Seroprevalence and risk factors for SARS-CoV-2 among incarcerated individuals and correctional workers in Quebec, Canada: A cross-sectional study

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Conflicts of interest

Grants from:

- Canadian Institutes of Health Research (CIHR)
- Canadian HIV Trials Network (CTN)
- Canadian Network on Hepatitis C (CanHepC)
- Réseau SIDA-Maladies Infectieuses
- McGill Interdisciplinary Initiative in Infection and Immunity (MI4)
- Gilead Sciences

Consulting and speaker fees from:

- ViiV Healthcare
- Merck
- Gilead Sciences
- Abbvie

Study hypothesis and objectives

Hypothesis

- The seroprevalence of SARS-CoV-2 in the prison population will be at least as high as Montreal (3%) ***among people in prison*** during the 1st wave (February 25, 2020 – July 11, 2020)[1]
- The seroprevalence of SARS-CoV-2 in the prison population will be at least as high as Montreal (10.5%) ***among correctional workers*** during the 2nd wave (August 23, 2020 – March 20, 2021)[2]

Objectives

1. To measure the seroprevalence of SARS-CoV-2 among people who are incarcerated and correctional workers in Quebec's provincial prisons; and
2. To identify *modifiable* carceral (+/- occupational) variables associated with SARS-CoV-2 seropositivity.

[1]Héma-Québec. Étude de séroprévalence des donneurs de sang: 2.23% de la population adulte du Québec aurait contracté la COVID-19. [cited 2020 August 10]. Available at: https://www.hema-quebec.qc.ca/publications/communiques/archives/2020/communiques-2020/etude-seroprevalence-resultats.fr.html
[2]Héma-Québec. Phase 2 de l'étude sur la séroprévalence des anticorps dirigés contre le SRAS-CoV-2 au Québec. [cited 2022 August 10]. Available at: https://www.hema-quebec.qc.ca/userfiles/file/coronavirus/COVID-rapport-final-ph2-11-06-2021.pdf

Methods

Design: Cross-sectional study

Study population: All incarcerated male adults and correctional workers in 3 Quebec provincial prisons:

- Établissement de détention de Montréal (EDM)
- Établissement de détention de Rivière-des-Prairies (EDRDP)
- Établissement de détention de St-Jérôme (EDSJ)

Sample size: 1,118 incarcerated male adults and 600 correctional workers

→ Sample proportional to the incarcerated population/correctional worker population at each prison

Compensation: $10 CAD/person in prison; $0/correctional worker

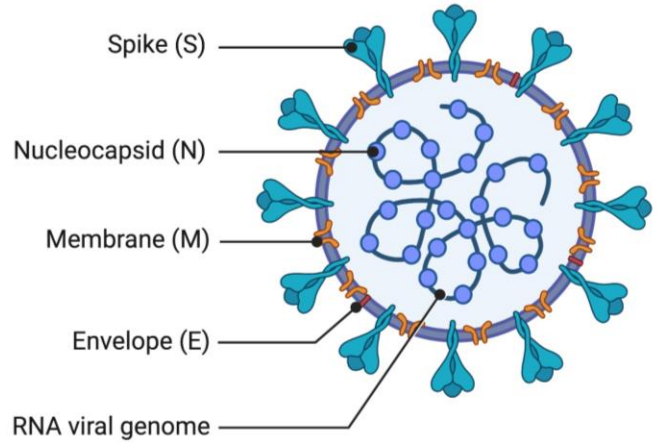
Data collection

Questionnaire

- 36-question paper-based participant-administered questionnaire [CITF core elements]

Biological sample

- A single antibody test approved by Health Canada and recommended by the CITF
  - Roche's Elecsys® Anti-SARS-CoV-2 serology test
    - Sensitivity: 99.5% (14 days post-PCR confirmation)
    - Specificity: > 99.8% (14 days post-PCR confirmation)
    - Turn-around-time: <24 hours



- Opted AGAINST orthogonal testing
  - Sacré-Coeur has only validated the Roche assay
  - Equipment for Diasorin, but lower SN/SP
  - Not felt to be critical as pre-test probability not low

