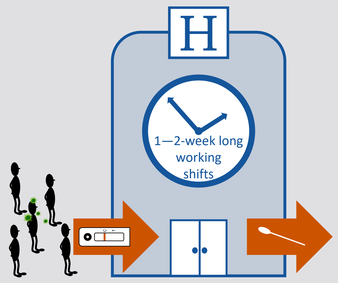

Estimating the risk of incident risk of SARS-CoV-2 infection and the contribution of different transmission routes among healthcare workers residing in Egyptian quarantine hospitals

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Preprint

INTRODUCTION

Quarantine hospitals

- **Implemented only in Egypt**
- Externally-referred COVID-19 patients only
- Healthcare workers (HCWs) **resided** continuously within hospital
- Infected HCWs were **isolated** or admitted

Testing strategy

- Screened for SARS-CoV-2 infection (IgM/IgG antibody tests) before starting working shifts
- HCWs tested using RT-PCR tests:
  - At the end of working shifts
  - Upon symptoms
  - In case of outbreak suspicion (>2 positive tests among HCWs)

OBJECTIVES

- To estimate the risk of SARS-CoV-2 infection among HCWs in quarantine-hospital settings
- To assess the relative contribution of HCW-to-HCW (HtoH) and patient-to-HCW (PtoH) transmissions.

DATA

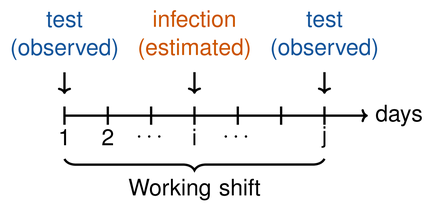
Detailed longitudinal data was collected in three quarantine hospitals (Hosp1–3), during the first wave of the epidemic, in 2020.

	Hosp1	Hosp2	Hosp3
Study period	March 14–August 1	April 1–July 31	June 6–July 11
Location	Cairo	Fayoum	Cairo
Working shifts duration	14 days	7–16 days	7 days
Mean per-shift number of HCWs (min–max)	46 (34–63)	15 (5–26)	19 (16–20)
Mean daily number of patients (min–max)	62 (0–108)	37 (0–103)	8 (0–20)

METHODS

Challenges

- Imperfect diagnosis (false negative test results)
- Right censoring (test at end of shift)



Model description

1. **SARS-CoV-2 infection model:**
   Stochastic compartmental model
   $$I_H \sim Binom(S, \lambda)$$
   where: I_H = infected HCWs
   S = susceptible HCWs
   λ = infection risk
2. **Observation model:**
   Time-since-exposure variation in false-negative rates of RT-PCR tests
3. **Model fitting:**
   Parameter estimation using Markov Chain Monte Carlo approaches

Modeling different routes of transmission

Model	Hypothesis	Force of infection (λ)
Model 0	Constant overall risk	λ_0
Model 1	PtoH transmission, dependent of the ratio patients/HCW by affectation (r^A)	$\lambda_P^A = \beta_P r^A I_P^A$
Model 2	Model 1 + HtoH transmission	$\lambda_{PH}^A = \beta_H I_H + \beta_P r^A I_P^A$

NOTATION: A = Affectation, with $A \in \{\text{ICU, Intermediate, Standard}\}$; P = Patients; H = HCWs; λ_X^A = Constant daily risk of infection in A, where $X \in \{H, P\}$; β_X = transmission rate from X; I_X^A= Daily number of infected X in A.

PRELIMINARY RESULTS

1. Observed relative risk of SARS-CoV-2 infection

		Crude rates			Adjusted Poisson		
		Events	PD	Rate	IRR	95%CI	p
Hospital	Hosp1	28	6 258	0.45	1	ref	–
	Hosp2	11	1 808	0.61	1.46	0.74-2.87	0.27
	Hosp3	15	667	2.25	5.59	3.13-10.01	<0.001
Affectation	ICU	15	2 628	0.57	1	ref	0.16
	Non-ICU	39	6 105	0.64	1.49	0.85–2.59	–

ABBREVIATIONS: PD=person-days; IRR=Incidence rate ratio; CI=Confidence interval.
*No standard care unit in Hosp3.

2. Model-based estimation of the daily risk of infection

Assuming constant risk over the study period:

	Hosp1	Hosp2	Hosp3
Incidence rate per 100 PD (95% CrI)	0.97 (0.56–1.53)	1.35 (0.55–2.58)	8.98 (3.81–17.75)
Per-shift probability of infection (95% CrI)	12.8% (7.6%–19.5%)	17.3% (7.46%–30.69%)	48.2% (23.8%–74.5%)

ABBREVIATIONS: PD=person-days; CrI=Credibility interval.

CONCLUSIONS

- HCWs tended to face a higher risk of infection when working in non-ICU services
- The large variation in the infection risk between Hosp1–2 and Hosp3 suggests that HCWs may face a high risk of infection, but that **implementing infection control measures can decrease this risk to levels observed in standard healthcare settings**.

ONGOING WORK

- Account for time-varying risk of SARS-CoV-2 infection, λ_k, where k denotes the working shift.
- Use the Deviance Information Criterion (DIC) for model selection.

Acknowledgments

- This project is funded by ANRS COV-19.
- We thank the EMEA-MESuRS working group on nosocomial SARS-CoV-2 modeling, for fruitful discussions.

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