A systematic review and meta-analysis of the efficacy of medical masks and N95 respirators for protection against respiratory infectious diseases, including COVID-19 in medical staff

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Abstract

To evaluate the efficacy of N95 respirators and medical masks for protection against respiratory infectious diseases, including COVID-19. We conducted a systematic review and meta-analysis of randomized controlled trials (RCTs) and observational studies evaluating the use of N95 respirators and medical masks for protection against respiratory infectious diseases. We retrieved relevant articles published from January 1994 to January 2020 by searching the PubMed, EMBASE, Cochrane CENTRAL, and Web of Science databases. The study quality was evaluated using the Cochrane Risk of Bias tool with RevMan 5.3 software. Eleven RCTs adjusted for clustering were included in the meta-analysis. Compared with the control group, N95 respirators or medical masks conferred significant protection against respiratory infectious diseases (odds ratio (OR) = 0.50; 95% CI: 0.29–0.84). Compared to medical masks, N95 respirators conferred significant protection against respiratory infectious diseases (OR = 0.75; 95% confidence interval (CI): 0.57–0.99). Meta-analysis of 10 observational studies adjusting for clustering also suggested that N95 respirators and medical masks are effective for protection against respiratory infectious diseases (OR = 0.59; 95% CI: 0.42–0.82). However, only one case report showed the effectiveness of medical masks for preventing COVID-19. Although medical masks and N95 respirators may confer significant protection against respiratory infectious diseases, there is insufficient evidence to conclude that these types of personal protective equipment offer similar protection against COVID-19. Therefore, in the absence of sufficient resources during an epidemic, medical masks and N95 respirators should be reserved for high-risk, aerosol-generating producing procedures.

Introduction

Respiratory infectious diseases are characterized by high infectivity and rapid epidemic contagion via multiple transmission channels that are difficult to control^[1]. The outbreak of severe acute respiratory syndrome coronavirus 2 (SARS-CoV-2), which originated in Wuhan, China, has become a major global health issue. This novel coronavirus can cause severe respiratory tract infections and lead to bronchiolitis or pneumonia, a disease designated coronavirus disease 2019 (COVID-19) by the World Health Organization (WHO) on February 12, 2020. The high prevalence of SARS-Cov-2 infections led the WHO to declare this an international public health emergency on January 30, 2020^[2]. At present, there are no specific treatments for COVID-19, but many public health measures have been implemented to improve disease control and prevention. Medical masks and N95 respirators are a type of personal protective equipment (PPE) used by medical staff that have been shown to be highly significant for the prevention of SARS-Cov-2^[3]. During the COVID-19 pandemic, there have been reports of shortages of PPE such as N95 respirators and medical masks for medical workers^[4]. There is evidence that medical masks and N95 respirators have similar protective efficacy and that N95 respirators should be reserved for aerosol-generating procedures^[5]. On the other hand, if N95 respirators are more effective than medical masks for

the prevention of respiratory infectious diseases, they should be prioritized for aerosol-generating procedures. In this study, we conducted a comprehensive meta-analysis of the effectiveness of N95 respirators and medical masks for protection against respiratory infectious diseases, including COVID-19, to provide scientific basis for the formulation of policies related to the use of medical masks and other PPE.

Methods

Systematic review registration

This systematic review was registered with number CRD42020179966 (<https://www.crd.york.ac.uk/PROSPERO>)

Search strategy

Articles published in English from January 1994 to January 2020 which explored the relationship between wearing medical masks and protection against respiratory infectious diseases were retrieved from PubMed, EMBASE, Cochrane CENTRAL, and Web of Science databases. The following search terms were used: “Respiratory infectious diseases”, “COVID-19”, “respiratory tract infection”, “prevention”, “Medical masks” and “N95 respirators”. Logical operators (OR, NOT, AND) were used to combine keywords and subject words (Table 1).

Inclusion criteria

Articles that met the following criteria were selected: This study design was peer-reviewed randomized controlled trials (RCTs) or observational studies (OSs); The population was medical staff; The exposure of interest was wearing medical masks or N95 respirators; The outcome of interest was the proportion of medical mask use in the experimental and control groups; The settings were healthcare settings worldwide.

Exclusion criteria

We excluded guidelines, editorials, public press articles, reviews, raw data unavailable, theoretical models and the articles published in languages other than English.

