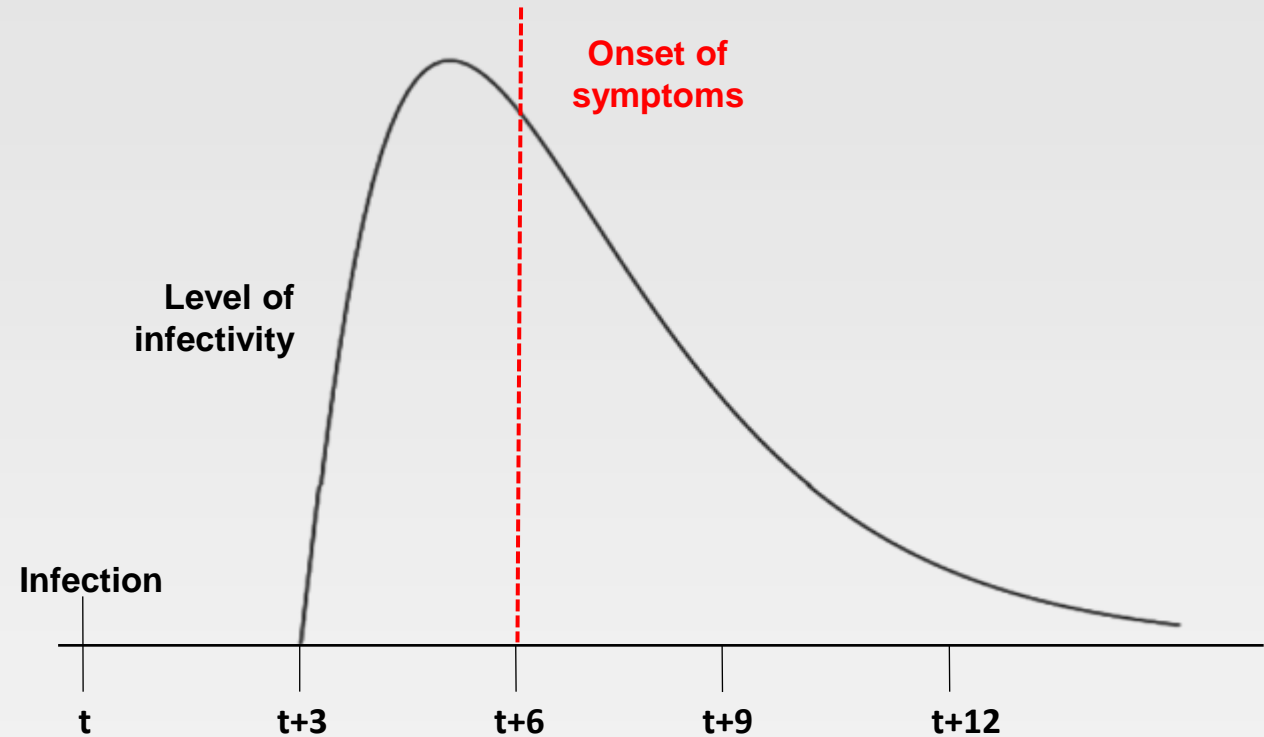
OUR IDEAS

We also propose

- The **design of work shifts that minimizes the probability of infection** among medical staff in order to maintain the care capacity throughout.
- **Dynamic optimization**, switching of shifts, hours, and location of staff as cases of infection appear.
- The system takes into account **specific situations of personnel** that could limit their ability to work certain shifts.
- A **visualization platform** that facilitates its implementation in practice.
- **Traceability to identify** members of staff with a **risk** of infection (tracking, tests, previous quarantine).
- **The integration of tech companies** with experience in some of the components of the integral solution.
- **Strategic testing** of personnel via **PCR pool testing** to accelerate the return of equipment into the field and identify cases of infection quicker.
- **Tele-ICU**. Ventilators that display relevant information will place it online allowing experienced staff members to collaborate remotely with personnel in the field.

SHIFT DESIGN

Recent studies have shown that symptoms appear between 5 and 6 days after the date of infection¹, while the period of infection begins 3 days prior to the onset of symptoms².



1. Lauer, Stephen A., et al. "The incubation period of coronavirus disease 2019 (COVID-19) from publicly reported confirmed cases: estimation and application." *Annals of internal medicine* (2020).
2. He, Xi, et al. "Temporal dynamics in viral shedding and transmissibility of COVID-19." *Nature medicine* (2020): 1-4.

SHIFT DESIGN

We require shift patterns that:

Reduce exposure to infection.

Benefit from the incubation period of the disease.

As a general rule, this can be achieved with shifts that combine:

- Concentrated work periods over 3-4 days.
- Long periods of rest (10 days approx.).
- Coordinated patterns that reduce the number of people who are exposed.

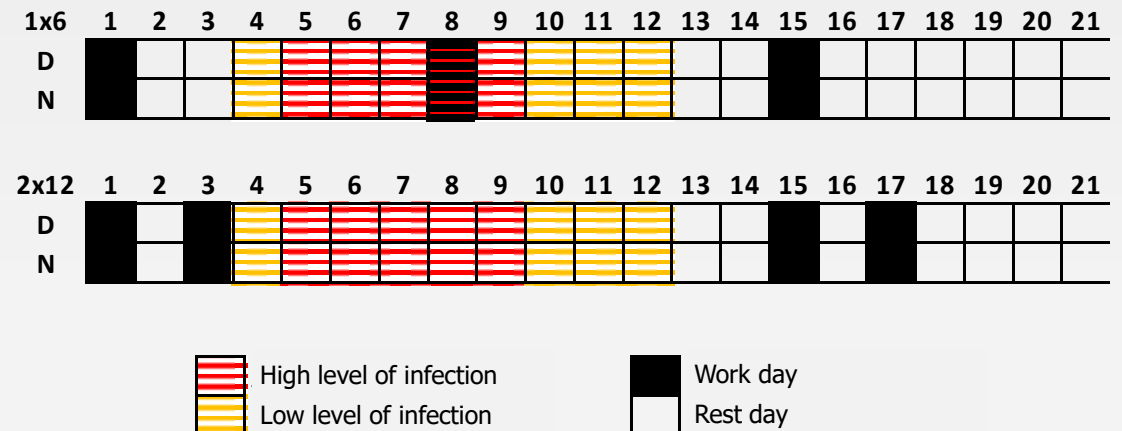
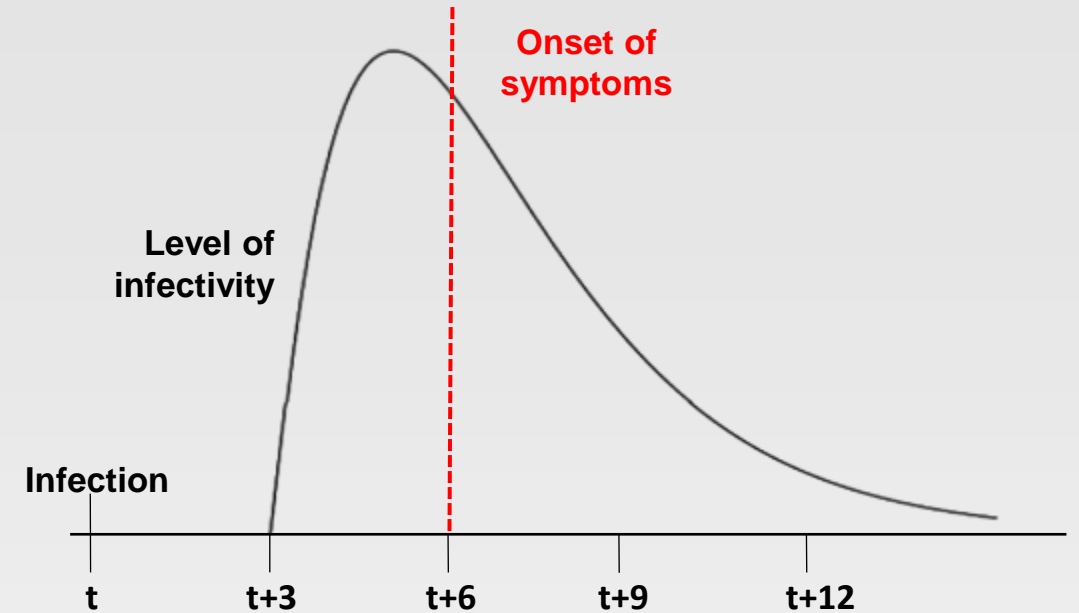
REDUCING INFECTION

Supposing that on Day 1:

- Onset of symptoms approximately Day 6
- Infectious period commences approximately 3 days before the onset of symptoms²

A **1x6 shift** does not fully benefit from the incubation period and considers a return to hospital during the timeframe in which the risk of infection is high.

A **2x12 shift** makes the most of the evolution times of the illness by concentrating the workdays before the period of infection and considers a return once the risk of infection is low (the same would occur if infection took place on Day 3). This way, the risk of infection among medical staff is reduced.



RISK EVALUATION OF SHIFTS

Each shift has a base utilization determined by:

$$U_{base} = \frac{\text{Hours Worked}}{\text{Total Hours}}$$

On a 1x6 shift, in which 24 hours a week are worked, the base utilization is:

1x6		-- 24h						
		1	2	3	4	5	6	7
D								
N								

$$U_{base}^{1x6} = \frac{24 \text{ hours}}{168 \text{ hours}} = 14,3\%$$

RISK EVALUATION OF SHIFTS

The number of shifts necessary N_{base} for a permanent provision (24/7) of D is determined by:

$$N_{base} = \frac{D}{U_{base}}$$

For a 1x6 shift of 24 hours per week, the number of shifts necessary to provide the ICU with three doctors 24/7 is:

$$N_{base}^{1x6} = \frac{3}{U_{base}^{1x6}} = \frac{3}{14,3\%} = 21$$

SIMULATION MODEL



Interactions are modeled and use probabilities of infection (horizon of 24 week):

- With patients
- With members of medical staff
 - Function of the shift pattern and Personal Protection Equipment (EPP)
- Outside the hospital

RISK EVALUATION OF SHIFTS

A risk of infection exists during every working day, which diminishes the availability of medical personnel due to preventive quarantine and periods of recovery in case of infection.

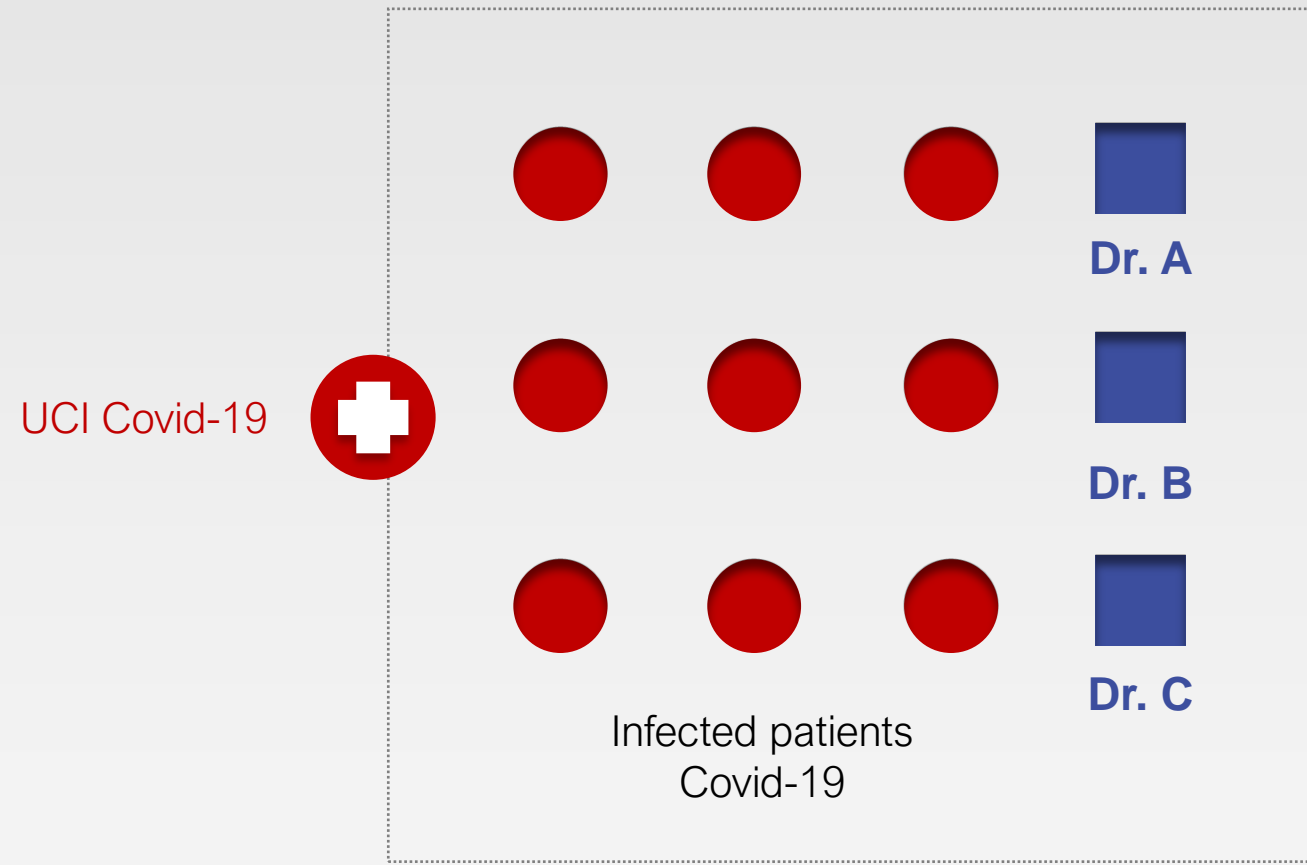


A simulation model was built that allows us to evaluate each shift in terms of the availability to work of medical staff, taking absenteeism into account.

