

# COVID-19 vaccine acceptance and hesitancy among migrants, refugees and foreign workers: A systematic review and meta-analysis



**Table S1: PRISMA 2020 Checklist**

Section and Topic	Item #	Checklist item	Location where item is reported
<b>TITLE</b>			
Title	1	Identify the report as a systematic review.	1
<b>ABSTRACT</b>			
Abstract	2	See the PRISMA 2020 for Abstracts checklist.	2
<b>INTRODUCTION</b>			
Rationale	3	Describe the rationale for the review in the context of existing knowledge.	2
Objectives	4	Provide an explicit statement of the objective(s) or question(s) the review addresses.	2
<b>METHODS</b>			
Eligibility criteria	5	Specify the inclusion and exclusion criteria for the review and how studies were grouped for the syntheses.	3
Information sources	6	Specify all databases, registers, websites, organisations, reference lists and other sources searched or consulted to identify studies. Specify the date when each source was last searched or consulted.	3
Search strategy	7	Present the full search strategies for all databases, registers and websites, including any filters and limits used.	Table S2
Selection process	8	Specify the methods used to decide whether a study met the inclusion criteria of the review, including how many reviewers screened each record and each report retrieved, whether they worked independently, and if applicable, details of automation tools used in the process.	3
Data collection process	9	Specify the methods used to collect data from reports, including how many reviewers collected data from each report, whether they worked independently, any processes for obtaining or confirming data from study investigators, and if applicable, details of automation tools used in the process.	3
Data items	10a	List and define all outcomes for which data were sought. Specify whether all results that were compatible with each outcome domain in each study were sought (e.g. for all measures, time points, analyses), and if not, the methods used to decide which results to collect.	NR
	10b	List and define all other variables for which data were sought (e.g. participant and intervention characteristics, funding sources). Describe any assumptions made about any missing or unclear information.	3
Study risk of bias assessment	11	Specify the methods used to assess risk of bias in the included studies, including details of the tool(s) used, how many reviewers assessed each study and whether they worked independently, and if applicable, details of automation tools used in the process.	3-4
Effect measures	12	Specify for each outcome the effect measure(s) (e.g. risk ratio, mean difference) used in the synthesis or presentation of results.	3-4
Synthesis methods	13a	Describe the processes used to decide which studies were eligible for each synthesis (e.g. tabulating the study intervention characteristics and comparing against the planned groups for each synthesis (item #5)).	3-4
	13b	Describe any methods required to prepare the data for presentation or synthesis, such as handling of missing summary statistics, or data conversions.	3-4
	13c	Describe any methods used to tabulate or visually display results of individual studies and syntheses.	3-4
	13d	Describe any methods used to synthesize results and provide a rationale for the choice(s). If meta-analysis was performed, describe the model(s), method(s) to identify the presence and extent of statistical heterogeneity, and software package(s) used.	3-4
	13e	Describe any methods used to explore possible causes of heterogeneity among study results (e.g. subgroup analysis, meta-regression).	3-4

Section and Topic	Item #	Checklist item	Location where item is reported
	13f	Describe any sensitivity analyses conducted to assess robustness of the synthesized results.	
Reporting bias assessment	14	Describe any methods used to assess risk of bias due to missing results in a synthesis (arising from reporting biases).	NA
Certainty assessment	15	Describe any methods used to assess certainty (or confidence) in the body of evidence for an outcome.	NA
<b>RESULTS</b>			
Study selection	16a	Describe the results of the search and selection process, from the number of records identified in the search to the number of studies included in the review, ideally using a flow diagram.	4
	16b	Cite studies that might appear to meet the inclusion criteria, but which were excluded, and explain why they were excluded.	NA
Study characteristics	17	Cite each included study and present its characteristics.	5, Table 1
Risk of bias in studies	18	Present assessments of risk of bias for each included study.	Table S3
Results of individual studies	19	For all outcomes, present, for each study: (a) summary statistics for each group (where appropriate) and (b) an effect estimate and its precision (e.g. confidence/credible interval), ideally using structured tables or plots.	5-6
Results of syntheses	20a	For each synthesis, briefly summarise the characteristics and risk of bias among contributing studies.	NA
	20b	Present results of all statistical syntheses conducted. If meta-analysis was done, present for each the summary estimate and its precision (e.g. confidence/credible interval) and measures of statistical heterogeneity. If comparing groups, describe the direction of the effect.	8-14
	20c	Present results of all investigations of possible causes of heterogeneity among study results.	9-12
	20d	Present results of all sensitivity analyses conducted to assess the robustness of the synthesized results.	NA
Reporting biases	21	Present assessments of risk of bias due to missing results (arising from reporting biases) for each synthesis assessed.	NA
Certainty of evidence	22	Present assessments of certainty (or confidence) in the body of evidence for each outcome assessed.	NA
<b>DISCUSSION</b>			
Discussion	23a	Provide a general interpretation of the results in the context of other evidence.	10-11
	23b	Discuss any limitations of the evidence included in the review.	11
	23c	Discuss any limitations of the review processes used.	NA
	23d	Discuss implications of the results for practice, policy, and future research.	11
<b>OTHER INFORMATION</b>			
Registration and protocol	24a	Provide registration information for the review, including register name and registration number, or state that the review was not registered.	NA
	24b	Indicate where the review protocol can be accessed, or state that a protocol was not prepared.	NA
	24c	Describe and explain any amendments to information provided at registration or in the protocol.	NA
Support	25	Describe sources of financial or non-financial support for the review, and the role of the funders or sponsors in the review.	NA
Competing interests	26	Declare any competing interests of review authors.	12
Availability of data, code and other materials	27	Report which of the following are publicly available and where they can be found: template data collection forms; data extracted from included studies; data used for all analyses; analytic code; any other materials used in the review.	NA