Table 1. Search strings for the four databases

Database	Search string
PubMed	(masks*[MeSH Terms] OR mask*[Title/Abstract] OR N95 respirators*[Title/Abstract] OR "medical masks"[Title/Abstract] OR "face masks"[Title/Abstract] OR "medical mask"[Title/Abstract] OR "medical masks"[Title/Abstract] OR "surgical mask"[Title/Abstract] OR "surgical masks"[Title/Abstract] OR "surgical facemask"[Title/Abstract] OR "surgical facemasks"[Title/Abstract] OR "surgical face mask"[Title/Abstract] OR "surgical face masks"[Title/Abstract] OR respiratory infectious diseases[Title/Abstract] OR COVID-19[Title/Abstract] OR prevention[Title/Abstract] OR control[Title/Abstract] OR measur[Title/Abstract] OR evaluat[Title/Abstract] OR effect[Title/Abstract] OR Public Health[Title/Abstract] OR medical workers[Title/Abstract])
EMBASE	('espiratory infectious diseases':ab,ti OR 'COVID-19':ab,ti) AND ('Public Health*':ab,ti OR 'medical workers*':ab,ti OR 'nursing home patient':ab,ti) AND ('prevention':ab,ti OR 'control*':ab,ti OR 'measure*':ab,ti OR 'evaluate*':ab,ti OR 'effect*':ab,ti OR 'prevent*':ab,ti OR 'control*':ab,ti OR 'intervention*':ab,ti OR 'outcome*':ab,ti)
Web of Science	TS=(mask* OR facemask* OR "face mask" OR "face masks" OR "medical" OR "medical mask" OR "medical masks" OR "medical facemask" OR "medical facemasks" OR "medical face mask" OR "medical face masks" OR "N95" OR "N95 respirators" OR "surgical facemask" OR "surgical facemasks" OR "surgical face mask" OR "surgical face masks" OR Infectious Diseases OR Respiratory infectious diseases OR "COVID-19" OR "prevention" OR "control" OR "prevention and control" OR PPE OR "measur" OR "evaluat" OR "effect" OR "Public Health" OR "medical workers") AND TS=("healthcare worker" OR "healthcare workers" OR "health care worker" OR "health care workers" OR "health-care worker" OR "health-care workers" OR "healthcare professional" OR "healthcare professionals" OR "health care professional" OR "health care professionals" OR "health-care professional" OR "health-care professionals" OR staff OR "healthcare personnel" OR "health care personnel" OR "health-care personnel")
Cochrane CENTRAL	Respiratory infectious diseases OR COVID-19 in Title, Abstract, Keywords, AND 'medical masks' OR 'N95 respirators' OR 'mask' in Title, Abstract, Keywords, AND practice OR control* OR measur* OR evaluat* OR effect* OR prevent* OR prevention and control* OR intervention* OR outcome* in Title, Abstract, Keywords,, Publication Year from 1994 to 2020 in Trials

Data extraction

Data extraction was conducted in two stages: first, the literature was screened by two researchers according to inclusion criteria. The screened literature was then searched and evaluated by two other researchers according to the inclusion criteria and exclusion criteria. To avoid errors, a pre-designed form was used to select the study characteristics, baseline patient characteristics, outcomes and definitions included in the literature, and any inconsistencies in recommendations were resolved through consultation. The main data extracted were as follows: the number of medical staff who insisted on wearing masks and those who did not insist on wearing masks.

Literature quality assessment

The quality of the methodology in the included studies was evaluated by using Cochrane Risk of Bias tool^[6]. The quality of RCTs was evaluated using RevMan 5.3 software. The risk of bias was evaluated from six perspectives: choice bias, performance bias, measurement bias, attrition bias, reporting bias,

other biases (Table 2). According to the criteria for low, unclear and high risk, the quality of the methodology of the included studies was divided into three levels as follows: Mild bias: four or more of the above six items are low risk; moderate bias: two or three of the above six items are low risk; severe bias: none or only one of the above six items is low risk.