The values of effective utilization U_{ef} and effective quantity N_{ef} for different shift configurations.

SIMULATION OF DIFFERENT SHIFT PATTERNS

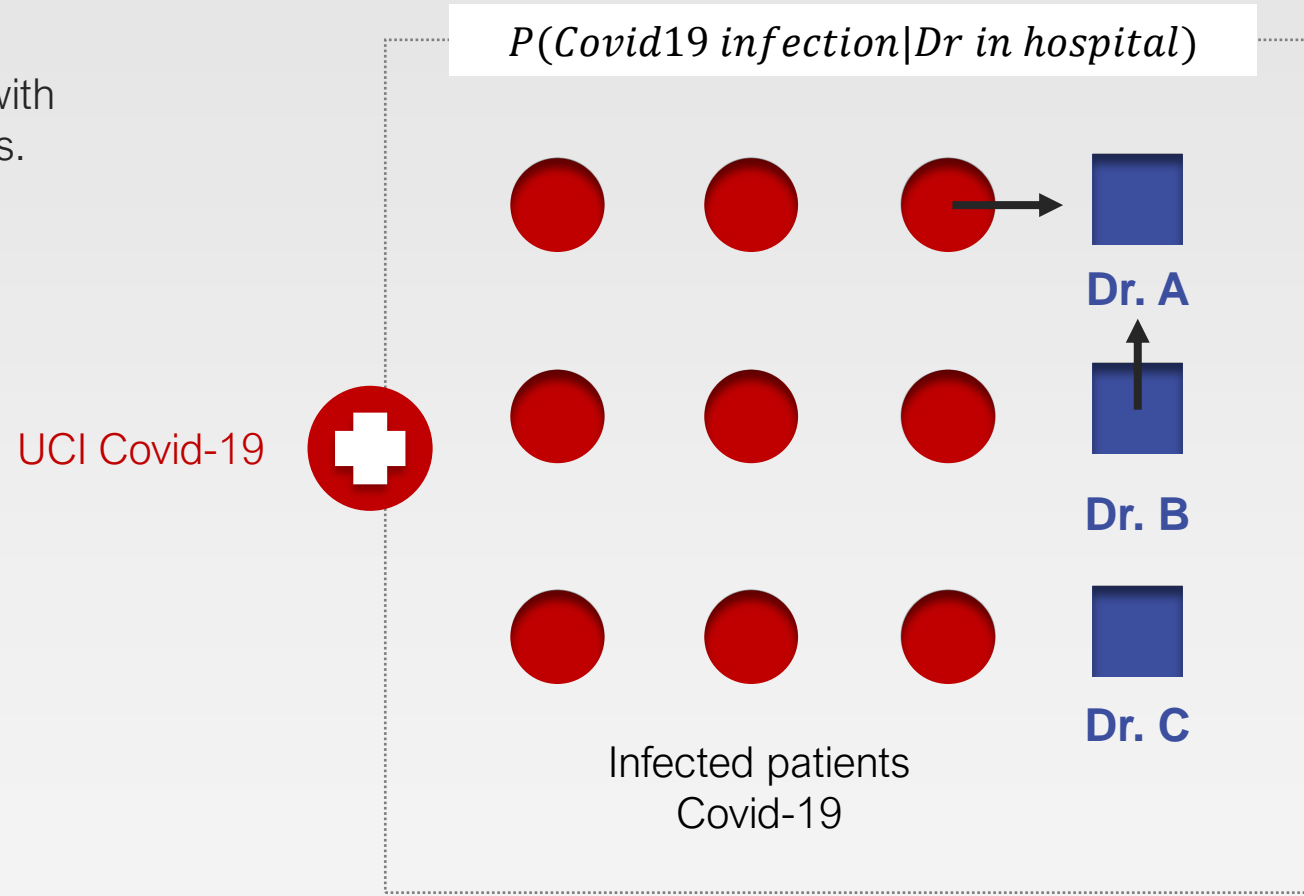
1/4 How does the simulation work?



SIMULATION OF DIFFERENT SHIFT PATTERNS

2/4 How does the simulation work?

On each shift doctors be infected through contact with their colleagues or patients.

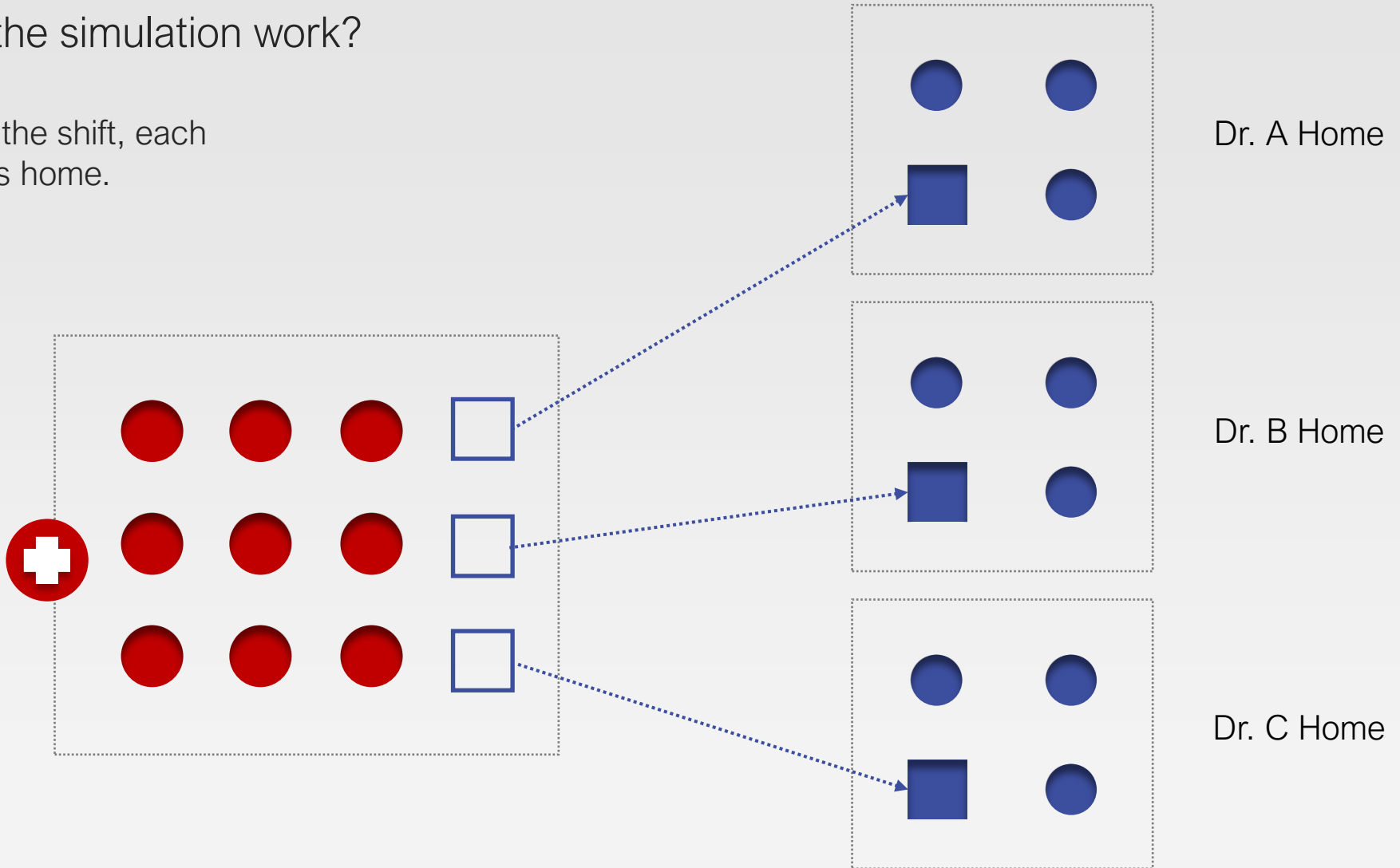


SIMULATION OF DIFFERENT SHIFT PATTERNS

3/4 How does the simulation work?

At the end of the shift, each doctor returns home.

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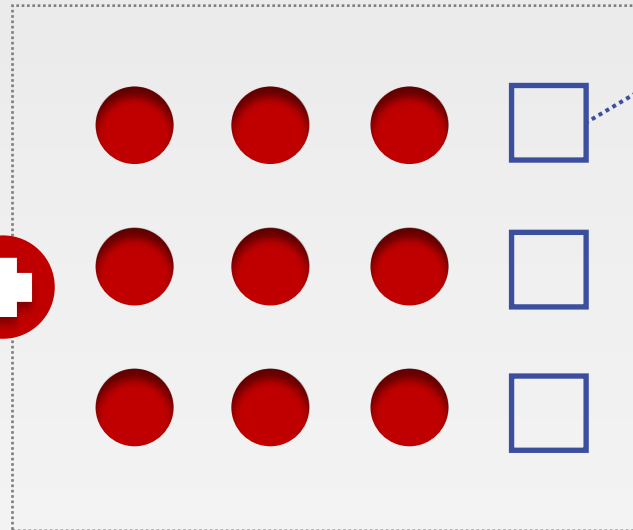


SIMULATION OF DIFFERENT SHIFT PATTERNS

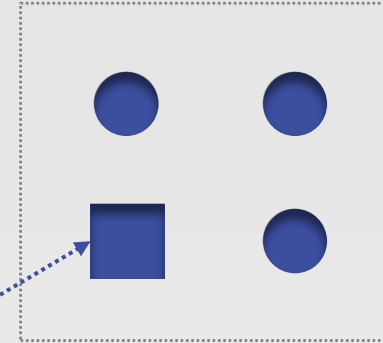
4/4 How does the simulation work?

Medical staff can be become infected outside the hospital.