From: Page MJ, McKenzie JE, Bossuyt PM, Boutron I, Hoffmann TC, Mulrow CD, et al. The PRISMA 2020 statement: an updated guideline for reporting systematic reviews. *BMJ* 2021;372:n71. doi: 10.1136/bmj.n71

For more information, visit: <http://www.prisma-statement.org/>

**Table S2: Detailed Search Strategy**

Databases	Search Strategy
<b>PubMed</b>	((((((((hesitancy[Title/Abstract]) OR (acceptance[Title/Abstract])) OR (accept[Title/Abstract])) OR (intention[Title/Abstract])) OR (rejection[Title/Abstract])) OR (reject[Title/Abstract])) OR (confidence[Title/Abstract])) OR (willingness[Title/Abstract])) AND ((((((SARS[Title/Abstract]) OR (SARS-CoV-2[Title/Abstract])) OR (SARS-CoV2[Title/Abstract])) OR (COVID-19[Title/Abstract])) OR (COVID19[Title/Abstract])) OR (coronavirus[Title/Abstract])) OR (nCoV[Title/Abstract])))) AND (((((((Migrants[Title/Abstract]) OR (Emigration[Title/Abstract])) OR (Immigration[Title/Abstract])) OR (Refugees[Title/Abstract])) OR (Immigrant[Title/Abstract])) OR (Migrant[Title/Abstract])) OR (Refugee[Title/Abstract])) OR (foreign[Title/Abstract]))
<b>Scopus</b>	TITLE-ABS (hesitancy OR acceptance OR accept OR intention OR rejection OR reject OR confidence OR willingness) AND TITLE-ABS ( SARS OR SARS-CoV-2 OR SARS-CoV2 OR COVID-19 OR COVID19 OR coronavirus OR ncov ) AND TITLE-ABS (Migrants OR Emigration OR Immigration OR Refugees OR Immigrant OR Migrant OR Refugee OR foreign)
<b>Web of Science</b>	((TI=(hesitancy OR acceptance OR accept OR intention OR rejection OR reject OR confidence OR willingness)) AND TI=(SARS OR SARS-CoV-2 OR SARS-CoV2 OR COVID-19 OR COVID19 OR coronavirus OR nCoV)) AND TI=(Migrants OR Emigration OR Immigration OR Refugees OR Immigrant OR Migrant OR Refugee OR foreign)
<b>sciencedirect</b>	Title, abstract, keywords: (hesitancy OR acceptance OR accept OR intention OR rejection OR reject OR confidence OR willingness) AND (SARS OR SARS-CoV-2 OR SARS-CoV2 OR COVID-19 OR COVID19 OR coronavirus OR nCoV) AND (Migrants OR Emigration OR Immigration OR Refugees OR Immigrant OR Migrant OR Refugee OR foreign)

