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Methods

Vaccine hesitancy

The eight vaccine-hesitancy items were adapted from the Giambi et al. ¹ vaccine hesitancy questionnaire and was used in prior COVID-19 studies ². This questionnaire included the following 8 items. 1) I am concerned about immediate negative vaccine side-effects; 2) I am concerned about long-term damage due to the vaccine; 3) The Covid-19 vaccine may be more dangerous than COVID-19 itself; 4) The need to vaccinate is driven by economic interests of the pharmaceutical companies; 5) The health authorities are exposing us to positive information about the vaccine but not its dangers; 6) Vaccination is not necessary, provided you live a healthy life and follow the health regulations concerning corona; 7) Vaccination is not necessary, since COVID-19 is not as dangerous as people say it is; 8) The vaccine will impair our immune system or cause an overload.

Side-effect severity

The severity of each of the 21 side-effects at each wave are depicted in Table S1. Wave 1 was conducted after the second Pfizer dose in February, 2021 and W2 was conducted after the booster dose in August, 2021.

Table S1. Percentage of participants (n= 756) endorsing each severity rating for each Pfizer vaccine side effect, at W1 (left of diagonal line) and W2 (right of diagonal line).

	Not at all	A Little	Moderate	Severe	Very Severe
Facial paralysis	99.04 / 98.7	0.53 / 0.90	0.21 / 0.30	0.00 / 0.00	0.21 / 0.1
Vomiting	98.19 / 98.9	1.28 / 0.80	0.32 / 0.30	0.00 / 0.00	0.21 / 0.00
Allergic reaction	97.76 / 98.00	1.38 / 1.50	0.43 / 0.40	0.21 / 0.00	0.21 / 0.1
Swollen lymph nodes	97.02 / 96.40	2.02 / 2.50	0.43 / 0.90	0.32 / 0.00	0.21 / 0.1
Rash	97.34 / 98.30	1.81 / 1.20	0.43 / 0.40	0.21 / 0.10	0.21 / 0.00
Swollen eyes	94.78 / 95.60	3.73 / 3.40	0.96 / 0.90	0.11 / 0.00	0.43 / 0.00
Fever	92.86 / 88.8	5.01 / 5.70	1.28 / 3.00	0.43 / 1.10	0.43 / 1.5
Tickling throat	90.42 / 93.70	8.20 / 4.80	0.75 / 1.50	0.21 / 0.00	0.43 / 0.1
Nausea	89.56 / 84.70	7.35 / 12.20	2.02 / 2.50	0.53 / 0.40	0.53 / 0.30
Cough	88.60 / 98.90	9.27 / 0.80	1.60 / 0.30	0.11 / 0.00	0.43 / 0.00
Stomach pain	88.82 / 94.30	7.24 / 5.20	2.34 / 0.30	1.06 / 0.10	0.53 / 0.10
Dizziness	86.58 / 89.00	10.12 / 7.80	2.02 / 1.90	0.85 / 0.80	0.43 / 0.50
Flu-like	85.30 / 81.10	10.22 / 11.60	2.88 / 3.60	1.17 / 1.90	0.43 / 1.90
Chills	84.24 / 89.70	10.01 / 5.40	3.73 / 2.10	1.28 / 2.00	0.75 / 0.80
Sleep problems	80.40 / 84.50	12.89 / 12.00	4.47 / 2.20	1.49 / 1.20	0.75 / 0.00
Joint pains	79.66 / 79.80	14.16 / 12.60	4.15 / 4.10	1.49 / 2.10	0.53 / 1.50
Headache	73.16 / 79.10	17.25 / 12.80	6.39 / 4.60	2.24 / 2.10	0.96 / 1.30
Weakness	66.35 / 62.70	22.79 / 23.50	7.45 / 7.70	2.56 / 3.40	0.85 / 2.60
Muscular pain	64.22 / 62.70	22.26 / 22.40	9.27 / 8.30	2.77 / 4.60	1.49 / 2.00
Feeling tired	54.74 / 54.8	26.73 / 23.0	12.57 / 12.80	4.37 / 6.5	1.60 / 2.9
Red/swollen arm injection site	41.53 / 36.20	36.74 / 34.90	14.27 / 19.40	5.43 / 6.70	2.02 / 2.60