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$P(\text{Covid19 infection} | \text{Dr outside the hospital})$



Dr. A Home

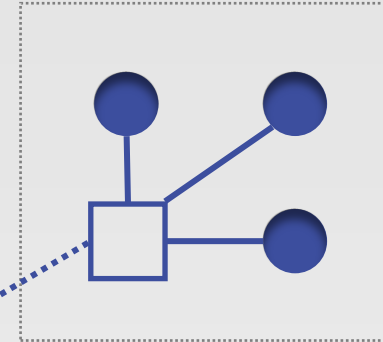
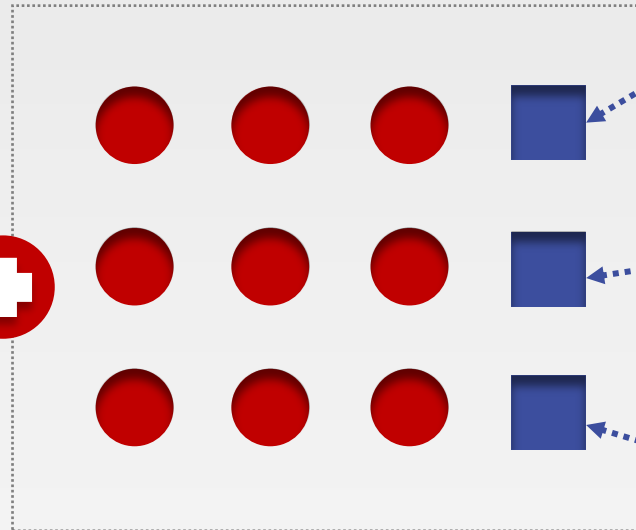


EXAMPLE 1

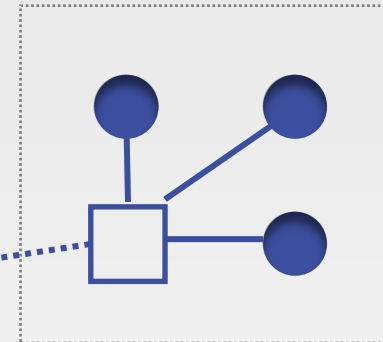
SIMULATION OF DIFFERENT SHIFT PATTERNS

1/6 Example of infection: **WORK SHIFT**

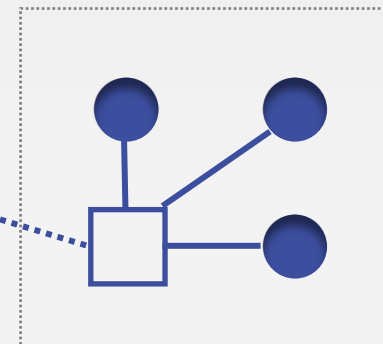
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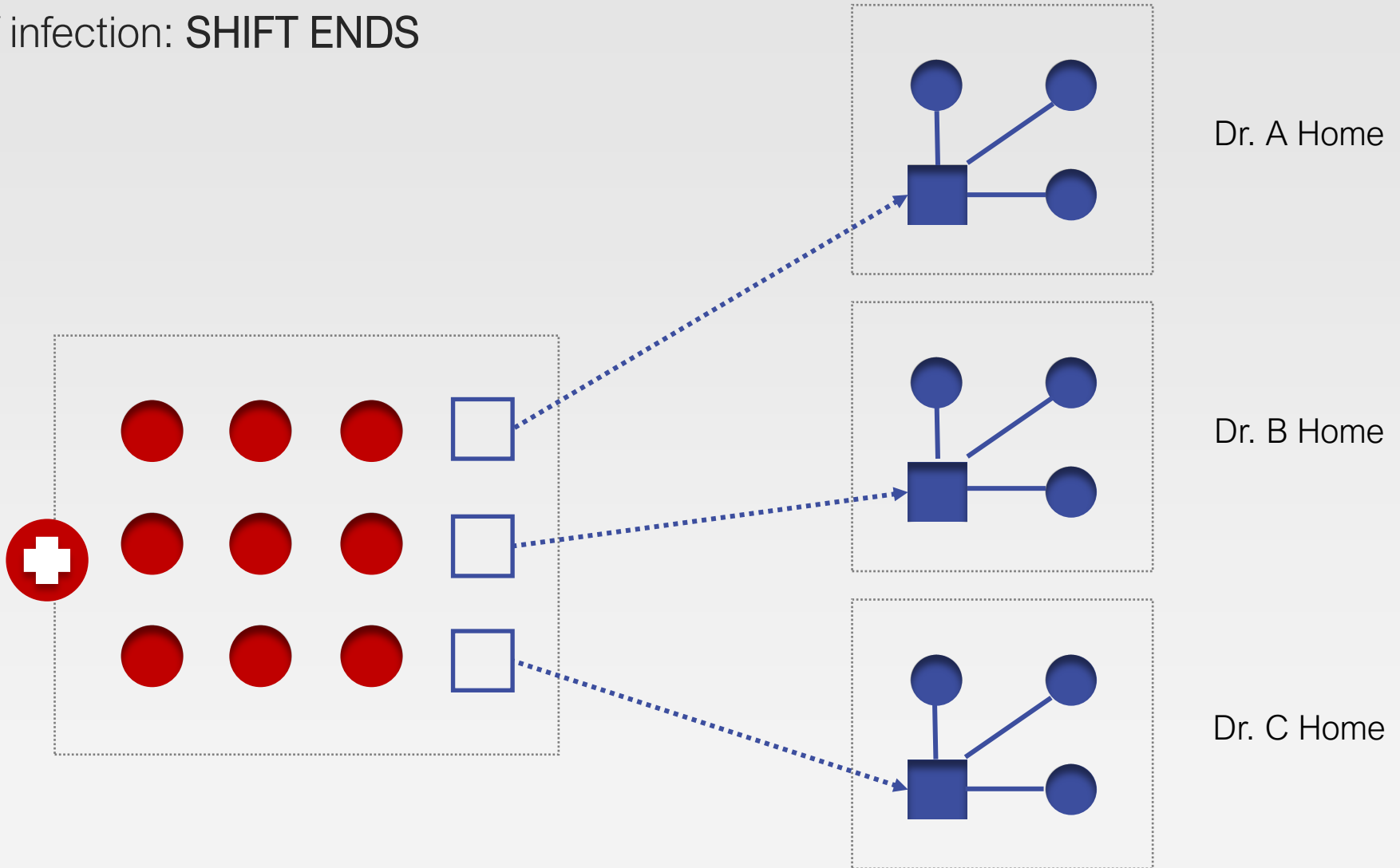


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SIMULATION OF DIFFERENT SHIFT PATTERNS

2/6 Example of infection: **SHIFT ENDS**

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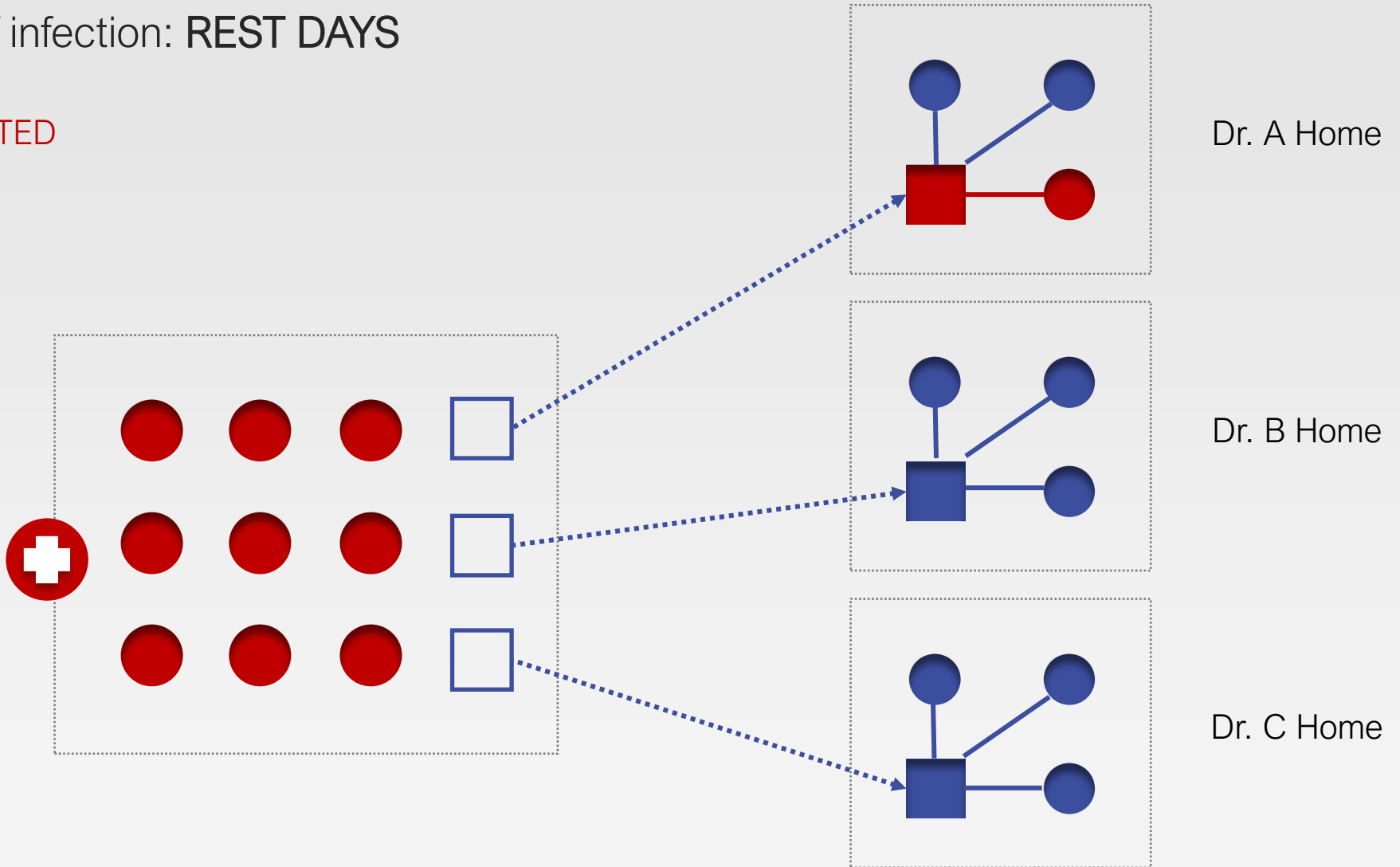


SIMULATION OF DIFFERENT SHIFT PATTERNS

3/6 Example of infection: REST DAYS

DR. A INFECTED

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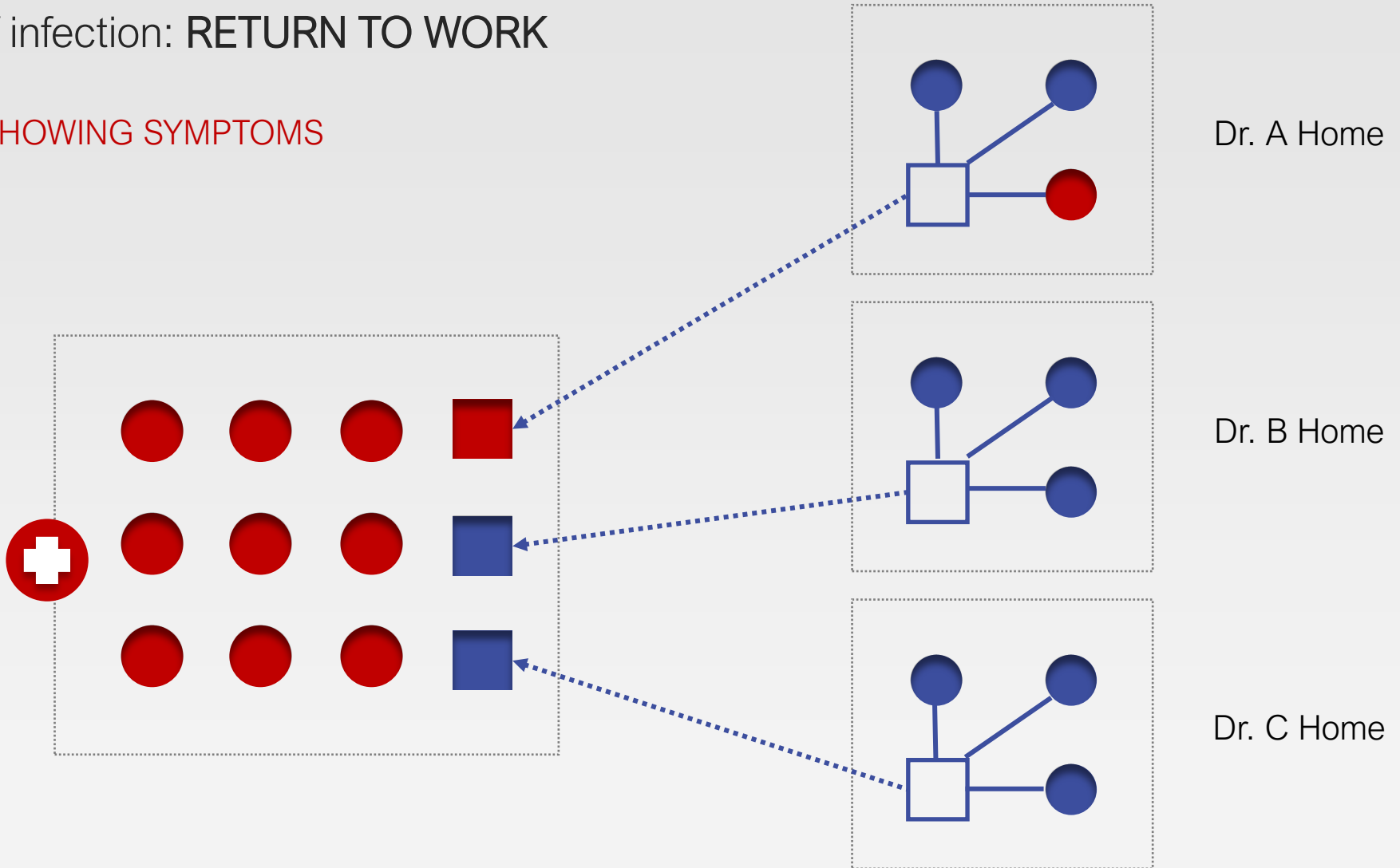