Statistical methods

Primary outcome: SARS-CoV-2 seropositivity

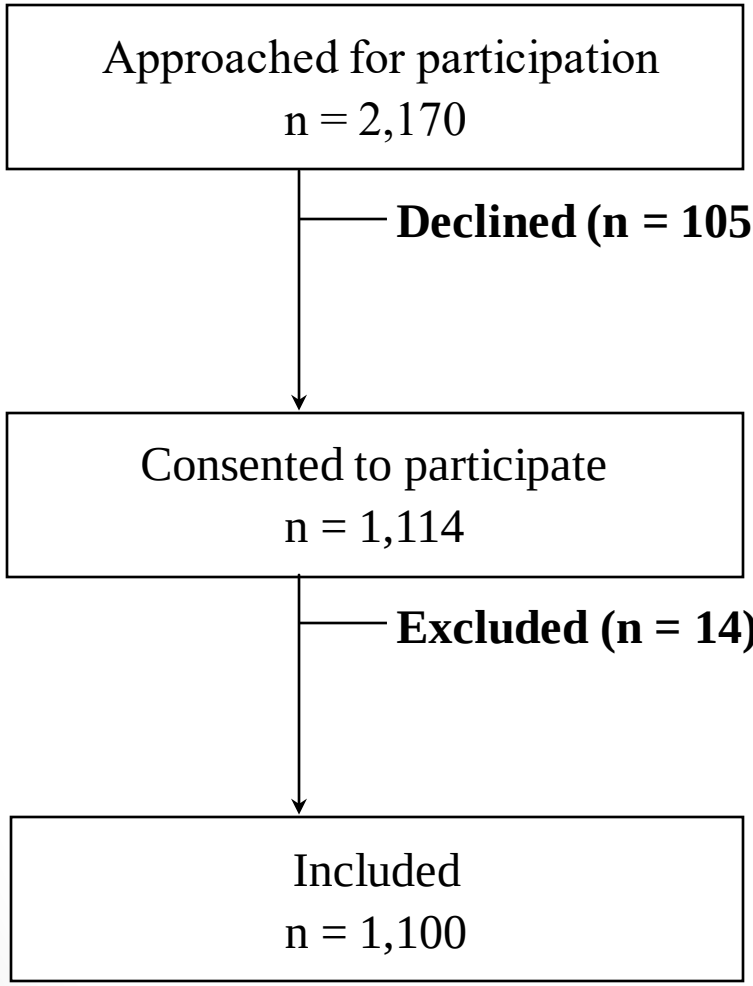
Independent variables

- *Sociodemographic* (age, ethnicity, education level, and housing status)
- *Clinical* (medical comorbidities, COVID-19 symptoms)
- *Carceral*
  - People in prison: provincial prison, time spent incarcerated since March 2020, room type, employment, meal consumption, and prison outbreak
  - Correctional workers: provincial prison, prison occupation, number of workdays, meal consumption, direct daily contact, ability to physically distance, and perceived concern of SARS-CoV-2

Statistical analysis

- Poisson regression model with robust standard error & fixed effects for prisons
- Directed acyclic graphs (DAGs)
- Multiple imputations

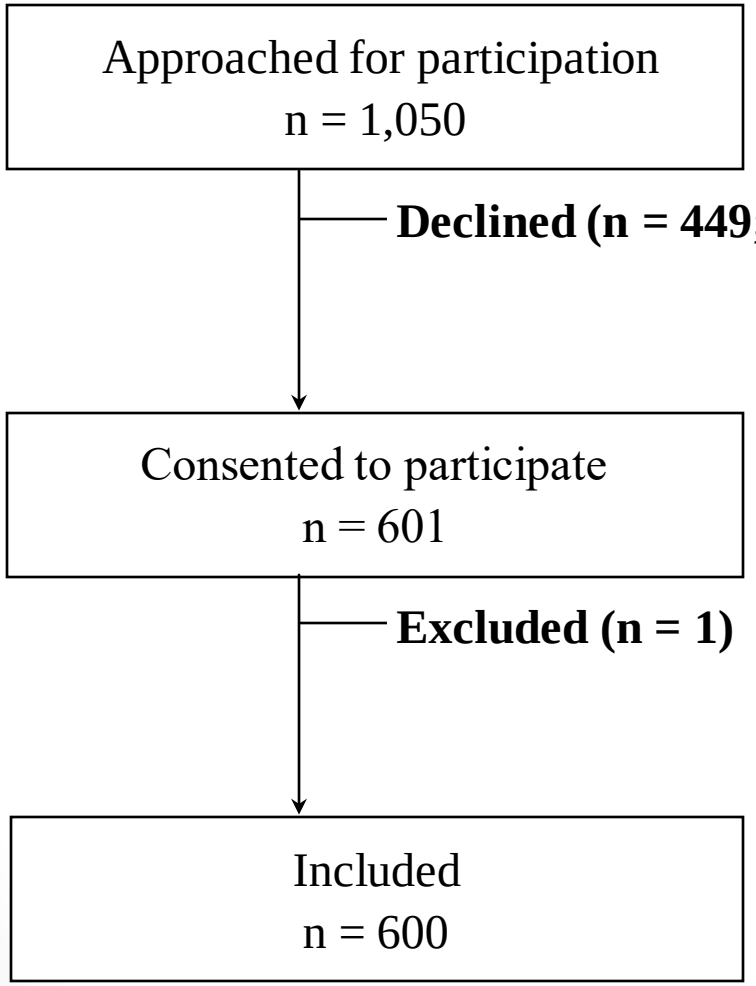
Recruitment of ***people in prison***: January 19 - September 15, 2021



