



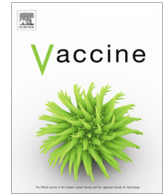
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Short communication

Do the vaccinated perform less distancing, mask wearing and hand hygiene? A test of the risk compensation hypothesis in a representative sample during the COVID-19 pandemic

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ABSTRACT

The “risk compensation hypothesis” holds that vaccinated individuals may be less motivated to protect themselves using other COVID-19 mitigation behaviors—e.g., masking, distancing and hand hygiene—given that they may perceive their infection risk to be lower. The current investigation provides an empirical test of the risk compensation hypothesis in the COVID-19 context using prospective data from the Canadian COVID-19 Experiences Survey (CCES). The survey comprised 1,958 unvaccinated and fully vaccinated individuals drawn from a representative sample, using quota sampling to ensure substantial representation of unvaccinated individuals. Two waves of data were collected 6 months apart. Findings revealed that vaccinated individuals performed COVID-19 mitigation behaviors significantly more frequently than their unvaccinated counterparts, and they also showed lower rates of attenuation as the pandemic continued. In summary, our findings do not support the risk compensation hypothesis; instead they support the notion that people adopt vaccination and other protective behaviors in parallel.

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1. Introduction

Although vaccines appear to be effective for preventing hospitalization and mortality from COVID-19 [1], it has been hypothesized that such effects could lead vaccinated individuals to rely less on other recommended mitigation behaviors. The “risk compensation hypothesis” holds that those who are vaccinated may be less motivated to protect themselves using distancing, mask wearing and hand hygiene because of lower perceived risk of COVID-19 [2]. This perspective would predict higher levels of consistency in distancing, mask wearing and hand hygiene among unvaccinated individuals compared to vaccinated individuals, and a general tendency among vaccinated individuals to reduce reliance on COVID-19 mitigation behaviors over time following vaccination. Although a previous cross-sectional analysis reported no association between mitigation behaviour and COVID-19 vac-

cine doses [3], this relationship was not explored using prospective data.

The current study provides an empirical test of the risk compensation hypothesis in the early waves of the COVID-19 pandemic, using prospective data of a population representative sample of vaccinated and unvaccinated adults between the ages of 18 and 55 years [4]. This age range is ideal for testing the compensatory hypothesis, because the medical comorbidities prevalent over the age of 55 may independently motivate mitigation behaviors in vaccinated and unvaccinated individuals alike. Wave 1 of the Canadian COVID-19 Experiences Survey (CCES) was completed between September 28 and October 21, 2021; Wave 2 was completed 6 months later on the same sample with a replenishment of 674 participants [5]. The initial survey recruited 1,958 vaccine-hesitant (49.8 %) and fully vaccinated (50.2 %) members of the general population using the Leger survey panel, which is the largest proprietary nationally representative probability-based panel in Canada. At the time of CCES Wave 1, all Canadians 12 years of age and older were eligible to receive the vaccine, and vaccines were widely available for all segments of the Canadian population. Additionally, 76.4 % of the Canadian population were fully or partially vaccinated [6]. The dominant variant of concern in North America was Delta during CCES Wave 1; during CCES Wave 2, the dominant variant was Omicron [7].

Abbreviations: CCEP, Canadian COVID-19 Experiences Project; CCES, Canadian COVID-19 Experiences Survey; COVID-19, Coronavirus Disease 2019.

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2. Methods

We examined the first two waves of CCES data, using vaccination status and mitigation behavior frequency as focal variables of interest. Percentages, percentage changes and confidence intervals were constructed for vaccinated, partially vaccinated and unvaccinated individuals. Three mitigation behaviors were assessed by self-report during both survey waves: social distancing (“How consistently do you follow the recommendations by your local or provincial public health officials about social distancing?”), mask wearing (“How often do you currently wear a mask when you are in indoor public places?”), and hand hygiene (“How often when washing your hands during the day do you thoroughly wash to the standards recommended by your local or provincial health officials?”). Responses were given on a frequency scale, which utilized the following collapsed response categories: 1= “Not at all/rarely”, 2=“Sometimes” and 3= “Most/All of the time.” Analyses of baseline values were undertaken using survey logistic regression models comparing vaccinated to unvaccinated respondents within each response category. Analyses of changes in mitigation behavior frequency among vaccinated and unvaccinated respondents from CCES Wave 1 to Wave 2 were examined using generalized estimating equations (GEE). All analyses adjusted for age, sex, ethnicity, income and geographic region (province). At Wave 1, the sample comprised 1,958 Canadian citizens, 61.2% of whom were female, and 25.2% non-white ethnicity. In terms of age, 17.0% were 18-24 years, 40.2% were 25-39 years, and 42.8% were 40-54 years of age. Based on the quota sampling methodology, 49.8% of the sample were vaccine hesitant. Sample weighting was employed to ensure population representativeness [5].