SIMULATION OF DIFFERENT SHIFT PATTERNS

4/6 Example of infection: RETURN TO WORK

DR. A NOT SHOWING SYMPTOMS

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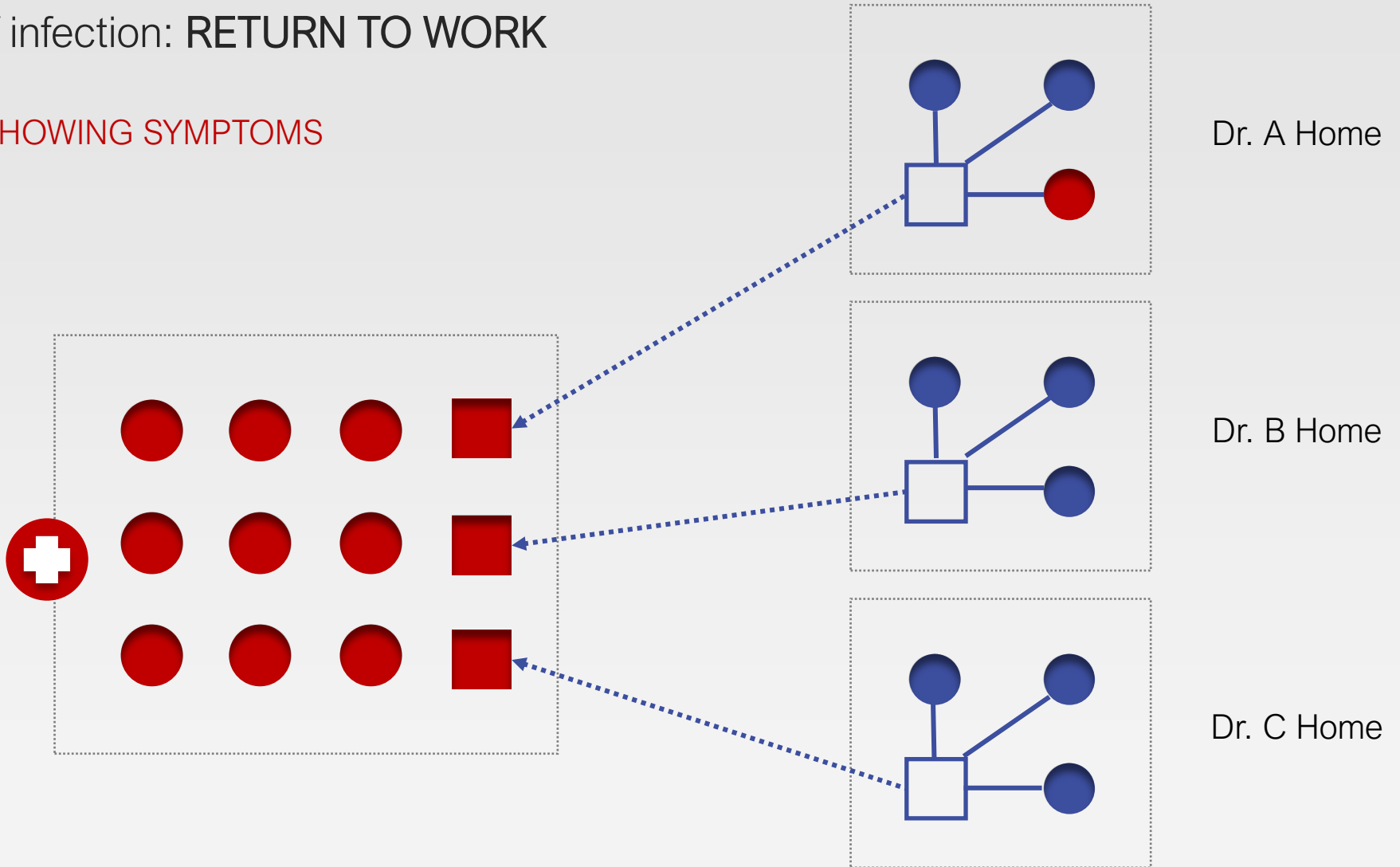


SIMULATION OF DIFFERENT SHIFT PATTERNS

5/6 Example of infection: RETURN TO WORK

DR. A NOT SHOWING SYMPTOMS

UCI Covid-19

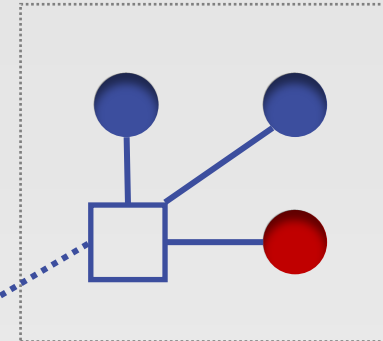
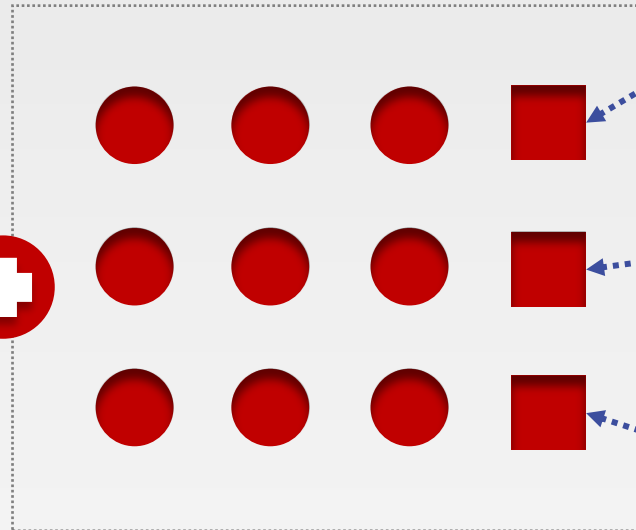


SIMULATION OF DIFFERENT SHIFT PATTERNS

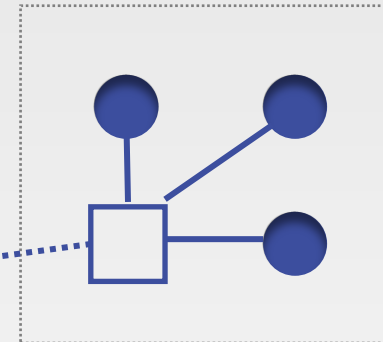
6/6 Example of infection: **END OF SHIFT**

ENTIRE MEDICAL TEAM INFECTED

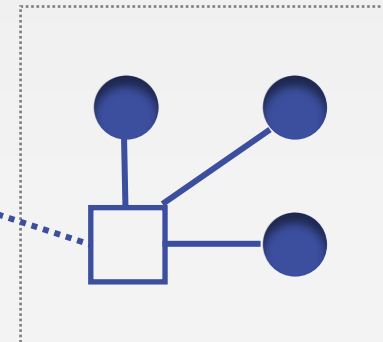
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Dr. C Home



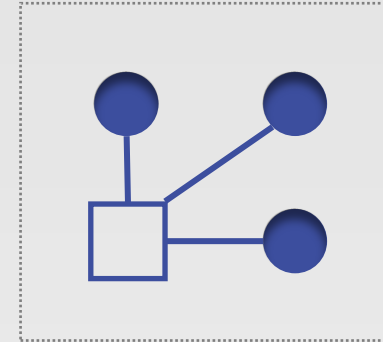
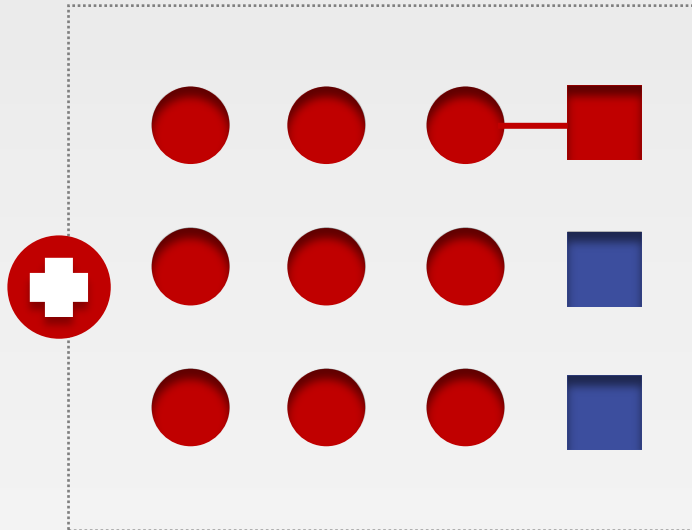
EXAMPLE 2

SIMULATION OF DIFFERENT SHIFT PATTERNS

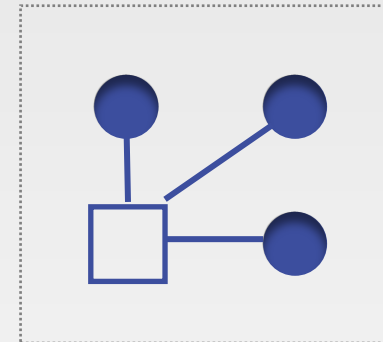
1/5 Example of infection: **WORK SHIFT**

DR. A INFECTED BY A PATIENT

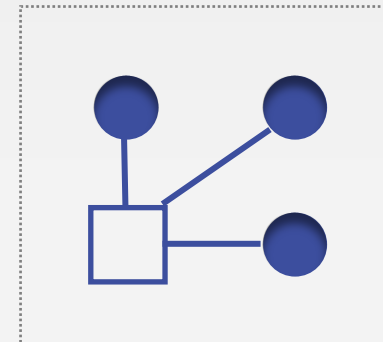
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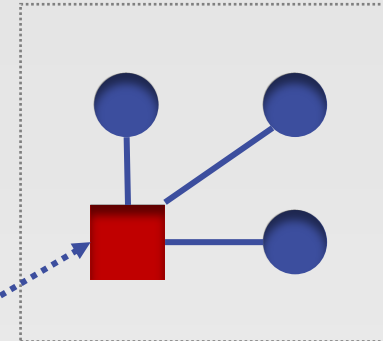
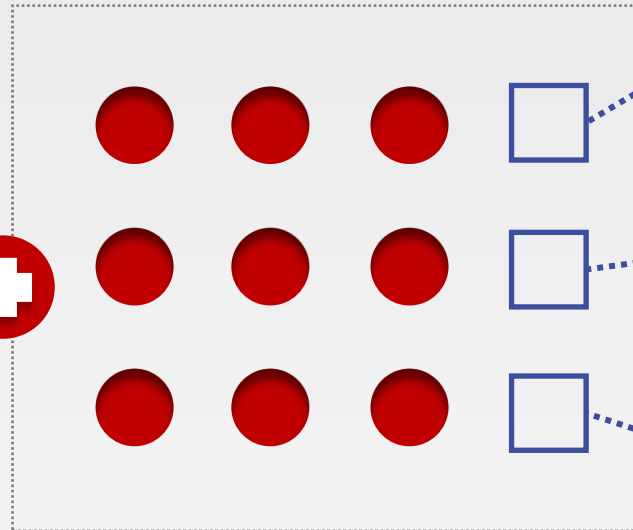
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SIMULATION OF DIFFERENT SHIFT PATTERNS