- No interest in research (n = 544; 52%)
- No reason given (n = 293; 28%)
- Declined phlebotomy (n = 138; 13%)
- Other (n = 77; 7%)

- Duplicate participants (n = 8; 58%)
- Incomplete questionnaires (n = 3; 21%)
- Withdrew consent (n = 3; 21%)

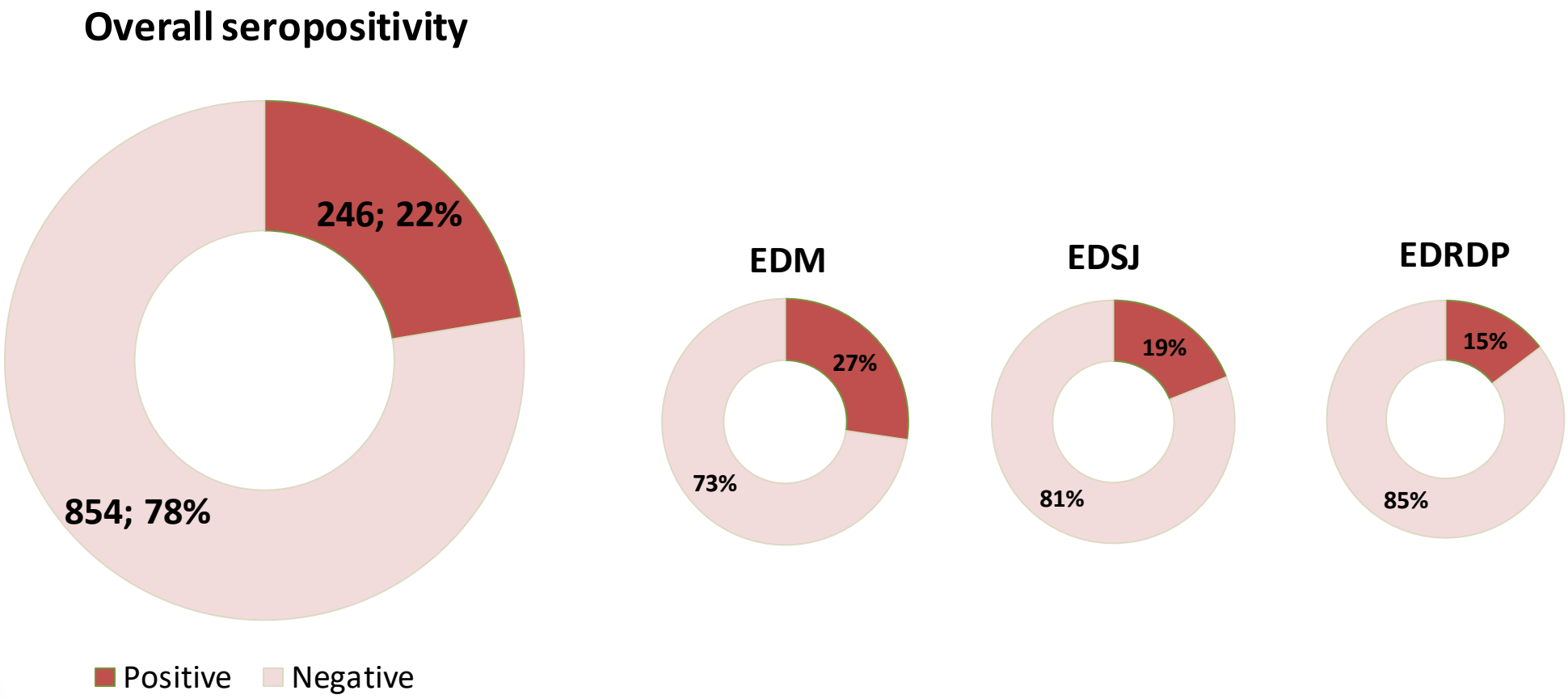
Recruitment of ***correctional workers***: July 14 - November 15, 2021