Additional Analyses

The additional analyses focus on two issues. The first goal was to further analyze sub-groups of side-effects to discern if the current findings were specific to certain side-effect clusters. The division of side-effects was based on earlier research which showed that psychological factors predicted a narrow list of three side-effects out of seven that were examined (3). Accordingly, results were re-analyzed to show that vaccine hesitancy predicted side-effects for both these narrow lists of 3 and 7 side effects, as well as the remaining side-effects (See Table S2). The second goal addressed whether vaccine hesitancy would predict future side-effects even if the side-effects items are removed, i.e., to ascertain that these effects were not being driven by these items.

Side-effect division

The 7 side-effects which were used in a previous study ³ were pain at injection site, fever, chills, headache, joint pain, nausea, fatigue and were selected for that study due to their importance in clinical trials ⁴ and appeared on the CDC site ⁵. We added weakness as another side effect related to the first group of side effects, yielding 8 side effects (this did not change results). The results appear in Table S2, which show that the hesitancy W1 cross effect to W2 side-effects was even slightly stronger for the non-typical side-effects (.15 vs. .20, See Table S2).

Table S2, Model results when for different groupings of side-effects (group of seven side-effects vs. remaining side effects).

	$\chi^2(df)$	p	CFI	TLI	RMSEA
Model based on factor 1 - pain at injection site, fever, chills, headache, joint pain, nausea, fatigue (CDC, https://www.cdc.gov/coronavirus/2019-ncov/vaccines/expect/after.html)	.156 (1)	.693	1.000	1.022	.02 (.000,.071)
Side effects (lagged effect) .35***					
Hesitancy to Side effects .15***					
Hesitancy (lagged effect) .53***					
Side effects to Hesitancy -.04 p=.211					
Multi-Gender group analysis (male/female)	4.73(2)	.094	.995	.929	.041 (.00, .09)
Side effects (lagged effect) .28 ***/ .37***					
Hesitancy to Side effects. 28*** / .09*					
Hesitancy (lagged effect) .53***/.54***					
Side effects to Hesitancy .01 p=.897 / .04 p=.270					
Model based on factor 2 - swollen lymph nodes, flu like symptoms, Face paralysis, allergy, dizzy, itchy throat, swollen eyes, intestine problems, vomiting, cough, rash, and sleeping problems	.160 (1)	.693	1.000	.1031	.02 (.000,.071)
Side effects (lagged effect) .14***					
Hesitancy to Side effects .20***					
Hesitancy (lagged effect) .55**					
Side effects to Hesitancy -.04 p=.221					
Multi-Gender group analysis (male/female)	4.73(2)	.094	.994	.903	.040 (.01, .08)
Side effects (lagged effect) .08 p = .131 / .24***					
Hesitancy to Side effects. 29** / .12*					
Hesitancy (lagged effect) .54***/.55***					
Side effects to Hesitancy -.05 p=.328 / -.03 p=.423					

*p<.01, **p<.001 ***p<.0001, p value depicted when not significant.

Results were reanalyzed to examine another division of side-effects, based on the finding that three side-effects namely, headaches, fatigue and pain at injection site, were prospectively predicted by psychological factors (3). Results are depicted in Table S3, where again, the effects seem even stronger in the larger group of side-effects (.20, vs. without 3 side effects .15).

Table S3, Model results when for different groupings of side-effects (group of three side-effects vs. remaining side effects).