Table 2 Cochrane risk of bias assessment form

Evaluation items	Evaluation content	
Choice bias	Random sequence generation	The method of generating random assignment sequence is described in detail, which is convenient for evaluation of the comparability between groups.
	Assignment hidden	The method of hiding random distribution sequence is described in detail, which is convenient for judging whether the distribution of intervention measures can be predicted.
Performance bias	Blind method for researchers and subjects	The method of blinding used to prevent researchers and subjects from knowing the intervention measures is described in detail. This provides information that can be used to judge whether the blinding method is effective.
Measurement bias	Blind evaluation of research results	The method of blinding used to prevent the evaluators of the research results from knowing the intervention measures is described in detail. This provides information that can be used to judge whether the blinding method is effective.
Attrition bias	Integrity of result data	The data for each major outcome indicator, including those of subjects who were lost or withdrew from the study, are reported completely. Including subjects who were lost or withdrew, the total number of people in each group (compared with the total number of randomly enrolled people), and the reasons for the loss of interview/withdrawal are clearly reported, so as to facilitate assessment of the relevant treatment by the system evaluator.
Reporting bias	Selective reporting of research results	The information described can be used by system evaluators to judge the possibility of selective reporting of research results and relevant information.
Other biases	Other sources of bias	In addition to the above biases, the information provided can be used to assess the existence of other bias factors. If a question or factor is mentioned in the plan, corresponding answers are required.

Statistical methods

RevMan 5.3 software provided by the Cochrane Collaboration was used to conduct this meta-analysis of the proportions of medical mask use between the experimental and control groups. Q and I^2 tests were used to evaluate the heterogeneity of the included studies (Q tests is the traditional method in the

heterogeneity test of meta-analysis; I^2 tests can measure the degree of difference among multiple research effects, and can describe the percentage of variation caused by inter research in the total variation). When $I^2 \leq 50\%$ and $P > 0.1$, a fixed effect model was used to merge the data; when $I^2 > 50\%$ or $P < 0.1$, a random effect model was used to merge the data. The odds ratio (OR) and 95% confidence interval (CI) were used to express the enumeration data. $P < 0.05$ was considered to indicate statistical significance.

Results

Literature search results

After searching 350 papers from four databases , 21 articles were included in the final screening (Figure 1). We searched the full text of 230 articles and excluded 209 that did not meet our inclusion criteria. Finally, we selected 11 RCTs (Table 3A, 3B) and 10 OSs (Table 4). Five of the RCTs analyzed the effectiveness of N95 respirators versus medical masks for protection against respiratory infectious diseases. There was no real evidence to suggest publication bias (Figure 2A, 2B, 2C).

Table 3A. Summary of RCTs assessing the effectiveness of masks for protection against respiratory infectious diseases (n = 7).

Author	Journal	Year of publication	Study design	Mask type	Experimental group (n)		Control group (n)		OR	95%CI
					Infected	Non-infected	Infected	Non-infected		
Steo ^[7] , China	<i>Lancet</i>	2003	RCTs	N95	0	13	92	149	0.06	0.00–1.02
Al-Asmary ^[8] , Arabia	<i>Int J Infect Dis</i>	2007	RCTs	N95	18	92	4	14	0.68	0.20–2.32
Ng ^[9] , China	<i>Infect Control Hosp Epidemiol</i>	2008	RCTs	Medical	10	83	20	20	0.12	0.05–0.30
Yang ^[10] , China	<i>Braz J Infect Dis</i>	2010	RCTs	Medical	73	88	44	76	1.43	0.88–2.32
MacIntyre ^[11] , Australia	<i>INFLUENZA OTHER RESP</i>	2011	RCTs	N95	3	946	6	475	0.25	0.06–1.01
MacIntyre ^[11] , Australia	<i>INFLUENZA OTHER RESP</i>	2011	RCTs	Medical	13	479	15	466	0.84	0.40–1.79
MacIntyre ^[12] , Australia	<i>Prev Med</i>	2014	RCTs	N95	31	918	39	442	0.38	0.24–0.62
MacIntyre ^[12] , Australia	<i>Prev Med</i>	2014	RCTs	Medical	32	460	39	442	0.79	0.49–1.28
MacIntyre ^[13] , Australia	<i>BMJ Open</i>	2015	RCTs	Medical	15	561	25	440	0.47	0.25–0.90

Table 3B. Summary of RCTs assessing the effectiveness of medical masks versus N95 respirators for protection against respiratory infectious diseases (n = 6)