3. Results and discussion

Findings were inconsistent with the risk compensation hypothesis. In raw and demographics-adjusted analyses, fully vaccinated individuals were significantly more likely than unvaccinated individuals to report engaging in distancing, mask wearing, and hand hygiene “most/all of the time” (Table 1; Fig. 1).

From CCES Wave 1 to CCES Wave 2 (Table 2), vaccinated individuals showed minimal changes in distancing ($M = -0.12$, $SE = 0.04$) and mask wearing ($M = -0.13$, $SE = 0.03$); in contrast, unvaccinated individuals showed reductions in these two behaviors (distancing: $M = -0.38$, $SE = 0.06$; masking: $M = -0.42$, $SE = 0.07$; hygiene: $M = -0.12$, $SE = 0.08$). The decreases in mitigation behavior frequency were significantly greater among

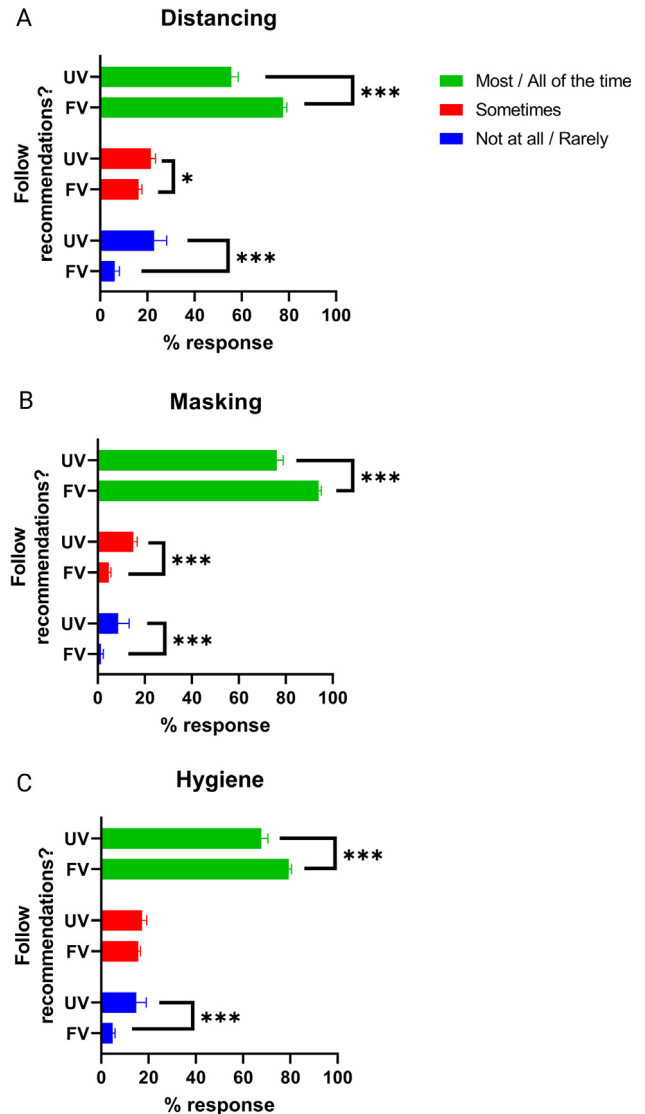


Fig. 1. Proportion of fully vaccinated (FV) and unvaccinated (UV) individuals endorsing each response option for each target behavior during CCES Wave 1; target behaviors include distancing (panel A), mask wearing (panel B), and hand hygiene (panel C). Error bars represent standard errors. Comparisons between vaccinated and unvaccinated groups: * $p \leq 0.05$, ** $p \leq 0.01$, *** $p \leq 0.001$.