- No interest in research
- No reason given
- Other

- Incomplete questionnaires (n = 1)

Seroprevalence among *people in prison*



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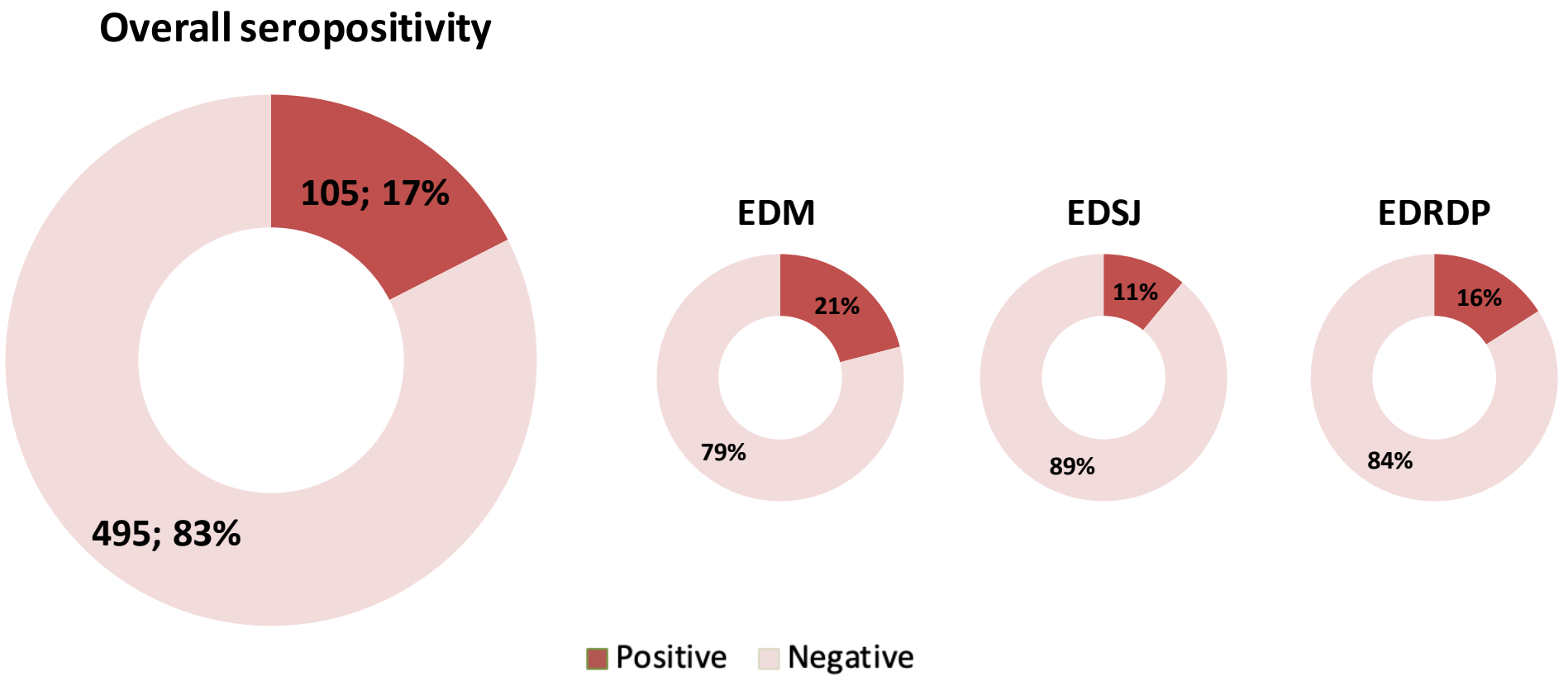
Seroprevalence among *correctional workers*

COs:
70/317
(22%)

Others:
35/280
(13%)



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Factors associated with SARS-CoV-2 Ab+ among *people in prison*