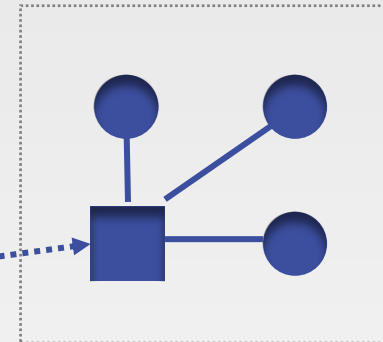
2/5 Example of infection: **END OF SHIFT**

DR. A INFECTED BY A PATIENT

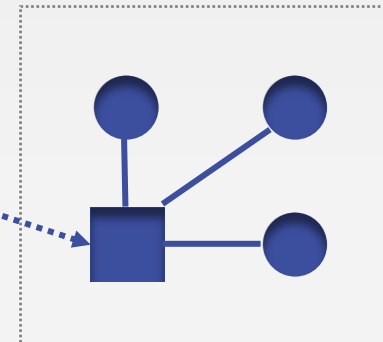
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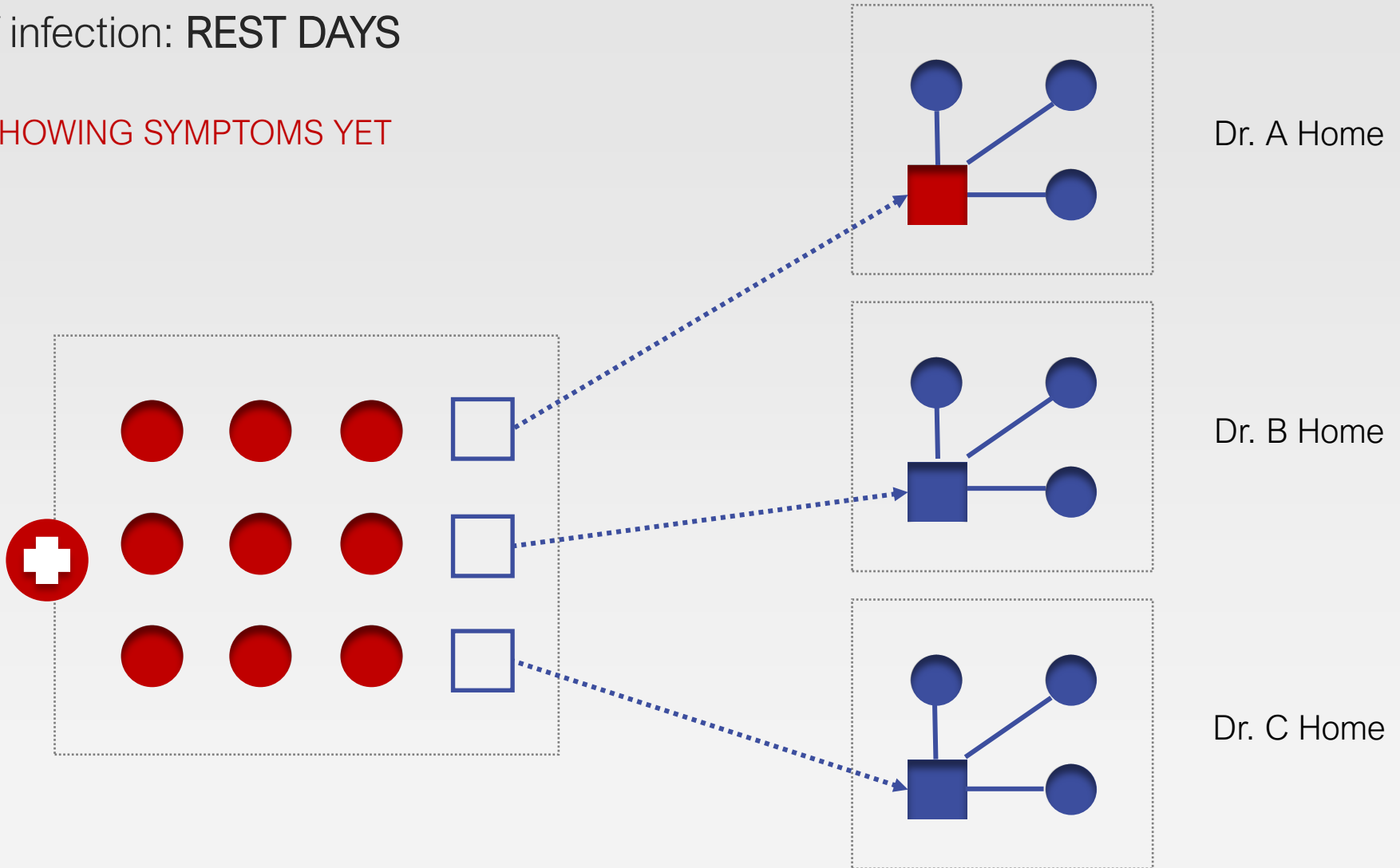
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SIMULATION OF DIFFERENT SHIFT PATTERNS

3/5 Example of infection: REST DAYS

DR. A NOT SHOWING SYMPTOMS YET

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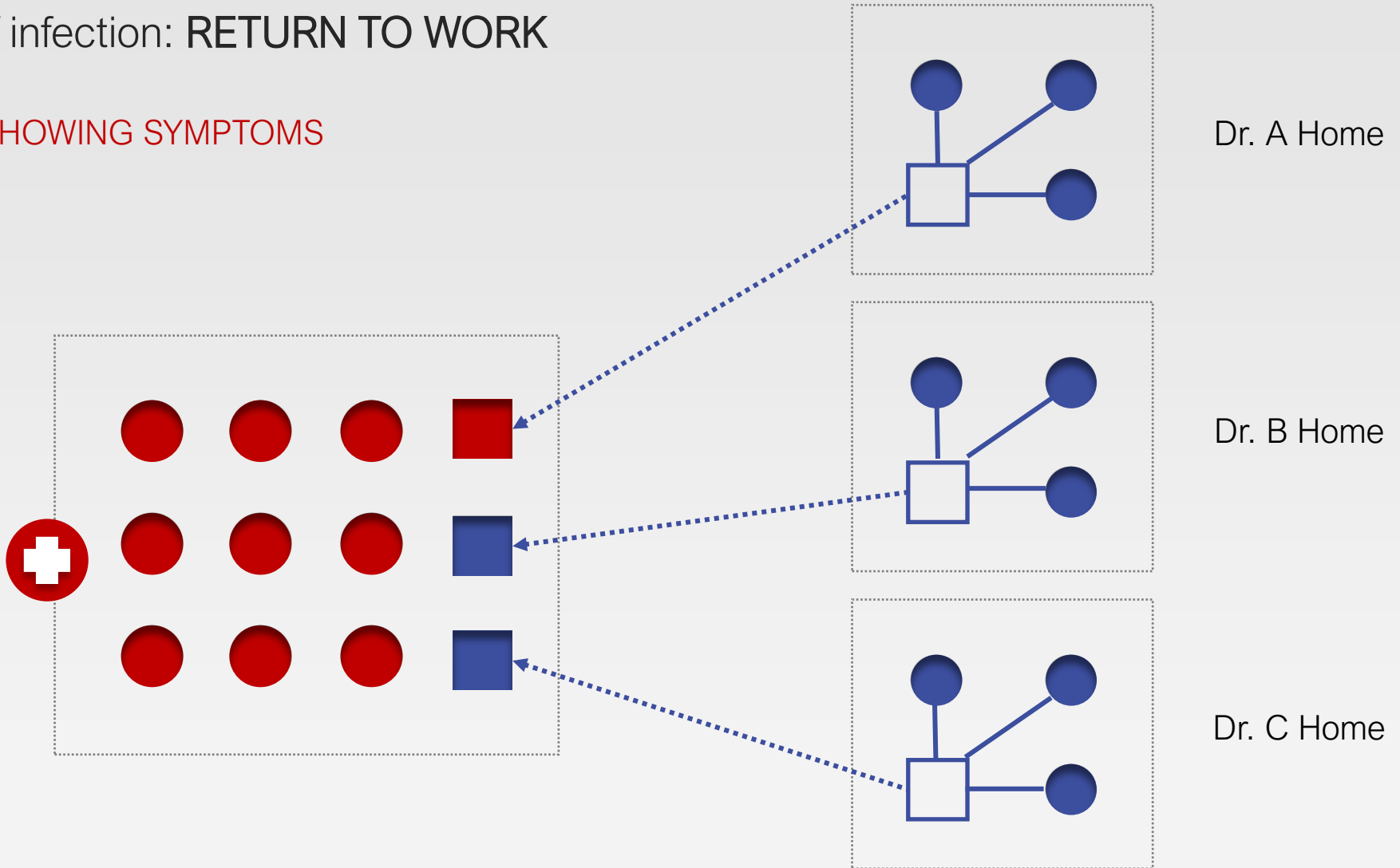


SIMULATION OF DIFFERENT SHIFT PATTERNS

4/5 Example of infection: RETURN TO WORK

DR. A NOT SHOWING SYMPTOMS

UCI Covid-19

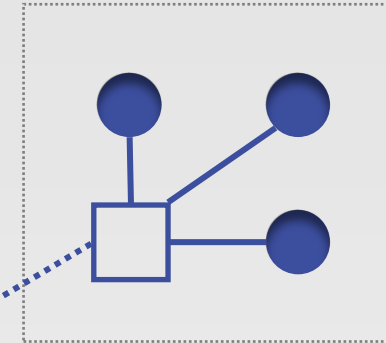
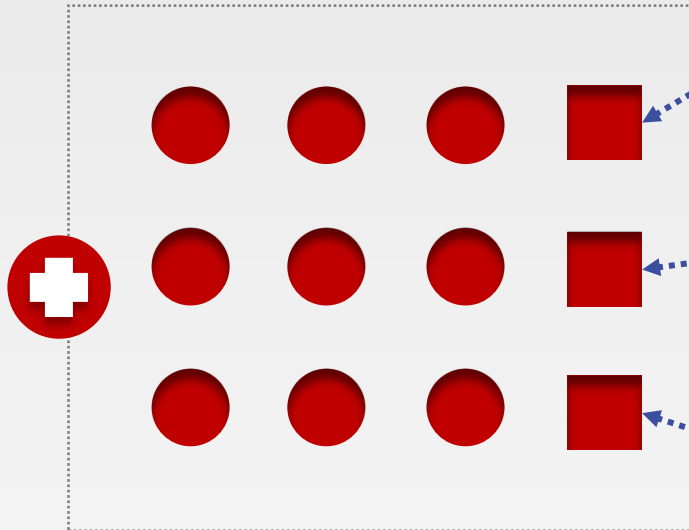


SIMULATION OF DIFFERENT SHIFT PATTERNS

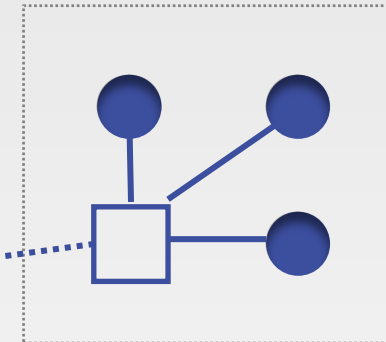
5/5 Example of infection: RETURN TO WORK