Author	Journal	Year of publication	Study design	N95 group (n)		Medical group (n)		OR	95%CI
				Infected	Non-infected	Infected	Non-infected		
Loeb ^[14] , Canada	<i>JAMA</i>	2009	RCTs	126	663	113	675	1.14	0.86–1.50
MachIntyre ^[15] , Australia	<i>Int J Infect Dis</i>	2009	RCTs	25	533	34	248	0.34	0.20–0.59
MachIntyre ^[11] , Australia	<i>Influenza and Other Respiratory Viruses</i>	2011	RCTs	19	2828	21	1455	0.47	0.25–0.87
MachIntyre ^[16] , Australia	<i>Am J Respir Crit Care Med</i>	2013	RCTs	58	2266	73	1991	0.70	0.49–0.99
MacIntyre ^[12] , Australia	<i>Prev Med</i>	2014	RCTs	43	906	41	901	1.04	0.67–1.62
Radonovich ^[17] , USA	<i>JAMA</i>	2019	RCTs	650	6886	776	7228	0.88	0.79–0.98

Table 4. Summary of OSs assessing the effectiveness of masks for protection against respiratory infectious diseases (n = 10).

Author	Journal	Year of publication	Study design	Mask type	Experimental group (n)		Control group (n)		OR	95%CI
					Infected	Non-infected	Infected	Non-infected		
Seto ^[18] , China	<i>Lancet</i>	2003	OSs	N95	0	11	92	164	0.08	0.00–1.34
Seto ^[18] , China	<i>Lancet</i>	2003	OSs	Medical	0	11	51	123	0.10	0.01–1.80
Scales ^[19] , Canada	<i>EMERG INFECT DIS</i>	2003	OSs	Medical	3	13	3	18	1.38	0.24–7.98
Scales ^[19] , Canada	<i>EMERG INFECT DIS</i>	2003	OSs	N95	1	5	3	17	1.13	0.10–13.44
Teleman ^[20] , Singapore	<i>Epidemiol Infect</i>	2004	OSs	N95	3	36	23	50	0.18	0.05–0.65
Yin ^[21] , China	<i>Zhonghua Liu Xing Bing Xue Za Zhi</i>	2004	OSs	Medical	46	55	156	158	0.85	0.54–1.33
Loeb ^[22] , Canada	<i>JAMA</i>	2004	OSs	N95	2	16	5	9	0.23	0.04–1.41
Loeb ^[22] , Canada	<i>JAMA</i>	2004	OSs	Medical	1	4	5	9	0.45	0.04–5.21
Nishiura ^[23] , Japan	<i>Jpn J Infect Dis</i>	2005	OSs	Medical	8	25	35	90	0.82	0.34–2.00
Wilder-Smith ^[24] , Singapore	<i>Emerg Infect Dis</i>	2005	OSs	N95	3	6	34	37	0.54	0.13–2.35

Randomized controlled trials

Assessment of the risk bias of 11 RCTs^[7-17] using RevMan 5.3 software showed moderate overall bias (Figure 3A, 3B).

Medical mask use versus no medical mask use for protection against respiratory infectious diseases

Nine RCTs compared respiratory infectious diseases risk in medical staff wearing masks to that of convenience-selected controls wearing no masks. Wearing N95 respirators or medical masks conferred significantly greater protection against respiratory infectious diseases (OR = 0.50; 95% CI: 0.29–0.84; $P < 0.05$) (Figure 4A). Because of heterogeneity, the data were divided into medical masks and N95 respirators for subgroup analysis. Subgroup analysis showed that heterogeneity of the data for medical mask use was $I^2 = 83\%$ ($P < 0.00001$) and the heterogeneity for N95 respirator use was $I^2 = 0\%$ ($P = 0.39$), showing that the heterogeneity of the data for N95 respirator use was very small, while the heterogeneity

of the data for medical mask use was very large. Therefore, the possibility that the heterogeneity of the data in the included studies was related to the type of mask used could not be excluded (Figure 4B).

Medical mask use versus N95 respirator use for protection against respiratory infectious diseases

Six RCTs compared the use of medical masks and N95 respirators for protection against respiratory infectious diseases^[11, 12, 14-17]. Compared with medical masks, N95 respirators were significantly more effective in protecting against respiratory infectious diseases (OR = 0.75; 95% CI: 0.57–0.99; $P < 0.05$) (Figure 5).

Observational studies

Assessment of the risk bias of nine OSs^[16-24] using RevMan 5.3 software showed moderate overall bias (Figure 6A, 6B).