Model	Carceral exposure	Adjusted Prevalence Ratio	95% CI
1	**Time spent incarcerated since March 2020**		
	Little (<10%)	*Reference*	
	Some (10-49%)	1.32	0.95-1.85
	Most (50-99%)	**1.47**	**1.01-2.12**
	All (100%)	**2.17**	**1.53-3.07**
2	**Room type**		
	Single cells	*Reference*	
	Shared cells	1.03	0.77-1.36
3	**Employment during incarceration**		
	No	*Reference*	
	Yes	**1.64**	**1.28–2.11**
4	**Meal consumption**		
	Alone	*Reference*	
	Cellmates	**1.46**	**1.08-1.97**
	Sector	**1.34**	**1.03-1.74**
5	**Prison outbreak**		
	Pre-outbreak	*Reference*	
	Post-outbreak	**2.32**	**1.69-3.18**

Factors associated with SARS-CoV-2 Ab+ among ***correctional workers***

Model	Variable	Adjusted prevalence ratio	95% CI
1	**Prison occupation**		
	Other	Reference	
	Correctional officer	**1.59**	**1.11-2.27**
2	**Meal consumption in prison**		
	Alone	Reference	
	With others	1.16	0.78-1.72
3	**Direct daily contact with people in prison**		
	<10%	Reference	
	10-49%	0.84	0.54-1.29
	≥ 50%	1.29	0.86-1.93
4	**Perceived concern of SARS-CoV-2 acquisition from others in prison**		
	Somewhat or extremely worried	Reference	
	Neutral	0.91	0.53-1.56
	Not or hardly worried	**1.62**	**1.11-2.38**

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Limitations

- Cross-sectional design
  - Prison- vs. community-acquired SARS-CoV-2 infections
- Duration of SARS-CoV-2 antibody+/seroreversion: Misclassification
- Exclusion of people with suspected or confirmed COVID-19 infection

Underestimation of seroprevalence

- Convenience samples
- Information and social desirability bias
- Assumption of missing data at random
- Unmeasured variables (e.g. timing of infection, IPC measures)

Conclusions: *People in prison*

- **Seroprevalence was high and varied (15-27%), likely reflecting:**
  - Type of incarcerated population (sentenced vs. remand) and duration of incarceration
  - Timing of recruitment vis-à-vis prison outbreaks and Quebec COVID-19 waves
  - Location of recruitment (size and special organization, staff movement, etc.)

- **Several *modifiable* carceral factors are associated with SARS-CoV-2+:**
  - Time spent in prison
  - Meal consumption
  - Employment during incarceration
  - Post-outbreak

- **Several policy-level recommendations:**
  - Decarceration
  - Limit meal consumption to alone
  - Limit employment to only necessary jobs and provide education, training, and evidence-based infection prevention and control (IPC) measures
  - Enhance IPC measures

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Conclusions: *Correctional workers*

- **Seroprevalence was high and varied (11-21%), reflecting:**
  - Prison occupation
  - Timing of recruitment vis-à-vis prison outbreaks and Quebec COVID-19 waves
  - Location of recruitment (prison design, size, staff and inmate movement, etc.)

- **Several policy-level recommendations:**
  - Reinforce occupational safety measures with correctional workers
  - Address COVID-19 risk misconceptions
  - Explore reasons for vaccine hesitancy among correctional workers

Knowledge translation

Clinical Infectious Diseases

MAJOR ARTICLE

Seroprevalence and Risk Factors for Severe Acute Respiratory Syndrome Coronavirus 2 Among Incarcerated Adult Men in Quebec, Canada, 2021

Nadine Kronfli,[1,2] Camille Dussault,[1] Mathieu Maheu-Giroux,[3] Alexandros Halavrezos,[1] Sylvie Chalifoux,[1] Jessica Sherman,[1] Hyejin Park,[1] Lina Del Balso,[1] Matthew P. Cheng,[4] Sébastien Poulin,[5] and Joseph Cox[1,2,3]