DR. A INFECTS HIS/HER COLLEAGUES

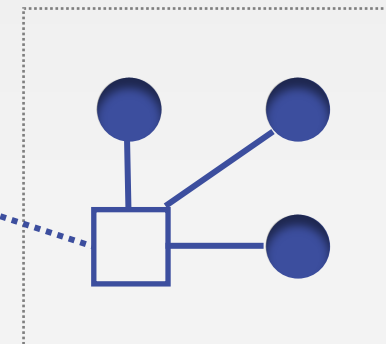
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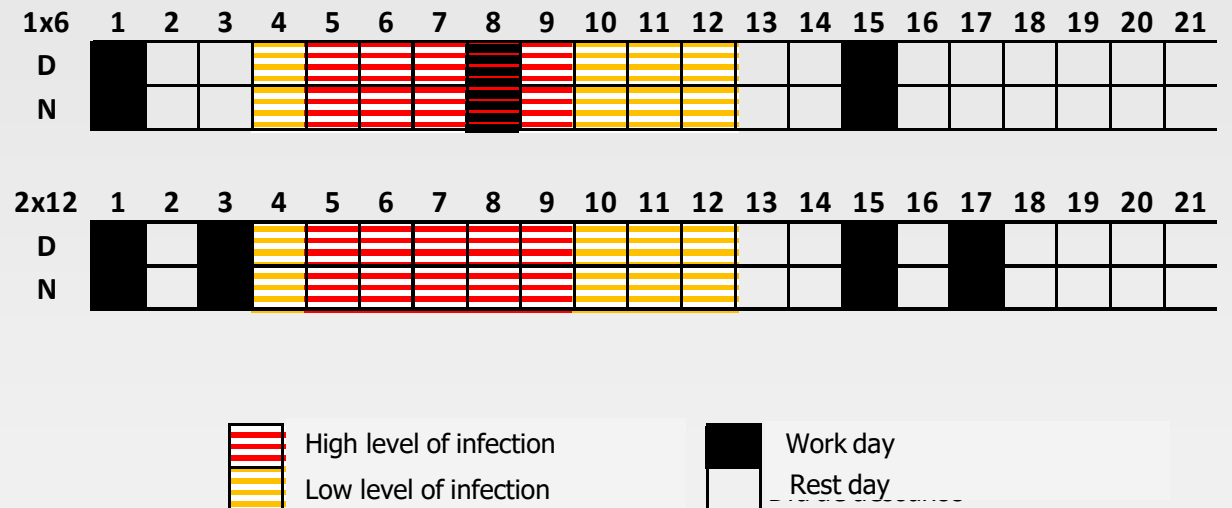
Dr. B Home



Dr. C Home

REDUCING INFECTION

The results of the simulations show that the **probability of infection** between members of medical staff is as much as **4 times lower** on a **2x12 shift** compared to a shift that considers on workday per week.



Proposal sent to the Hospital Clínico of the Universidad de Chile for their Critical Patient Unit campaign

Como se puede apreciar en la Tabla 2, que muestra la eficiencia y un indicador de riesgo de contagio relativo al turno 1x5 24h¹, estos esquemas de turno están entre los más riesgosos en términos de contagio. El turno 1x3 incluso tiene mayor riesgo de producir un contagio que esquemas de mayor utilización como el 4x10 con jornada de 24 horas (Figura 3).

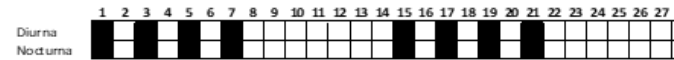


Figura 3: Esquema de turno 4x10 24h, que contempla cuatro jornadas de trabajo de 24 horas intercaladas con un día de descanso, seguidas por 7 días de descanso consecutivos.

Turno	Días de trabajo	Días de descanso	Horas diarias	Horas semanales (promedio)	Eficiencia	Riesgo de contagio
1x5 24h	1	5	24	28	0.730	1.00
1x3 24h	1	3	24	42	0.608	2.35
2x10 24h	2	10	24	28	0.732	0.39
2x12 24h	2	12	24	24	0.787	0.25
3x11 24h	3	11	24	36	0.689	0.83
4x10 24h	4	10	24	48	0.615	1.43
4x10 12h	4	10	12	24	0.779	0.20

Tabla 2: Eficiencia y riesgo de contagio entre miembros del personal médico para algunos esquemas de turno, determinadas a través de una simulación que modela las interacciones del personal médico. El riesgo de contagio se reporta en relación al riesgo de contagio del turno 1x5 24h.

Se propone por tanto, para los tipos de jornada “Rotativo”, utilizar turnos 2x10 24h (Figura 4), que permiten reducir en más de un 60% el riesgo de contagio entre miembros del equipo médico, manteniendo las mismas horas semanales promedio que el turno 1x5 24h, que corresponde al tipo de jornada “Rotativo”. Este esquema permite mantener la dotación propuesta de 24 médicos generalistas y 48 médicos junior, disminuyendo considerablemente el riesgo de contagio.

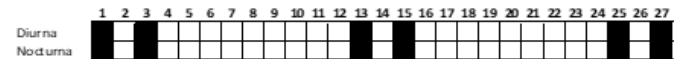


Figura 4: Esquema de turno 2x10 24h, que contempla dos jornadas de trabajo de 24 horas intercaladas con un día de descanso, seguidas por 9 días de descanso consecutivos.

¹ Este esquema de turno es utilizado frecuentemente en centros de atención médica de pacientes críticos.

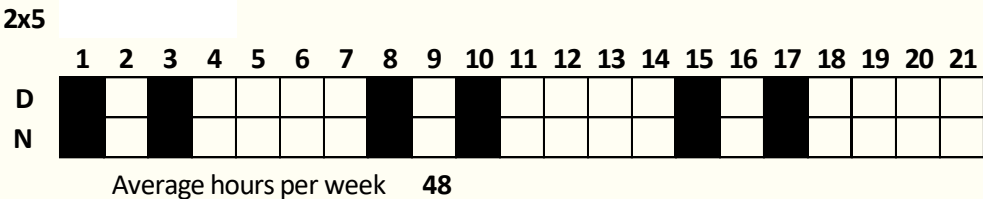
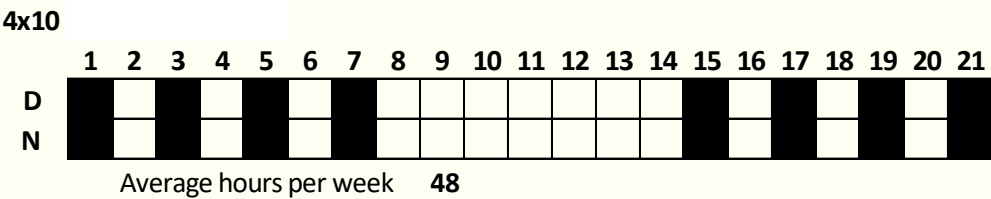
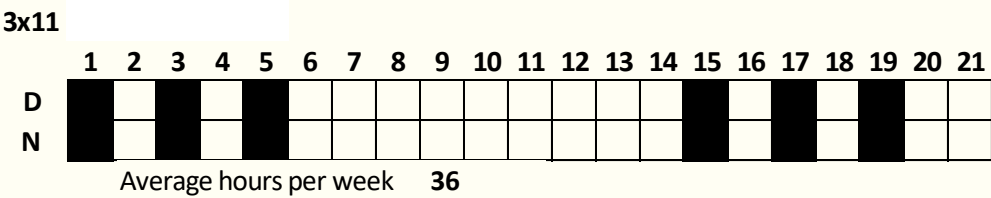
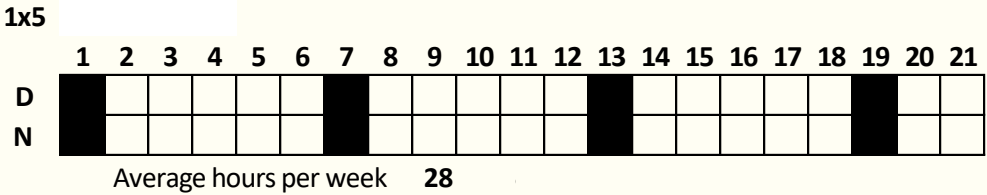
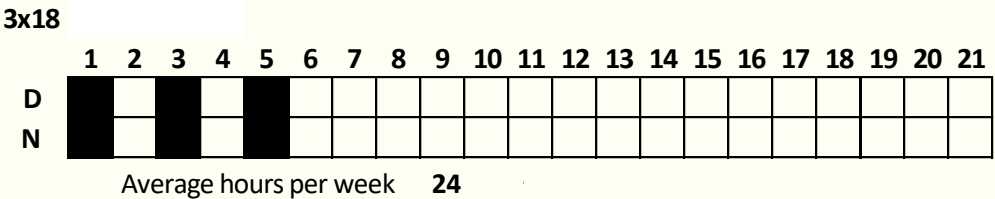
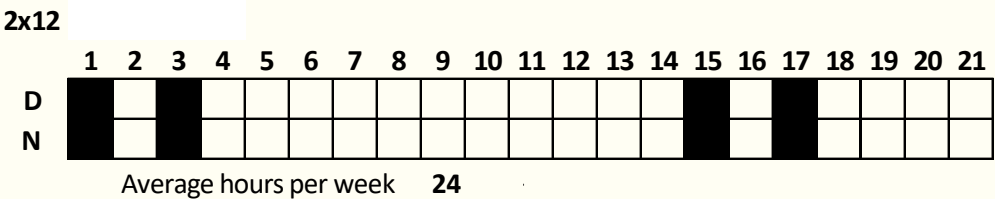
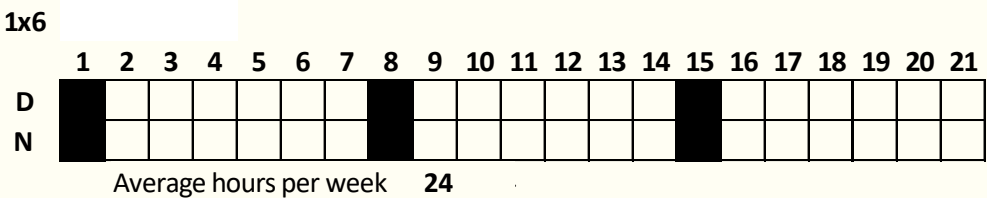
Shift	Work Day	Hours per week	High Protection		Low Protection	
			Low PPE	High PPE	Low PPE	High PPE
1 x 6	24h	24h	63,1%	75,5%	58,4%	69,4%
2 x 12	24h	24h	64,3%	78,7%	65,0%	71,7%
3 x 18	24h	24h	65,3%	76,8%	63,6%	70,0%
1 x 5	24h	28h	59,8%	73,0%	54,8%	65,9%
3 x 11	24h	36h	56,2%	68,9%	53,0%	63,1%
4 x 10	24h	48h	50,7%	61,5%	48,4%	59,0%
2 x 5	24h	48h	46,3%	59,2%	46,3%	55,7%

Table 1: Efficiency of selected shift schemes with a 24-hour working day. The efficiency is measured as the availability to meet the shift scheme while taking into account absenteeism as a result of quarantine or recovery periods.