Medical mask use versus no medical mask use for protection against respiratory infectious diseases

Ten OSs compared respiratory infectious diseases risk in medical staff wearing masks with that of convenience-selected controls wearing no masks. Wearing medical masks or N95 respirators conferred significantly greater protection against respiratory infectious diseases (OR = 0.59; 95% CI: 0.42–0.82; $P < 0.05$) (Figure 7A). Because of heterogeneity, the data were divided into medical masks and N95 respirators for subgroup analysis. Subgroup analysis showed that heterogeneity of the data for medical mask use was $I^2 = 0\%$ ($P = 0.61$), and the heterogeneity for N95 respirator use was $I^2 = 0\%$ ($P = 0.49$), showing that the heterogeneity of the data for N95 respirator use was very small, while the heterogeneity of the data for both medical mask and N95 respirator use was very small. Therefore, the heterogeneity of the data in the included studies has little relationship with difference in the use of medical masks or N95 respirators and may be caused by other factors (Figure 7B).

Discussion

Both the RCTs and OSs included in this meta-analysis showed that the use of N95 respirators or medical masks has a significantly greater protective effect against respiratory infectious diseases among medical workers compared with those who did not use these types of PPE. Furthermore, although our meta-analysis showed that N95 respirators provide better protection against respiratory infectious diseases than medical masks, there is no convincing evidence that medical masks are inferior to N95 respirators, especially in routine care and during non-aerosol-generating procedures. Medical masks have also been reported to be similarly effective to N95 respirators in preventing influenza infection^[17]. For a few respiratory infectious diseases, our meta-analysis suggested that N95 respirators were more protective than medical masks; however, the confidence intervals were wide and there was considerable heterogeneity ($P = 0.0008$, $I^2 = 76\%$). This heterogeneity may have been due to differences in the inclusion and exclusion criteria among the studies (Figure 5). It should be noted that we have not yet searched for

RCTs comparing the use of medical masks with N95 respirators for protection against SARS-CoV-2 infection and this issue is worthy of consideration.

National and international guidelines unanimously recommend the use of N95 respirators for protection against aerosols; however, this is inconsistent with the current recommendations for non-aerosol prophylaxis and routine care for COVID-19 patients^[25-28]. Although medical masks are cheaper, the European Centers for Disease Control and Prevention and the Centers for Disease Control and Prevention still recommend N95 respirators for non-aerosol-generating procedures^[29]. Indeed, Kobayashi et al. argued that long-term use and reuse of N95 respirators during the COVID-19 pandemic could effectively protect volunteer workers^[30]. In contrast, the WHO and the Public Health Agency of Canada recommend the use of medical masks during the care of patients with COVID-19^[29]. Ng et al. published a case report on the use of respiratory devices for protection against COVID-19^[31]. Thirty-five of the 41 medical workers wore medical masks. Despite exposure to a patient with severe pneumonia who tested positive for SARS-CoV-2 nucleic acids, all of these medical staff tested negative for SARS-CoV-2 nucleic acids 14 days later^[31]. Thus, among the studies included in our analysis, this case report provides the only direct evidence of the protective effects of medical masks against SARS-CoV-2 infection. Therefore, the effectiveness of mask use for protection against COVID-19 remains to be fully clarified.

There are some limitations to this meta-analysis. First, the number of included studies is small, and therefore, may result in distribution bias. Analysis of a greater number of studies is required to reduce the risk of distribution bias. Second, there may be measurement bias, publication bias and selection bias in the included articles. Third, the limitations of the underlying studies, beyond just the biases, For instance, the Radonovich et al. (2019) RCT did not really control for consistency of use between its medical mask and N95 groups^[17], so its conclusions about non-inferiority may be swayed by differential consistency in use among healthcare personnel assigned to the various groups within the study. Further studies with high-quality methodology and strictly defined inclusion and exclusion criteria are required. Fourth, heterogeneity among the data in the included studies was identified, which may be related to the research population, region, and virus species. Although the subgroup analysis of the use of N95 respirators and medical masks was conducted for some indicators in this study, it was not conducted for different populations, virus species and other types of masks. Therefore, more detailed subgroup analysis is required to provide a more convincing basis for our conclusions. Fifth, the source of infection was not identified in all trials and some medical staff may have been infected before the trial. Finally, at present, the protective effects of N95 respirators and medical masks against SARS-CoV-2 infection have not been studied specifically; therefore, therefore, it is not possible to extend our conclusion to the situation for SARS-CoV-2.