Table 1 Frequency of COVID-19 mitigating behavior as a function of vaccination status during CCES Wave 1.

	“Not at all/Rarely”			“Sometimes”			“Most/All of the time”		
	n	%	95% CI	n	%	95% CI	n	%	95% CI
Social Distancing									
Unvaccinated	179	22.9	(19.39, 26.82)	169	21.5	(18.27, 25.18)	493	55.6	(51.24, 59.84)
Partially vaccinated	17	9.9***	(5.59, 16.80)	40	34.4*	(24.96, 45.16)	67	55.8	(44.84, 66.21)
Fully vaccinated	58	6.2***	(4.73, 8.03)	166	16.3*	(14.00, 18.89)	752	77.5***	(74.64, 80.16)
Mask Wearing									
Unvaccinated	67	8.7	(6.37, 11.72)	104	15.1	(12.11, 18.66)	675	76.2	(72.20, 79.83)
Partially vaccinated	3	3.0*	(0.85, 9.90)	17	15.0	(8.51, 25.10)	107	82.0	(71.48, 89.24)
Fully vaccinated	14	1.4***	(0.77, 2.36)	43	4.7***	(3.38, 6.36)	923	94.0***	(92.14, 95.44)
Hand Hygiene									
Unvaccinated	106	14.9	(12.04, 18.25)	129	17.3	(14.24, 20.81)	586	67.8	(63.70, 71.72)
Partially vaccinated	9	10.7	(5.23, 20.55)	31	22.7	(15.39, 32.19)	86	66.6	(55.93, 75.84)
Fully vaccinated	47	4.9***	(3.65, 6.55)	151	15.7	(13.41, 18.34)	777	79.4***	(76.53, 81.97)

Note. * $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$ for comparison of % endorsement within a vaccination group (partially or fully) for a given response category (e.g., not at all/rarely, sometimes, most/all of the time); reference category = “unvaccinated.” Models are adjusted for age, sex, ethnicity, income, and geographic region; N=1,958 (49.8% vaccine hesitant; 50.2% vaccinated)

Table 2
Changes in mitigation behaviour frequency from Wave 1 to Wave 2 as a function of vaccination status.

	"Not at all/Rarely"			"Sometimes"			"Most/All of the time"		
	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI	<i>n</i>	%	95% CI
Social Distancing*** (est.=0.25, SE=.074, t=3.421, p<.001)									
Fully Vaccinated									
Wave 1	26	5.0	(3.30, 7.64)	102	17.3	(14.20, 20.93)	457	77.7	(73.69, 81.17)
Wave 2	49	7.6	(5.58, 10.25)	120	20.8	(17.44, 24.67)	420	71.6	(67.40, 75.43)
Overall	75	6.3	(4.71, 8.44)	222	19.1	(16.53, 21.91)	877	74.6	(71.26, 77.67)
Unvaccinated									
Wave 1	98	27.4	(22.19, 33.23)	78	20.0	(15.47, 25.40)	210	52.7	(46.31, 58.92)
Wave 2	135	37.4	(31.37, 43.79)	85	20.9	(16.29, 26.41)	168	41.7	(35.38, 48.35)
Overall	233	32.4	(27.34, 37.88)	163	20.4	(16.60, 24.91)	378	47.2	(41.26, 53.17)
Mask Wearing*** (est.=0.28, SE=.074, t=3.827, p<.001)									
Fully Vaccinated									
Wave 1	7	1.0	(0.43, 2.14)	25	5.5	(3.61, 8.30)	557	93.5	(90.68, 95.56)
Wave 2	20	3.3	(2.04, 5.35)	30	6.0	(4.07, 8.66)	539	90.7	(87.66, 93.09)
Overall	27	2.1	(1.38, 3.28)	55	5.7	(4.11, 7.94)	1096	92.1	(89.65, 94.06)
Unvaccinated									
Wave 1	36	10.6	(7.24, 15.36)	47	13.3	(9.19, 18.79)	305	76.1	(70.10, 81.20)
Wave 2	90	24.3	(19.50, 29.78)	43	12.0	(8.07, 17.42)	255	63.8	(57.45, 69.61)
Overall	126	17.5	(13.76, 21.88)	90	12.6	(9.17, 17.15)	560	69.9	(64.35, 74.96)
Hand Hygiene (est.=.03, SE=.083, t=0.368, p=.723)									
Fully Vaccinated									
Wave 1	26	4.5	(2.99, 6.77)	99	17.8	(14.58, 21.60)	457	77.7	(73.64, 81.23)
Wave 2	41	6.7	(4.85, 9.05)	108	18.0	(14.78, 21.62)	433	75.4	(71.41, 79.00)
Overall	67	5.6	(4.17, 7.43)	207	17.9	(15.27, 20.83)	890	76.5	(73.13, 79.63)
Unvaccinated									
Wave 1	55	17.5	(12.90, 23.40)	63	14.2	(10.50, 18.82)	258	68.3	(62.11, 73.90)
Wave 2	79	23.4	(18.06, 29.74)	68	17.2	(12.94, 22.43)	228	59.4	(53.03, 65.52)
Overall	134	20.5	(16.01, 25.77)	131	15.7	(12.36, 19.66)	486	63.9	(58.32, 69.07)