	$\chi^2(df)$	p	CFI	TLI	RMSEA
Model based on factor 1 - headaches, fatigue and pain at injection site	.156 (1)	.693	1.000	1.022	.02 (.000,.071)
Based on Geers et al. (3)					
Side effects (lagged effect) .37***					
Hesitancy to Side effects .15***					
Hesitancy (lagged effect) .54***					
Side effects to Hesitancy .03 p=.386					
Multi-Gender group analysis (male/female)	4.73(2)	.094	.995	.926	.043 (.00, .088)
Side effects (lagged effect) .31 ***/ .37***					
Hesitancy to Side effects .22*** /.11*					
Hesitancy (lagged effect) .54***/.54***					
Side effects to Hesitancy -.02 p=.745 / .03 p=.398					
Model based on factor 2 - fever, chills, joint pain, nausea, swollen lymph nodes, flu like symptoms, Face paralysis, allergy, dizzy, itchy throat, swollen eyes, intestine problems, vomiting, cough, rash, and sleeping problems	.160 (1)	.693	1.000	.1031	.02 (.000,.071)
Side effects (lagged effect) .14***					
Hesitancy to Side effects .20***					
Hesitancy (lagged effect) .55**					
Side effects to Hesitancy -.04 p=.221					
Multi-Gender group analysis (male/female)	4.73(2)	.094	.995	.918	.043 (.000, .094)
Side effects (lagged effect) .16** / .31***					
Hesitancy to Side effects. 34*** /.10*					
Hesitancy (lagged effect) .54***/.55***					
Side effects to Hesitancy -.02 p=.643 /.01 p=.786					

* $p < .01$, ** $p < .001$ *** $p < .0001$, p value depicted when not significant.

Summary

To summarize these results, results remained like the main results depicted in the text for the different groupings of side effects. Namely, only hesitancy predicted subsequent side-effects but not the reverse. Similar results were obtained when the model was run on each of the five factors obtained after running a factor analysis. The aim of the final analyses was to examine if results also remain the same when removing vaccine hesitancy items related to side-effects. This analysis was performed once after removal of items that even indirectly pertained to vaccination danger (items 1,2,3,5 & 8), and again a second time after removing only three items directly pertaining to vaccination side-effects. Indeed, as shown in Table S4, the expected results were obtained.

Table S4. Model results when vaccine items pertaining to side-effects were removed.

	$\chi^2(df)$	p	CFI	TLI	RMSEA
Model based on Hesitancy without items that even indirectly address vaccine safety 1,2, 3, 5, and 8)	.156 (1)	.693	1.000	1.044	.02 (.000,.071)
Side effects (lagged effect) .30***					
Hesitancy to Side effects .09**					
Hesitancy (lagged effect) .44***					
Side effects to Hesitancy -.03 p=.417					
Multi-Gender group analysis (male/female)	4.73 (2)	.094	.991	.866	.043 (.000, .094)
Side effects (lagged effect) .23*** / .36***					
Hesitancy to Side effects. 19*** / .07 p = .126					
Hesitancy (lagged effect) .42***/.46***					
Side effects to Hesitancy -.04 p=.463 /-.02 p=.582					
Model based on Hesitancy without the three side-effect items (1,2,8)	.156 (1)	.693	1.000	.1032	.00 (.000,.071)
Side effects (lagged effect) .31***					
Hesitancy to Side effects .12***					
Hesitancy (lagged effect) .50***					
Side effects to Hesitancy -.02 p=.578					
Multi-Gender group analysis (male/female)	4.73 (2)	.094	.993	.901	.043 (.000, .094)
Side effects (lagged effect) .21*** / .35***					
Hesitancy to Side effects. 23*** / .08 p = .091					
Hesitancy (lagged effect) .48***/.52***					
Side effects to Hesitancy -.04 p=.424 /-.01 p=.863					

* $p < .01$, ** $p < .001$ *** $p < .0001$, p value depicted when not significant.

In summary, the supplementary results indicate that the obtained results of the main model reported in the main text, were reliable across side-effects and across vaccine hesitancy items. Namely, for all cases, while vaccine-hesitancy predicted subsequent side-effects across items and side-effects, the opposite direction was not obtained in any scenario.

References

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