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January 2022

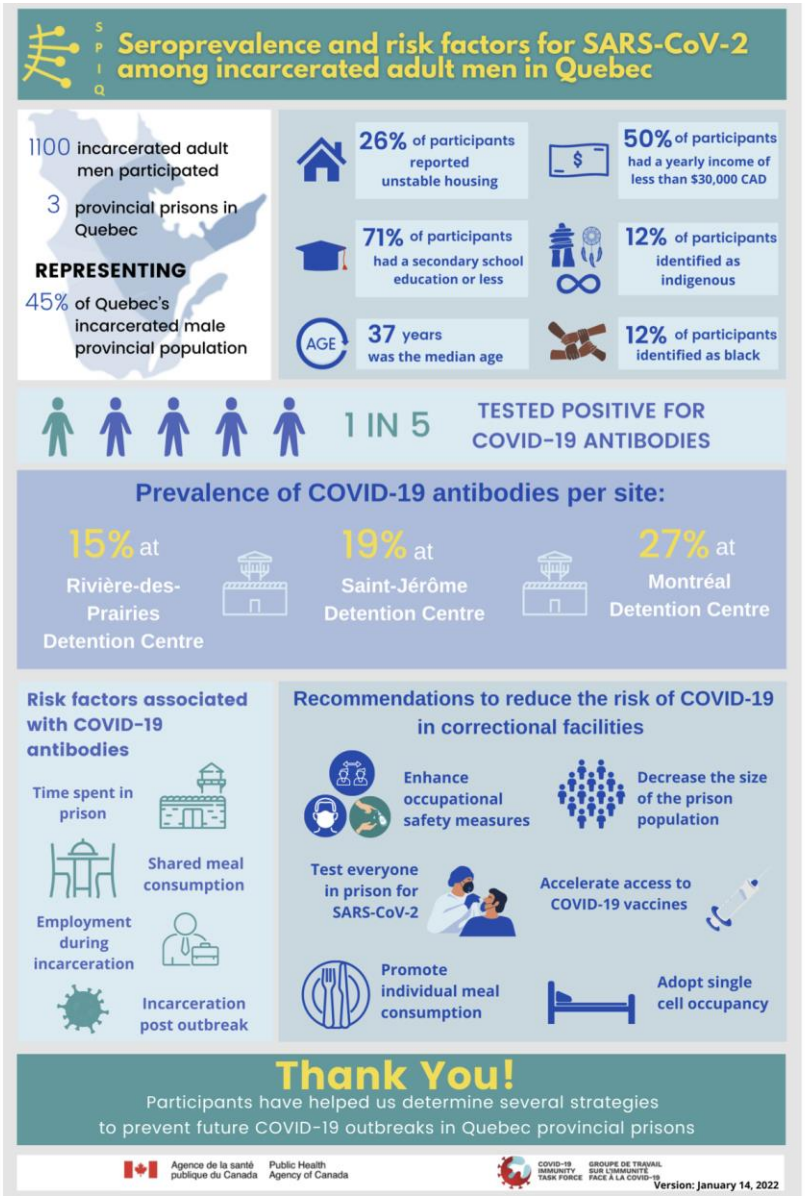
November 2022

Importance of occupation for SARS-CoV-2 seroprevalence and COVID-19 vaccination among correctional workers in Quebec, Canada: A cross-sectional study

frontiers | Frontiers in Public Health

Nadine Kronfli[1,2*], Camille Dussault[1], Mathieu Maheu-Giroux[3], Alexandros Halavrezos[1], Sylvie Chalifoux[1], Hyejin Park[1], Lina Del Balso[1], Matthew P. Cheng[4] and Joseph Cox[1,2,3]

Knowledge translation with participants



Lessons learned

Stakeholder engagement, both with people with lived experience of incarceration and correctional stakeholders, was critical to study design, implementation, and knowledge translation.

Lessons learned: Community advisory committee

What we learned

1. Cell-to-cell recruitment compromises confidentiality.
2. Verbal results compromise confidentiality.
3. SARS-CoV-2 is as stigmatizing as HIV or hepatitis C.

How we adapted

1. Recruitment in a semi-private space with 1-2 other people.
2. Results given via written memo.
3. “Note de service” to all correctional employees.

« Tout projet comme ça, spécialement auprès des détenus qui n’ont jamais leur mot à dire, est le bienvenu. C’est bien qu’ils soient entendus. »

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Lessons learned: Recruitment during a pandemic

Prison setting

- Ethical challenges
  - Confidentiality, autonomy, privacy
- Logistical challenges
  - Movement restrictions due to counts, mandatory escort, meals
- System-level challenges
  - Access to prison setting, navigating policies/procedures
- Coercion through monetary incentives

COVID-19 pandemic

- Prison lockdown due to outbreaks
- Fewer recruitment opportunities:
  - Reduced recruitment hours
  - Unpredictable access to security
  - Sector lockdown
  - Isolation of symptomatic PWAI
  - Decarceration
- Quarantine of new admissions
- Lack of knowledge re. +Ab result
  - Fear of being quarantined or contributing to lockdown
  - Stigma

Acknowledgments

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- Director of Professional Services at each provincial prison
- Lab technicians at Sacré-Coeur

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Thank you!

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