Note. *** significantly larger decrease ($p < .001$) in behavior frequency from CCES Wave 1 to Wave 2 among unvaccinated respondents as compared with vaccinated respondents. Models are adjusted for age, sex, ethnicity, income, and geographic region.

unvaccinated than among vaccinated individuals for distancing (est = 0.25, SE = 0.074, $t = 3.421$, $p = .0006$), and for mask wearing (est. = 0.28, SE = 0.074, $t = 3.8269$, $p = .0001$). Only for hand hygiene was there similar sized reductions over time for unvaccinated and vaccinated individuals (est. = 0.03, SE = 0.0826, $t = 0.3681$, $p = .7129$). Further, compared to those who remained unvaccinated across both waves, those initially unvaccinated individuals who subsequently became vaccinated at Wave 2 were more likely to wear masks "most/all of the time" (est. = 0.14, SE = 0.046, $t = 3.0528$, $p = .0023$) and less likely to be complacent about distancing ("Not at all/Rarely"; est. = -0.12, SE = 0.041, $t = -2.8133$, $p = .005$).

Overall, our findings are consistent with a "parallel protection" hypothesis wherein individuals seek to maximize protection from all means, including vaccination and other recommended COVID-19 mitigation behaviors in parallel [8,9]. Mitigation behaviors decreased among all groups from Wave 1 to Wave 2; however, the reductions were greater among unvaccinated individuals than among vaccinated individuals. Combined with similar findings from other studies [10], the present findings go some distance toward dispelling the notion that COVID-19 vaccination motivates complacency about other mitigation behaviors. Strengths of the investigation include the use of a sample drawn from a population representative panel, and a well powered test of the influence of vaccination status, given the equal prevalence of vaccinated and unvaccinated individuals within the sample.

3.1. Limitations

Limitations of this study include the lack of serological confirmation of COVID-19 infection and the exclusion of some unmeasured covariates which could account for some variability in vaccination status and mitigation behavior performance (e.g., med-

ical field occupation). Additionally, although the CCES used sample weighting to ensure representativeness of the larger Canadian population, given the quota sampling procedures, the equal proportion of vaccinated and unvaccinated were necessarily divergent from the population values (which would have been ~ 76 % vaccinated to 24 % unvaccinated at the time of the survey). Finally, the generalizability of the present findings outside of the study context is not fully known; in some country contexts, wherein vaccination rates are much lower or vaccines are limited supply, there might be more (or less) tendency to rely on compensatory effects of other mitigation behaviors. The rates of vaccination and mitigation behavior performance were generally high in this Canadian sample, and mitigation behavior observance was relatively high for both vaccinated and unvaccinated individuals. Future studies should examine longitudinal trajectories of vaccinated and unvaccinated individuals with respect to mitigation behaviors described here across country contexts characterized by more variable adherence to public health recommendations.

3.2. Conclusions

There is no clear evidence in support of the risk compensation hypothesis in relation to COVID-19 vaccination in the current sample. Those who accept COVID-19 vaccines are more likely to also perform distancing, mask wearing and hand hygiene at recommended levels, as compared to those who are unvaccinated. Moreover, there is evidence that vaccinated individuals tend to retain these mitigation behaviors more consistently over time.

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Data availability

Data will be made available on request.

Declaration of Competing Interest

The authors declare that they have no known competing financial interests or personal relationships that could have appeared to influence the work reported in this paper.

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