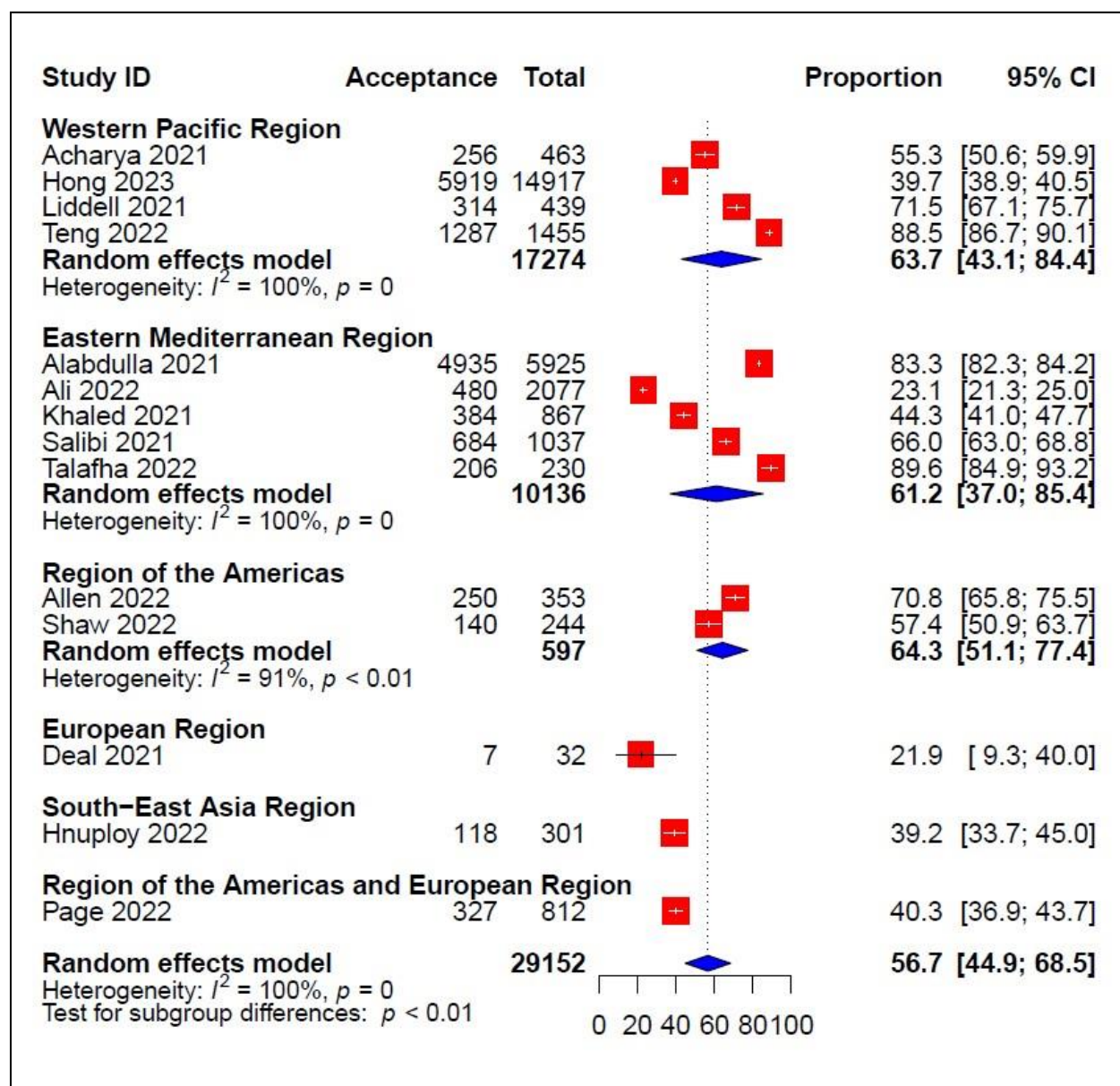
**Table S3.** Quality assessment of the included cross-sectional studies.

