Descriptive analysis of post vaccination anti-SARS-CoV-2 antibody levels among long-term-care facilities (LTCF) residents and incidence of COVID-19

Bonita E. Lee[1], Qiaozhi Li[2], Christopher Sikora[3], Eleanor Risling[3], Lorie A. Little[3], Douglas Faulder[3], Anne-Claude Gingras[4], Carmen Charlton[1,2], John Kim[5], Heidi Wood[5], Alyssia Robinson[5], Jamil N Kanji,[1,2], Nathan Zelyas[1,2], Sheila F O'Brien[6], Steven Drews[1,6], Yuanyuan Qiu[1], Xiaoli Pang[1,2].

[1] University of Alberta, Edmonton, AB, Canada, [2] Alberta Precision Laboratories (APL), Edmonton, AB, Canada, [3] Edmonton Zone, Alberta Health Services, Edmonton, AB, Canada. [4] Lunenfeld-Tanenbaum Research Institute, Mount Sinai Hospital, and University of Toronto, Toronto, Ontario, Canada. [5] National Microbiology Laboratory, Winnipeg, Manitoba, Canada. [6] Canadian Blood Services, Canada.

Introduction

Significant knowledge gaps during COVID-19 pandemic included the optimal timing and frequency of booster COVID-19 vaccine required to protect population at highest risk from severe illness, e.g., LTCF residents and the staff providing care to them. The interaction between vaccine immune response, history of COVID-19 and protection against subsequent infections is complicated by the emergence of SARS-CoV-2 variants-of-concern.

Objective

1. Comparison of the performance of detecting anti-SARS-CoV-2 antibody by different commercial and in-house assays
2. Assessment of the trends of antibody levels as related to COVID-19 vaccinations and time points of infections among residents and staff of LTCF

Methods

Venous blood / DBS
- LTCF residents & staff of 13 LTCF Edmonton, AB
- Multiple time points Paired dry blood spots (DBS) & plasma from venous blood (EDTA)
- COVID-19 history

Anti-SAR-CoV-2 antibody testing at U of Alberta, National Microbiology Laboratory (NML) & Lunenfeld-Tanenbaum Research Institute (LTRI) - two sample types, five assays

Plasma samples: tested using ARCHITECT SARS-CoV-2 IgG & ARCHITECT AdviseDx SARS-CoV-2 IgG II (UA), neutralizing SARS-CoV-2 antibody test using plaque reduction neutralization titer (PRNT) assay (NML), Bioplex 2200 SARS-CoV-2 IgG Panel (NML), automated chemiluminescence ELISA-based assay (LTRI) and surrogate neutralization ELISA assay (snELIZA) (LTRI)
DBS: tested using Bioplex (NML) and ELISA-based assay (LTRI)

Results

Figure 1a & 1b. Timing of enrollment and types of blood samples collected from LTCF resident and staff

Fig 1a

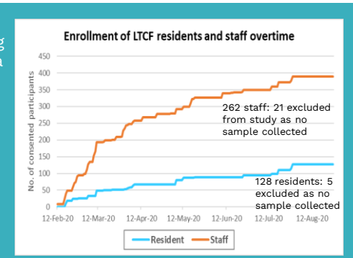


Fig 1b

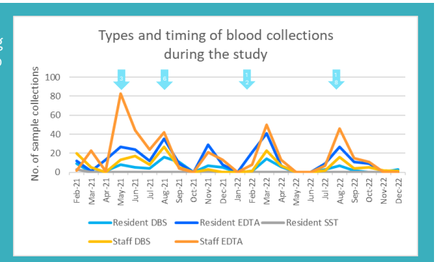


Table 1. Demographics, vaccine and COVID-19 history of LTCF residents vs. staff

	Resident (n=123)	Staff (n=241)
*Median age (years)	86.2 (min-max: 57.0-102.3, IQR: 81.0-90.5)	45.2 (min-max: 19.7-74.2, IQR: 36.0-52.7)
*Female : male	2.7 : 1	6.5 : 1
% had 1st, 2nd, 3rd & 4th dose vaccine	100%, 98%, 96%, 87% (4Th dose Incomplete data)	100%, 100%, 68%, 15% (3rd & 4Th Incomplete data)
Median days bet *1st&2nd , *2nd&3rd and *3rd&4th dose	21 (IQR: 21-21) 201 (IQR: 197-217) 235 (IQR: 218-250)	38 (IQR: 33-39) 279 (IQR: 268-295) 269 (IQR: 237-309)
Type of vaccine (3 doses)	P_P_P (114), M_M_P (2) P_P_M (1), P_M_M (1)	P_P_P (88), M_M_M (68), P_P_M (9), P_M_P (1)
No. of COVID-19 PCR test	123 had 1088 tests (median 6, IQR: 3-15)	239 had 3399 tests (median 12, IQR: 7-19)
No. and timing of PCR confirmed COVID-19 (>90 days apart)	Total 48: once (38); twice (5) Before vaccine (18), after 2 dose (1), after 3 (15), after 4 (12), after 5 (2)	Total 173: Once (120); twice (25); trice (1) Before vaccine (45), after 2 dose (11), after 3 (74), after 4 (3), incomplete vaccine history (40)
Positive Anti-NP Ab test & no pos PCR in 12 months prior	37 residents with 6 having pos anti-NP test prior to Omicron wave	43 staff with 6 having pos anti-NP test prior to Omicron wave

* P<0.005 comparison between LTCF residents vs. staff

Results

Table 2. Comparison of different sample types (DBS vs. plasma)

	Anti-RBD	Anti-S1/SmT1	Anti-NP
Bioplex	0.90 (0.99)*	0.94 (0.99)*	0.96 (0.98)*
LTRI ELISA-based assay	0.80 (0.91)*	0.85 (0.93)*	0.83 (0.94)*

Table 3. Comparison of plasma samples tested by 3 assays

Plasma samples only	Anti-RBD	Anti-S1/SmT1	Anti-NP
Bioplex vs. LTRI ELISA-based assay	0.77 (0.91)*	0.82 (0.90)*	0.70 (0.70)*
LTRI ELISA-based assay vs. ARCHITECT	0.83 (0.90)*	NA	NA
Bioplex vs. ARCHITECT	0.82 (0.89)*	NA	NA

* Bracketed numbers are correlations using $\log_{10}$ transformed BAU/mL

Figure 2. Comparison of PNRT (NML) & snELISA (LTRI)

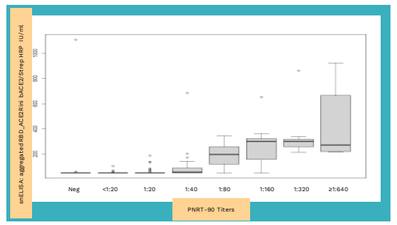
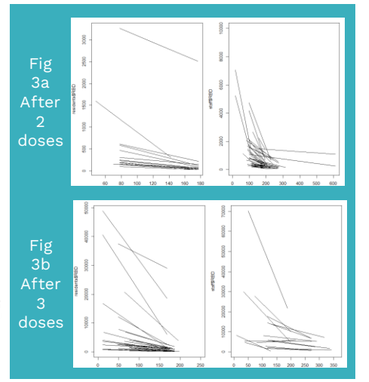


Figure 3a & 3b. Decline of anti-RBD IgG in serial DBS from vaccinated residents & staff with no known COVID-19 tested using Bioplex



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