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Background

- Live poultry markets (LPMs) are important in many settings including Bangladesh for fresh animal protein and other food items.
- The high population density, frequent contacts, limited waste management and biosecurity and inadequate ventilation in live poultry markets in Dhaka, Bangladesh, can facilitate transmission of airborne infectious diseases including SARS-CoV-2.
- Market workers are at higher risk of exposure to SARS-CoV-2 than the average population due not just to crowded working conditions but also as they mostly belong to a population group with low socioeconomic conditions.
- During a study of the risk of avian influenza virus spillover from birds to humans in Dhaka's LPMs, we measured the prevalence of anti-SARS-CoV-2 antibodies in market workers and investigated its association to socio-demographic characteristics and COVID-19 vaccination history.

Methods

- This was a cross-sectional study conducted in February and March 2022.
- 15 LPMs in Dhaka were selected among those with >40 poultry stalls with probability proportional to number of poultry stalls.
- Stalls were stratified in poultry and vegetable/fruit stalls and were selected using simple random sampling, and workers invited at random to participate.
- We recruited 13 to 14 poultry stall and 6 to 7 vegetable and fruit stall workers per market
- Naso-pharyngeal swab and blood samples were collected from each participants. Swab samples were tested by Multiplex RT-PCR for influenza and SARS-CoV-2 viruses. Blood samples tested separately for anti-SARS-CoV-2 IgG antibodies against the spike (anti-S) and nucleocapsid (anti-N) proteins using the Abbott ELISA assay.
- We computed the prevalence and 95% confidence interval (95%CI) of anti-S and anti-N antibodies overall, per market workers group and by characteristics, taking into account the cluster sampling design at the market level.



Figure: Selling, slaughtering and leisure at the same place



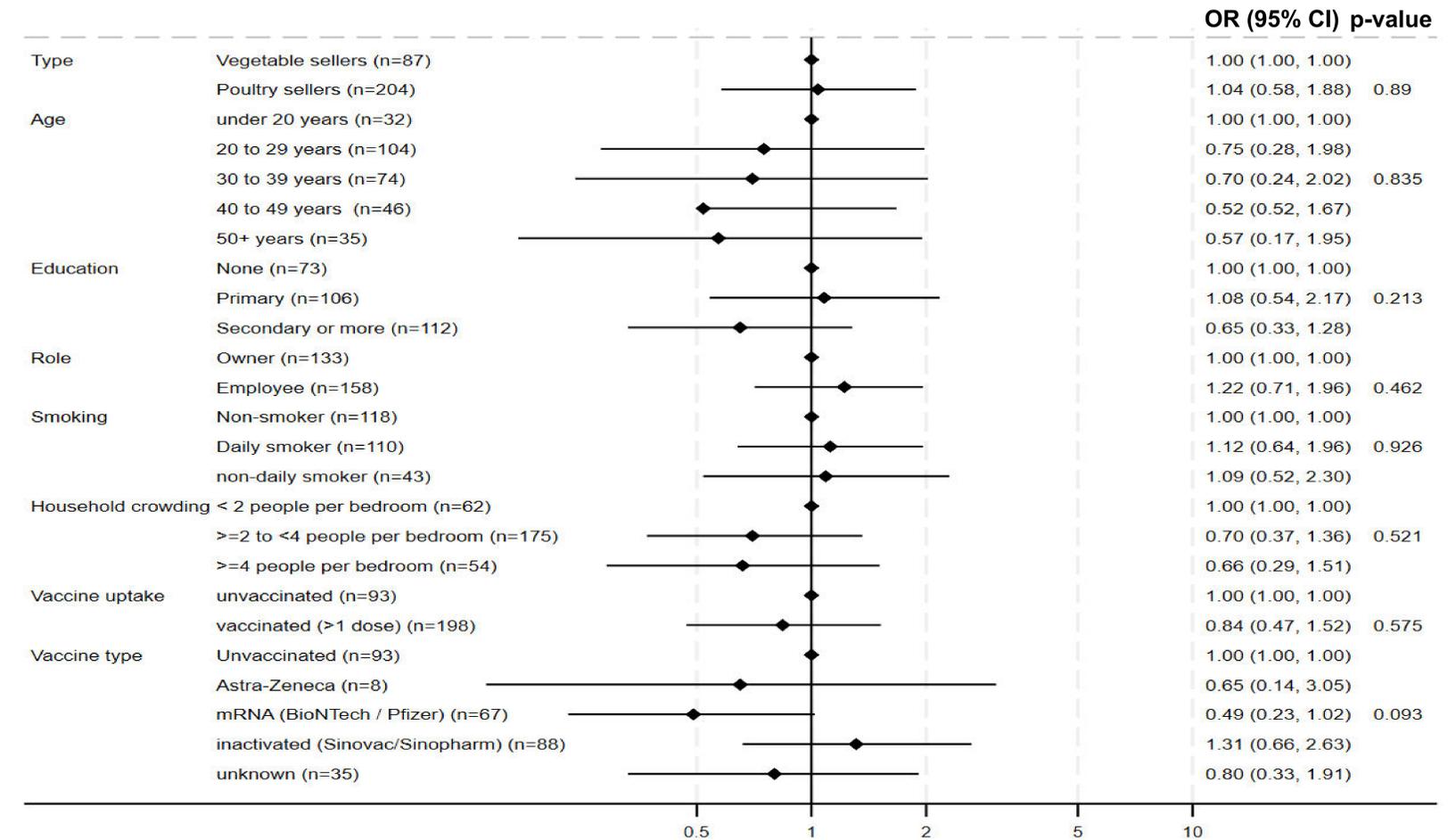
Figure: Different poultry species in the same stall and market