	Study ID	Questions assessing included cross-sectional studies								Yes (%)
		1	2	3	4	5	6	7	8	
1	Acharya 2021[21]	N	Y	Y	Y	Y	Y	Y	Y	87.5
2	Alabdulla 2021[22]	Y	Y	Y	Y	Y	Y	Y	Y	100
3	Al-Hatamleh 2022[23]	Y	Y	Y	Y	Y	Y	N	Y	87.5
4	Ali 2022[24]	Y	Y	Y	Y	Y	Y	N	Y	87.5
5	Allen 2022[25]	N	N	Y	Y	Y	N	Y	Y	62.5
6	Benavides-Melo et Al[26]	N	Y	Y	N	U	N	U	N	25
7	Deal 2021[27]	Y	Y	Y	Y	N	N	Y	Y	75
8	Führer 2022[28]	Y	Y	Y	U	U	U	N	N	37.5
9	Hnuploy 2022[29]	Y	Y	Y	Y	Y	N	N	Y	75
10	Hong 2023[30]	Y	Y	Y	Y	Y	N	Y	Y	87.5
11	Khaled 2021[31]	N	Y	Y	Y	U	N	Y	Y	62.5
12	Liddell 2021[32]	Y	Y	Y	Y	U	N	Y	Y	75
13	Lin 2022[33]	U	N	Y	Y	Y	N	N	Y	50
14	Page 2022[34]	Y	Y	Y	Y	N	N	N	Y	62.5
15	Salibi 2021[35]	N	N	Y	Y	Y	N	N	Y	50
16	Shaw 2022[36]	N	N	Y	Y	U	N	Y	Y	50
17	Talafha 2022[37]	N	Y	Y	Y	U	N	N	Y	50
18	Teng 2022[38]	Y	Y	Y	Y	U	N	Y	Y	75
19	West 2021[39]	Y	Y	Y	Y	Y	N	N	Y	75

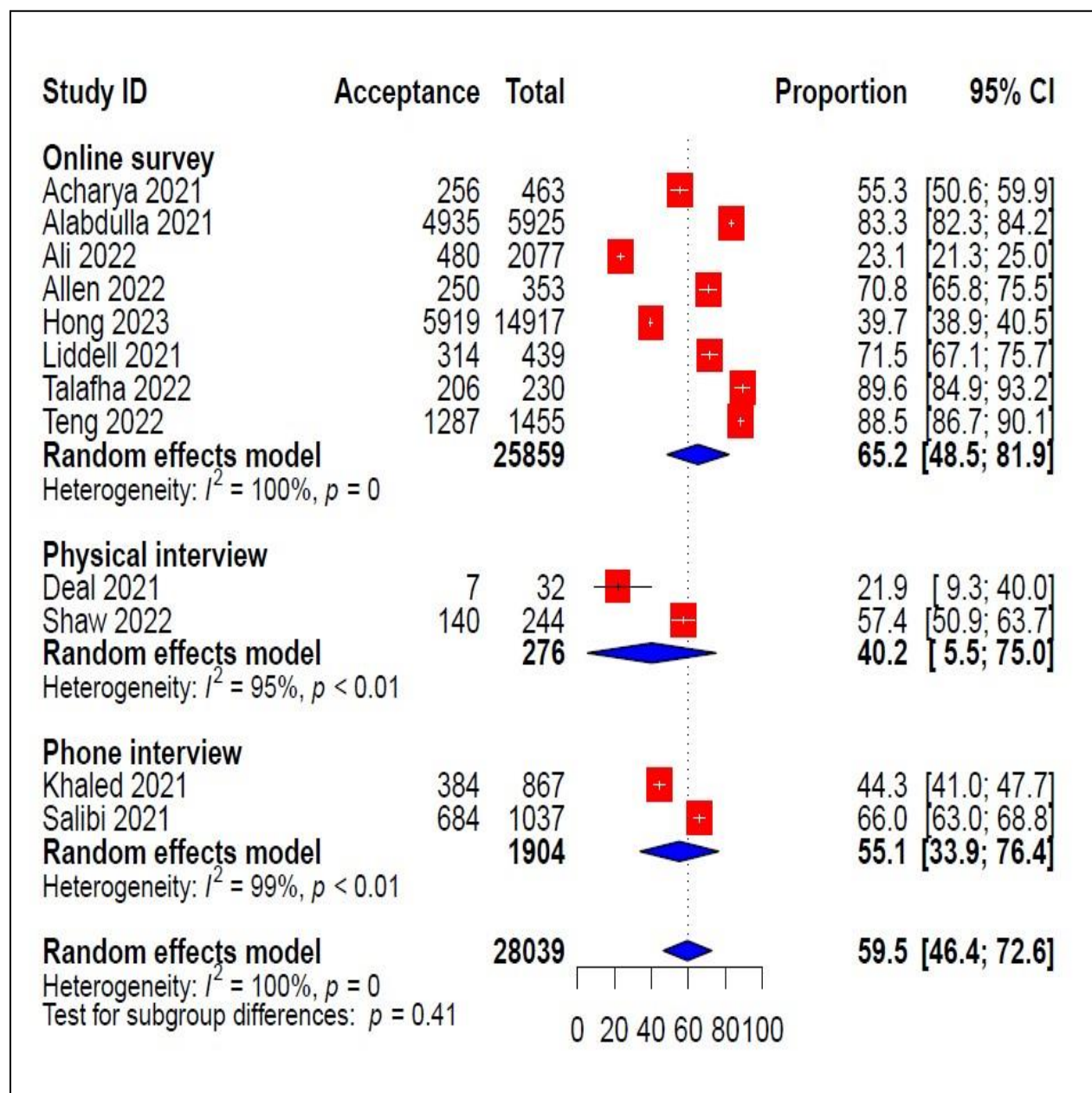
1. Were the criteria for inclusion in the sample clearly defined? 2. Were the study subjects and the setting described in detail? 3. Was the exposure measured in a valid and reliable way? 4. Were objective, standard criteria used for measurement of the condition? 5. Were confounding factors identified? 6. Were strategies to deal with confounding factors stated? 7. Were the outcomes measured in a valid and reliable way? 8. Was appropriate statistical analysis used? Y=Yes; N=No; U=Unclear.