EFFICIENCY OF THE SHIFT PATTERNS

24h

SHIFT PATTERN



■ Work day
□ Rest day

EFFICIENCY OF THE SHIFT PATTERNS

12h

Shift	Work Day	Hours per week	High Protection outside hospital		Low Protection outside hospital	
			Low PPE	High PPE	Low PPE	High PPE
3 x 11	12h	18h	70,7%	82,7%	66,4%	78,0%
4 x 10	12h	24h	65,2%	77,9%	62,2%	72,9%
2 x 5	12h	24h	60,2%	75,8%	56,0%	69,7%
2 x 5*	12h	24h	60,4%	72,3%	56,3%	69,1%
5 x 9	12h	30h	61,2%	72,5%	57,5%	67,9%
3 x 4	12h	36h	51,6%	63,8%	49,1%	62,0%
4 x 3	12h	48h	44,9%	57,7%	44,6%	55,4%

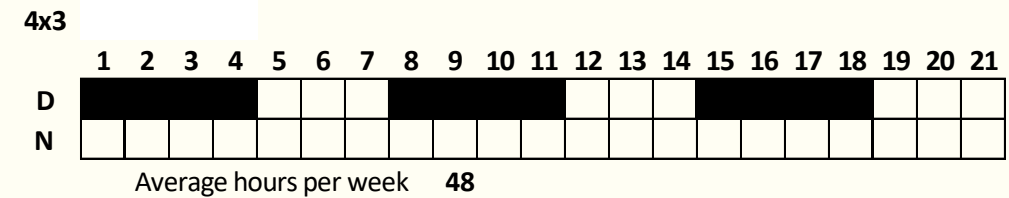
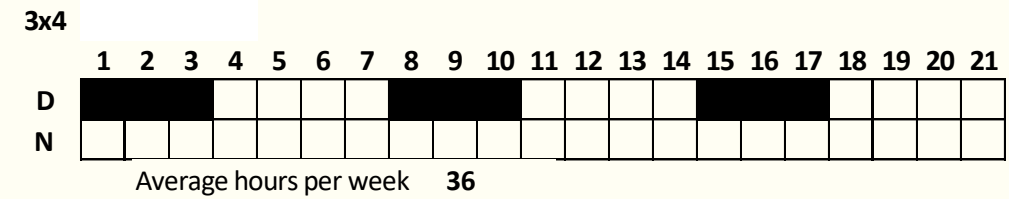
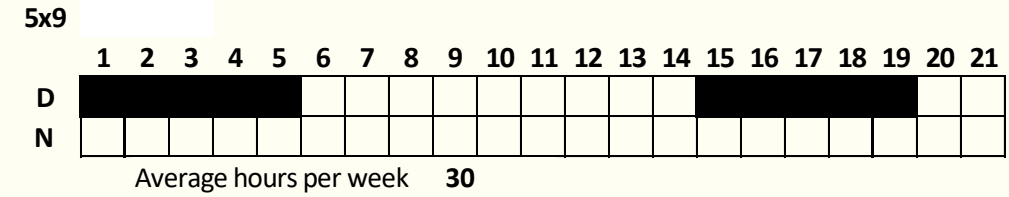
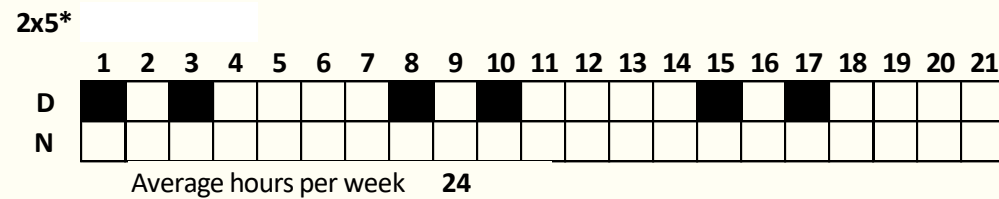
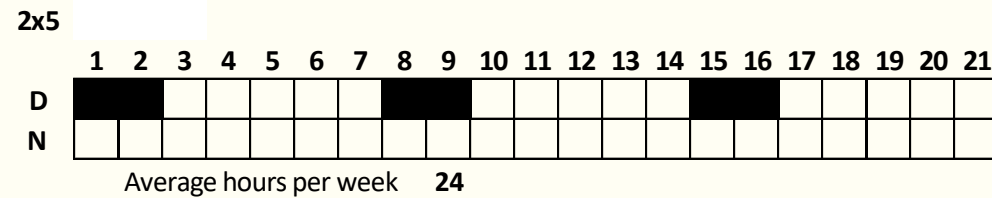
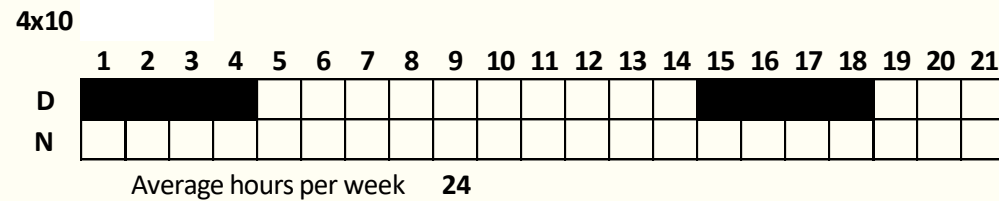
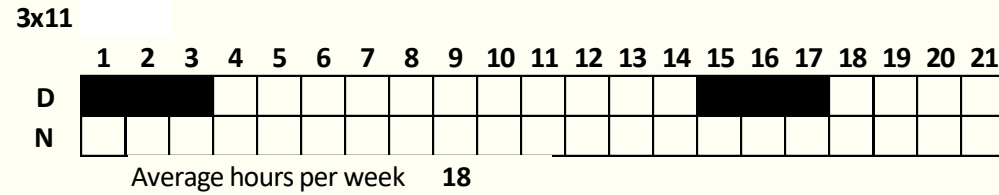
* Shift with one rest day between workdays.



Table 2: Efficiency of selected shift schemes with a 12-hour working day. The efficiency is measured as the availability to meet the shift scheme while taking into account absenteeism as a result of quarantine or recovery periods.

EFFICIENCY OF THE SHIFT PATTERNS

12h

SHIFT PATTERN



 Work day
 Rest day

DEFINITION OF FEASIBLE SHIFTS (ÑUBLE)

- Each member of the ICU medical staff is asked in detail the shift configurations they are able to work.
- The survey considers multiple configurations of shift with workdays of 12 hours and 24 hours, and of between 18 and 48 hours per week.

SURVEY

The following shows different work schemes. Analyze each one thoroughly.

In terms of the following options, would you be available to work the shift patterns described below?

Please remember that the first day of work could be any day of the week, after which you will be asked about your specific availability.

Pattern 1:

1 X 5 - 24h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
D																					
N																					

Average weekly hours: 28.0

Yes

No

ASSIGNMENT OF SHIFTS



An integer programming model was developed that makes it possible to identify shift assignments that minimize the risk of infection in the hospital.

.



Contracts of each member of the critical care team become restrictions along with their availability expressed in the survey.

DEFINITION OF FEASIBLE SHIFTS

- Each member of the ICU medical staff is asked in detail the shift configurations they are able to work.
- The survey considers multiple configurations of shift with workdays of 12 hours and 24 hours, and of between 18 and 48 hours per week.

SURVEY

The following shows different work schemes. Analyze each one thoroughly.

In terms of the following options, would you be available to work the shift patterns described below?

Please remember that the first day of work could be any day of the week, after which you will be asked about your specific availability.

Pattern 1:

1 X 5 - 24h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21
D																					
N																					

Average weekly hours: 28.0

Yes

No

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D																												
N																												

It is necessary to assign shifts to doctors in such a way that it covers the entire planning horizon.

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D																												
N																												

► 2 shifts of 2x12 – 24h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Dr. A																												
N																												
Dr. J																												
N																												

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D																												
N																												

► 4 shifts of 2x12 – 24h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Dr. A																												
D																												
N																												
Dr. J																												
D																												
N																												
Dr. M																												
D																												
N																												
Dr. Z																												
D																												
N																												

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D	Red	Green	Red	Green				Purple	Yellow	Purple	Yellow				Red	Green	Red	Green				Purple	Yellow	Purple	Yellow			
N	Red	Green	Red	Green				Purple	Yellow	Purple	Yellow				Red	Green	Red	Green				ⓘ Purple	Yellow	Purple	Yellow			

4 shifts of 2x12 with a 24h working day is assigned, covering days:

Dr. A 1, 3, 15 and 17

Dr. J 2, 4, 16 and 18

Dr. M 8, 10, 22 and 24

Dr. Z 9, 11, 23 and 25



It is necessary to assign more shifts to cover days:

5-7, 12-14, 19-21 and 26-28

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D	Red	Green	Red	Green		Dark Blue		Purple	Yellow	Purple	Yellow		Dark Blue		Red	Green	Red	Green		Dark Blue		Purple	Yellow	Purple	Yellow		Dark Blue	
N	Red	Green	Red	Green		Dark Blue		Purple	Yellow	Purple	Yellow		Dark Blue		Red	Green	Red	Green		Dark Blue		Purple	Yellow	Purple	Yellow		Dark Blue	

► 1 shift of 1x6 – 24h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D						Dark Blue							Dark Blue							Dark Blue							Dark Blue	
N						Dark Blue							Dark Blue							Dark Blue							Dark Blue	

Dr. E

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D																												
N																												

4 shifts of 2x12 with a 24-hour working day are assigned, covering days:

Dr. A 1, 3, 15 and 17

Dr. J 2, 4, 16 and 18

Dr. M 8, 10, 22 and 24

Dr. Z 9, 11, 23 and 25

A 1x6 shift with a working day of 24 hours is assigned, covering the days:

Dr. E 6, 13, 20 and 27



It is necessary to assign more shifts to cover days:

5, 7, 12, 14, 19, 21, 26 and 28

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D	Red	Green	Red	Green	Blue	Dark Blue	Blue	Purple	Yellow	Purple	Yellow	Blue	Dark Blue	Blue	Red	Green	Red	Green	Blue	Dark Blue	Blue	Purple	Yellow	Purple	Yellow	Blue	Dark Blue	Blue
N	Red	Green	Red	Green	Orange	Dark Blue	Orange	Purple	Yellow	Purple	Yellow	Orange	Dark Blue	Orange	Red	Green	Red	Green	Orange	Dark Blue	Orange	Purple	Yellow	Purple	Yellow	Orange	Dark Blue	Orange

► 2 shifts of 2x5 –12h

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
Dr. D					Blue		Blue					Blue		Blue					Blue		Blue					Blue		Blue
D																												
N																												
Dr. N					Orange		Orange					Orange		Orange					Orange		Orange					Orange		Orange
D																												
N																												

DEFINITION OF FEASIBLE SHIFTS

Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D																												
N																												

4 shifts of 2x12 with a 24-hour working day are assigned, covering days:

Dr. A 1, 3, 15 and 17

Dr. J 2, 4, 16 and 18

Dr. M 8, 10, 22 and 24

Dr. Z 9, 11, 23 and 25

A 1x6 shift with a working day of is assigned, covering the days:

Dr. E 6, 13, 20 and 27

2 2x5 shifts with a 24-hour working day are assigned, covering the days:

Dr. D 5, 7, 12, 14, 19, 21, 26 y 28 during the day


Dr. N 5, 7, 12, 14, 19, 21, 26 y 28 during the night


DEFINITION OF FEASIBLE SHIFTS


Example of planning

	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18	19	20	21	22	23	24	25	26	27	28
D	Red	Green	Red	Green	Light Blue	Dark Blue	Light Blue	Purple	Yellow	Purple	Yellow	Light Blue	Dark Blue	Light Blue	Red	Green	Red	Green	Light Blue	Dark Blue	Light Blue	Purple	Yellow	Purple	Yellow	Light Blue	Dark Blue	Light Blue
N	Red	Green	Red	Green	Orange	Dark Blue	Orange	Purple	Yellow	Purple	Yellow	Orange	Dark Blue	Orange	Red	Green	Red	Green	Orange	Dark Blue	Orange	Purple	Yellow	Purple	Yellow	Orange	Dark Blue	Orange

This scheme uses seven shifts to provide the ICU with a doctor 24/7:

4 shifts of 2x12 (24-hour workdays) 

1 shifts of 1x6 (24-hour workdays) 

2 shifts of 2x5 (12-hour workdays) 

Each one of these 7 shifts equals a 24-hour working week.

A permanent capacity of N doctors can be achieved by repeating this scheme N times.

SHIFT PROBLEMS



► The project has the backing of the company **Intelligenxia**, which has created a platform that allows us to:

- Keep each doctor informed regarding the shifts they must work over a 2-month planning horizon.
- Visualize on a temporary horizon of one month the calendar which doctors have been assigned to which shift.
- Carry out changes in planned shifts.
- Integrate attendance control systems.