Results

- Overall 291 participants (204 poultry workers and 87 vegetable sellers) enrolled in 15 LBMs
- COVID-19 vaccine uptake was similar in both groups (respectively 69% and 67%), with the most common vaccines being whole inactivated (SINOVAC or SINOPHARM; 44%).
- Nearly all (99%) participants were positive for anti-S antibodies, which can be elicited by natural infection in the distant past and vaccination.
- Prevalence of anti-N antibodies, indicative of recent infection, was 59.4% (95%CI 54.7% to 64.0%), which was similar in poultry (59.8%; 95%CI: 55.7 to 63.7) and vegetable sellers (58.6%; 95%CI: 46.2 to 70.1) ($p=0.890$).

Table: Characteristics of study participants (N=291)

Variable	Poultry workers (%)	Vegetable/Fruit sellers (%)	Overall (%)
Sample size	204 (100%)	87 (100%)	291 (100%)
Sex	Male	Male	291 (100%)
Age (median [IQR], in years)	29.5 [22.0; 36.5]	35.0 [24.0; 47.0]	30.0 [23.0; 40.0]
Age group	under 20 years	6 (6.9%)	32 (11.0%)
	20 to 29 years	28 (32.2%)	104 (35.8%)
	30 to 39 years	16 (18.4%)	74 (25.4%)
	40 to 49 years	19 (21.8%)	46 (15.8%)
	50+ years	18 (20.7%)	35 (12.0%)
Religion	Muslim	86 (99.0%)	290 (99.7%)
	None	22 (25.3%)	73 (25.1%)
	Primary	40 (46.0%)	106 (36.4%)
Education	Secondary or more	25 (28.7%)	112 (38.5%)
	Owner	55 (63.2%)	133 (45.7%)
Role in stall	Employee	32 (36.8%)	158 (54.3%)
	Non-smoker	32 (36.8%)	118 (40.5%)
Tobacco smoking	Daily smoker	38 (43.7%)	110 (37.8%)
	non-daily smoker	17 (19.5%)	43 (14.8%)
	missing	0 (0.0%)	20 (6.9%)
	< 2 people per bedroom	16 (18.4%)	62 (21.3%)
Household crowding	>=2 to <4 people per bedroom	61 (70.1%)	175 (60.1%)
	>=4 people per bedroom	10 (11.5%)	54 (18.6%)
COVID-19 Vaccine uptake	unvaccinated	29 (33.3%)	93 (32.0%)
	vaccinated (>1 dose)	58 (66.7%)	198 (68.0%)
COVID-19 vaccine type	Astra-Zeneca	6 (10.3%)	8 (4.0%)
	mRNA (Moderna / Pfizer)	15 (25.9%)	67 (33.9%)
	inactivated (Sinovac/Sinopharm)	26 (44.8%)	88 (44.4%)
	unknown	11 (19.0%)	35 (17.7%)



OR and 95%CI from logistic regression with robust standard error, adjusting for market clustering, and all variables presented in the plot

Figure: Forest plot for association between seroprevalence of SARS-CoV-2 anti-N IgG antibodies and participants characteristics

- There was no evidence that the anti-N antibody seroprevalence was associated with any of the participants' characteristics, except for COVID-19 vaccination.
- There was some evidence that the seroprevalence was 55% lower in people who received an mRNA vaccine compared to unvaccinated participants (crude OR 0.45; 95%CI 0.23 to 0.85%; $p=0.037$), with the estimate remaining similar, albeit with wider confidence interval after adjusting for all other characteristics (aOR 0.49; 95%CI 0.23 to 1.02; $p=0.093$).

Conclusions

- ✓ The near ubiquity of anti-S and high prevalence of anti-N antibodies with a self-reported vaccine uptake of ~65%, consistent with high transmission and infections from the three waves prior to the survey especially among a population with highly crowded living conditions.
- ✓ A lower anti-N sero-prevalence was seen in participants with mRNA vaccination consistent with reported effectiveness against infection.
- ✓ The study provided evidence of reasonably good vaccine uptake in manual workers in fixed settings that may indicate the potential for good vaccine coverage in other poor or daily wage populations.
- ✓ This study underlines the potential of LPMs to amplify transmission of airborne pathogens like AIV, and their importance as hotspots to monitor closely.
- ✓ This study also provided a template and capacity building experience for surveys of the risk and extent of future new and emerging infections in wet markets.



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