# A

## WHO regions

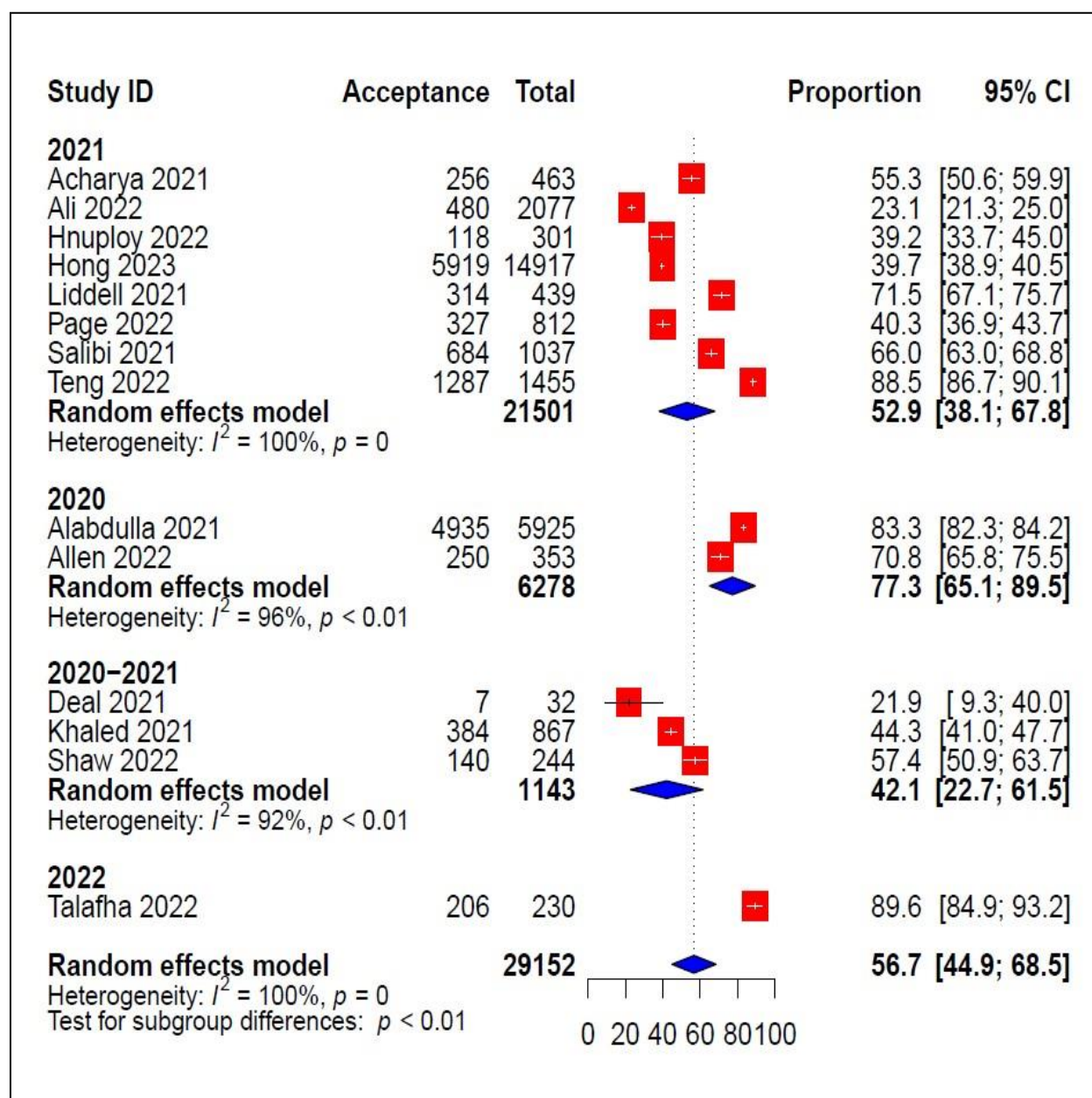


**B**  
**Survey tool**



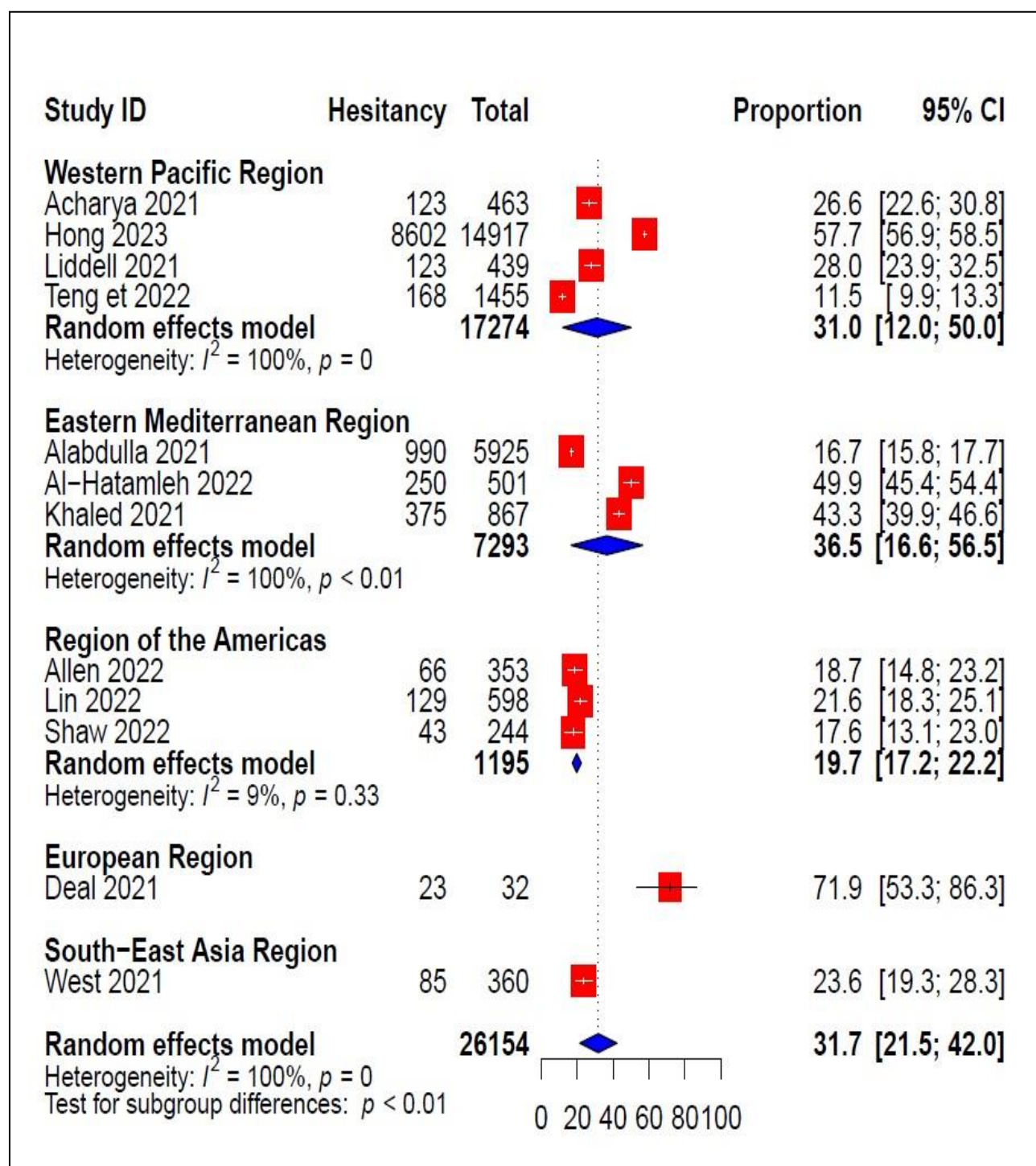