SHIFT PLATFORM Intelligenxia

Semana 14

Personal	Lunes 06/04/20	Martes 07/04/20	miércoles 08/04/20	jueves 09/04/20	viernes 10/04/20	sábado 11/04/20	domingo 12/04/20
Dr. Eduardo Montes							
Enf. Cecilia Jorquera							
Enf. Claudio Lorca							
Enf. Camila Lira							
Dr. Pedro Reyes							
Enf. Pilar Costa							
Enf. Sofia Briones							
Enf. Roberto Santis							

Semana 15

	Lunes 13/04/20	Martes 14/04/20	miércoles 15/04/20	jueves 16/04/20	viernes 17/04/20	sábado 18/04/20	domingo 19/04/20
Dr. Eduardo Montes							
Enf. Cecilia Jorquera							
Enf. Claudio Lorca							
Enf. Camila Lira							
Dr. Pedro Reyes							
Enf. Pilar Costa							
Enf. Sofia Briones							
Enf. Roberto Santis							

SHIFT PLATFORM Intelligenxia

Horario Planificado

Dr. Eduardo Montes



Status: **Sano**
 Días Ultimo Test: **12 Días**
 % de Enfermar con Turno: **8,6%**
 % Cumplimiento Turno: **84,3%**

Semana 12 - Actual

Personal	Lunes 23/03/20	Martes 24/03/20	miércoles 25/03/20	jueves 26/03/20	viernes 27/03/20	sábado 28/03/20	domingo 29/03/20
Dr. Eduardo Montes							

Semana 13

	Lunes 30/03/20	Martes 31/03/20	miércoles 01/04/20	jueves 02/04/20	viernes 03/04/20	sábado 04/04/20	domingo 05/04/20
Dr. Eduardo Montes							

Semana 14

Personal	Lunes 06/04/20	Martes 07/04/20	miércoles 08/04/20	jueves 09/04/20	viernes 10/04/20	sábado 11/04/20	domingo 12/04/20
Dr. Eduardo Montes							

Personal en Contacto Últimos 21 Días

Personal	Tiempo	Status	Ultimo Test
Enf. Cecilia Jorquera	0 Días	Sano	24/03/2020
Enf. Claudio Lorca	0 Días	Sano	24/03/2020
Enf. Camila Lira	0 Días	Sano	24/03/2020
Enf. Pilar Costa	7 Días	Sano	24/03/2020
Enf. Rosa Larrain	14 Días	Cuarentena Preventiva	22/03/2020
Enf. Roberta Santillana	21 Días	Covid-19	22/03/2020

TRACEABILITY



► The project has the backing of the company **Unholster** that created the 'Cuidémonos' application that allows us to:

- Maintain information regarding the health conditions of medical staff.
- Have traceability of the shifts completed in order to detect early on medical staff in risk of infection.
- Monitor doctor quarantines.
- Visualize the information on the health conditions of medical staff whether they are infected, with possible infection, exposed to contact with an infected person, or at low risk.

“Cuidémonos” App Unholster

The image displays four sequential screenshots of the 'Cuidémonos' app, illustrating the 'Check-in de Salud' (Health Check-in) process. Each screen shows a mobile interface with a status bar at the top (9:41, signal, Wi-Fi, battery) and a header with the app logo and a menu icon.

- Screen 1:** Titled 'Check-in de Salud', it asks '¿Has tenido que salir hoy?' (Have you had to go out today?). Below the question are two buttons: 'Si' (Yes) and 'No' (No).
- Screen 2:** Also titled 'Check-in de Salud', it asks 'Cuéntame a donde tuviste que ir' (Tell me where you had to go). Below the question are four buttons: 'A comprar' (To buy), 'A trabajar' (To work), 'A realizarme el test Covid-19' (To get the Covid-19 test), and 'Otra opción' (Other option).
- Screen 3:** Also titled 'Check-in de Salud', it asks 'Si me pudieras comentar qué medio de transporte ocupaste' (If you could tell me what mode of transport you used). Below the question are five buttons: 'Metro' (Metro), 'Auto' (Car), 'Bici' (Bike), 'Caminando' (Walking), and 'Otra opción' (Other option).
- Screen 4:** Also titled 'Check-in de Salud', it contains a paragraph: 'Como sabes, quiero ayudarte en tus reportes diarios de salud, pero también es importante ayudar a los otros.' (As you know, I want to help you with your daily health reports, but it is also important to help others). Below this is the question '¿Estuviste en contacto cercano con posibles casos o confirmados de Covid-19?' (Were you in close contact with possible or confirmed Covid-19 cases?). Below the question are three buttons: 'Si' (Yes), 'No' (No), and 'No sé' (I don't know). At the bottom, there is a small text block: 'Contacto cercano: vivir en la misma vivienda, tener contacto cara a cara, si has tenido cerca de ti, estar a menos de 2 metros de la persona durante más de 15 min.' (Close contact: living in the same household, having face-to-face contact, if you have been near you, being within 2 meters of the person for more than 15 minutes).

Each screen includes a back arrow and the text 'Volver atrás' (Go back) at the bottom left.

“Cuidémonos” App Unholster



Dashboard Operativo
Dashboard Riesgo
Priorizador de Atención
Configurador de Riesgo
Felipe Rivera Mellado

MONITOREO CUARENTENA
35 PERSONAS

Nombre	Planta / Sucursal
Felipe Osorio	Planta Nos
Camila López	Planta Nos
Dominga Pérez	Planta Nos
Magdalena Pérez	Planta Reñaca
Ángeles Vidaurre	Planta Reñaca
Beatriz López	Planta Reñaca
Alejandra Jorquera	Planta Reñaca
Manuel García	Planta Reñaca

FICHA PERSONA
Actualizado 30 Marzo, 2020

Felipe Andrés Osorio Soto
Colaborador

Planta / Sucursal: Planta Nos
Dirección: Camino Longitudinal Sur N° 5201, Km. 23, Nos, San Bernardo, Región Metropolitana.
RUT: 6.948.857-3
Tel.: (56 2) 2377 6400

Días Cuarentena
14

Días Cumplidos
7

Fecha Inicio
06-03-20

Fecha Término
19-03-20

Fecha Testeo
02-04-20

Log de Control
30-03-20

Llamar
Notificar Contactos

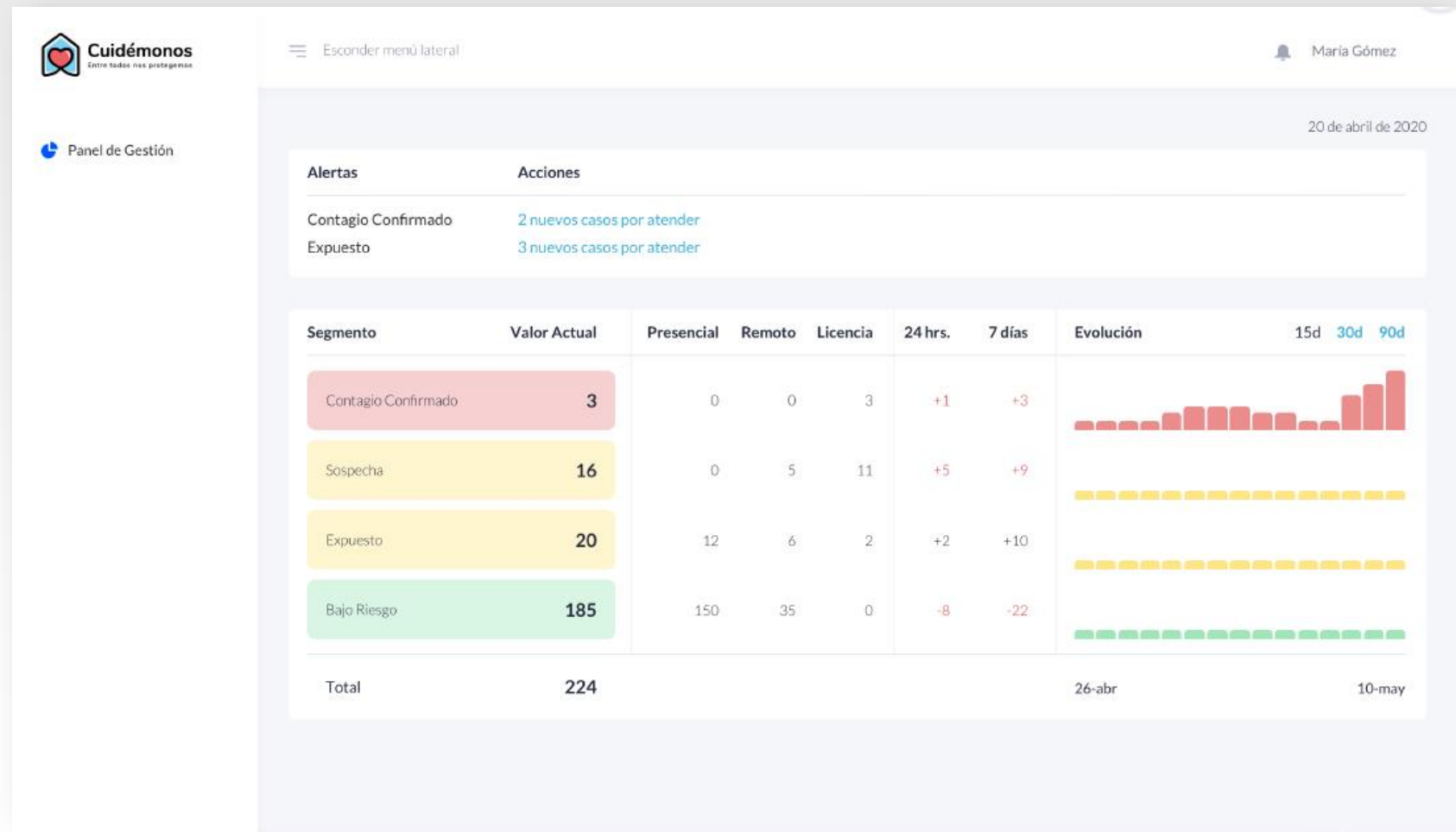
Esconder menú lateral
Maria Gómez
20 de abril de 2020

Alertas
Contagio Confirmado
Expuesto

Acciones
2 nuevos casos por atender
3 nuevos casos por atender

Segmento	Valor Actual	Presencial	Remoto	Licencia	24 hrs.	7 días	Evolución
Contagio Confirmado	3	0	0	3	+1	+3	
Sospecha	16	0	5	11	+5	+9	
Expuesto	20	12	6	2	+2	+10	
Bajo Riesgo	185	150	35	0	-8	-22	
Total	224						26-abr 10-may

“Cuidémonos” App Unholster



TELE-ICU

Dadneo Consortium



As the number of cases of infection among critical care staff rises, or staff members enter periods of protection/rest, the front-line presence of experienced intensive care staff will decrease.

- The Dadneo consortium has developed hardware and software that makes it possible to display online the most relevant information from a mechanical ventilator.
- This information can be monitored remotely by experienced professionals, thus offering support to front-line staff.
- Dadneo has made this technology available for this project. The on-line work can be incorporated into the shift schemes.
- The hardware is currently in operation at Hospital de Ñuble

Strategic Group Testing of Medical Personnel



We propose PCR Pool Testing for preventive testing (screening) for healthcare teams.

Idea: Identify early on COVID-19 infections and cut quarantine times

Pool testing: Samples from multiple people (5 to 10) analyzed with a PCR kit

- Two-stage protocol: If a group is negative, everyone in the group is declared negative. If a group is positive, individual testing is carried out.
- Carrying out group tests allows us to: (i) multiply several times the testing capacity and (i) deliver the test results quicker.
- The protocol does not effect the normal PCR technique, as shown in clinical trials carried out by the Universidad de Chile.

Further details in Iniciativa ISCI

“Multiplying testing capacity: RT-PCR Pool Testing” (www.isci.cl)

TASK FORCE

The Complex Engineering Systems Institute

Marcelo Olivares: PhD, ISCI Researcher, Academic at FCFM UCH

Daniel Yung: PhD, Postdoc ISCI & Universidad de Chile

Víctor Bucarey: PhD, Affiliated

Sebastián Cerda: ISCI Scientist

Magdalena Badal: ISCI Scientist **Sebastián Santana:** ISCI Scientist

Colaboran

Leonardo Basso: PhD, Director ISCI, Academic at FCFM UCH

Denis Sauré: PhD, Researcher ISCI, Academic at FCFM UCH

Healthcare Advisory Team

Dr. Eduardo Tobar: Hospital Clínico UCH

Dr. Juan Pablo Torres: Faculty of Medicine UCH

Empresas tecnológicas



Uholster
(<https://www.unholster.com/>)



Intelligenxia
(<http://intelligenxiabg.com/>)



Dadneo
(<https://www.dadneo.com/>)

Application

Hospital Clínico Herminda Martín, Ñuble Region

Hospital Clínico of the Universidad de Chile

Complejo Asistencial Dr. Sótero del Río

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