**C**  
**Enrolment time**



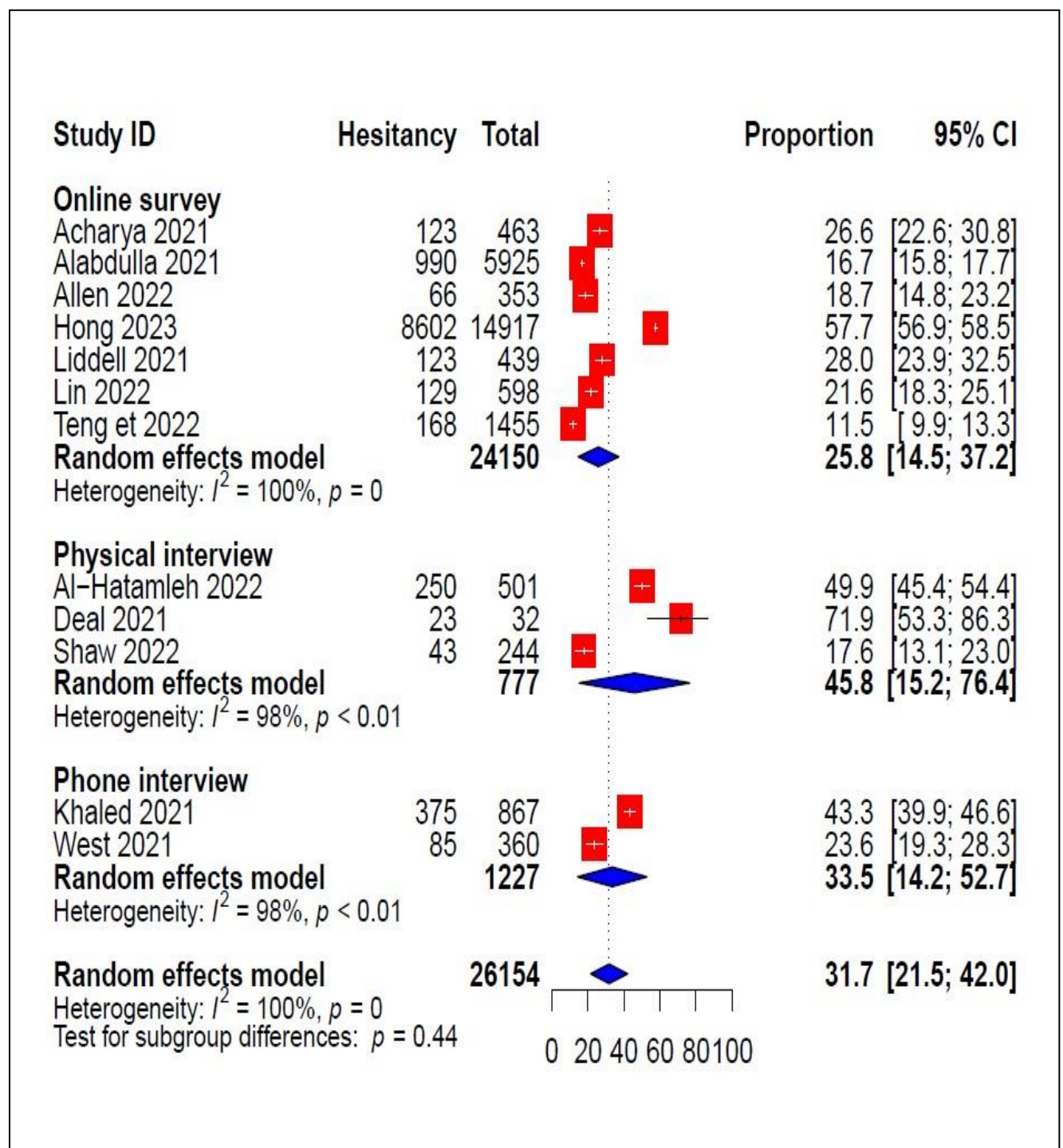
**Figure S1.** Subgroup analysis representing the COVID-19 vaccine acceptance based on:  
A. WHO regions, B. Survey tool and C. Enrolment time[21,22,24,25,27,29–32,34–38]

**A**  
**WHO regions**

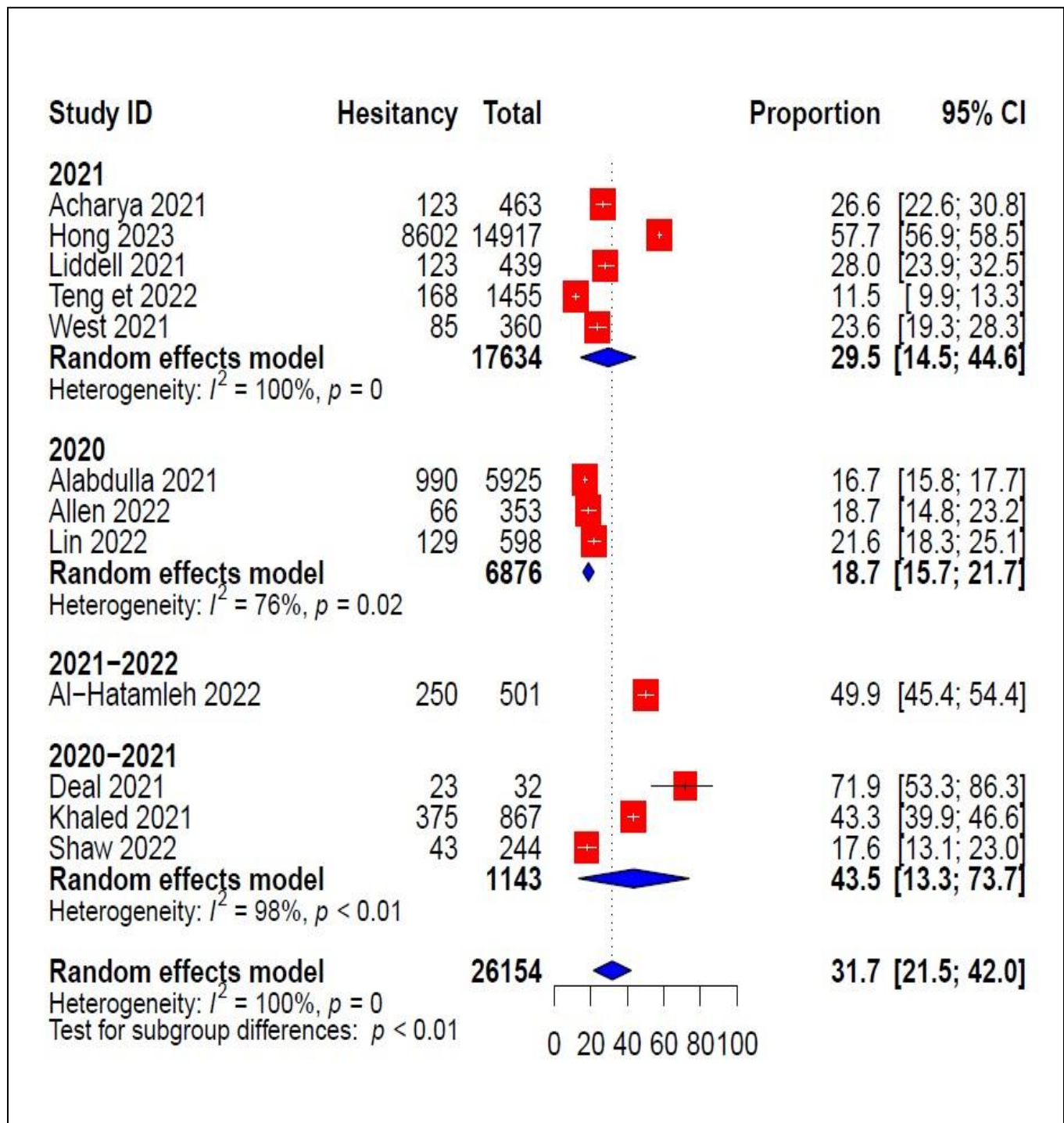




**B**  
**Survey tool**



**C**  
**Enrolment time**



**Figure S2.** Subgroup analysis representing the COVID-19 vaccine hesitancy based on: A. WHO regions, B. Survey tool and C. Enrolment time[21–23,25,27,30–33,36,38, 39]