Conclusions

Here, we conducted a literature review and meta-analysis of RCTs and OSs of the protective effects of N95 respirators and medical masks against respiratory infectious diseases, including COVID-19. Our

analysis provides evidence to support the universal use of N95 respirators and medical masks in the medical and healthcare environment. However, the effectiveness of masks for protection against COVID-19 remains to be established.

Declarations

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None.

Author Contributions

GW participated in the study design and writing of the manuscript; PJ and HY participated in the English grammar correction and writing of the manuscript; YS and XZ participated in analysis and writing of the manuscript. All authors read and approved the final manuscript.

Competing financial interests

The authors declare no competing financial interests.

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Figures

Figure 1

Summary of the literature search and inclusion process.

Figure 2

A. RCTs effect of mask compared to no mask. Funnel plot assessing publication bias in RCTs investigating the effectiveness of medical masks for protection against respiratory infectious diseases; Harbord's estimated bias coefficient: -0.58; $P = 0.599$. B. OSs effect of mask compared to no mask Funnel plot assessing publication bias in OSs comparing the effectiveness of masks for protection against respiratory infectious diseases; Harbord's estimated bias coefficient: 0.40; $P = 0.635$. C. RCTs effect of N95 respirators compared to medical masks Funnel plot assessing publication bias in RCTs investigating the effectiveness of medical masks and N95 respirators for protection against respiratory infectious diseases; Harbord's estimated bias coefficient: -0.44; $P = 0.491$. Funnel plots were generated to evaluate publication bias in RCT and OSs. The unadjusted effect estimates in some studies correspond to their standard errors. The real line and dotted line represent the aggregate effect estimates of different standard errors and their 95% CI, respectively. To determine publication bias, the Harbord test of small-study effects was used to assess funnel plot asymmetry. RCTs, randomized controlled trials; OSs, observational Studies; CI, confidence interval, OR, the odds ratio.

A

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Al-Asmary 2007	+	+	?	?	?	?	?
Loeb 2009	?	?	+	?	+	+	?
MachIntyre 2009	+	+	?	?	+	?	?
MachIntyre 2011	?	?	+	?	?	+	+
MachIntyre 2013	+	?	+	?	?	?	?
MachIntyre 2014	+	?	+	+	?	?	?
MacIntyre 2015	?	?	?	?	?	+	+
Ng 2008	?	?	+	?	+	+	?
Radonovich 2019	+	?	?	+	?	+	?
Steo 2003	?	+	?	+	?	?	+
Yang 2010	?	?	?	+	+	+	?

B

Figure 3

A. RCTs received a high (red), low (green) or uncertain (yellow) risk of bias score for each of the domains.
 B. Percentage of RCTs with high, low or uncertain risk of bias in each domain.

A

B

Figure 4

Meta-analysis of RCTs assessing the protective effects of N95 respirators and medical masks against respiratory infectious diseases. (A) Meta-analysis of the effect of wearing N95 respirators and medical masks for protection against respiratory infectious diseases. (B) Subgroup analysis of the effect of wearing N95 respirators and medical masks for protection against respiratory infectious diseases.

Figure 5

Meta-analysis of RCTs comparing the protective effects of medical masks and N95 respirators against respiratory infectious diseases.

A

	Random sequence generation (selection bias)	Allocation concealment (selection bias)	Blinding of participants and personnel (performance bias)	Blinding of outcome assessment (detection bias)	Incomplete outcome data (attrition bias)	Selective reporting (reporting bias)	Other bias
Loeb .2004	?	?	?	?	?	+	+
Loeb 2004	+	+	+	?	?	?	-
Nishiura 2005	+	-	+	?	?	?	?
Scales .2003	+	+	+	?	?	?	?
Scales 2003	?	?	+	?	+	+	?
Seto 2003	+	?	+	?	+	?	?
Seto N95	?	+	+	?	+	?	?
Teleman 2004	+	?	+	+	?	?	?
Wilder-Smith 2005	+	?	+	?	?	+	?
Yin 2004	+	?	?	+	+	?	?

B

Figure 6

A. OSs received a high (red), low (green) or uncertain (yellow) risk of bias score for each of the domains.
 B. Percentage of OSs with high, low or uncertain risk of bias in each domain.

A

B

Figure 7

Meta-analysis of OSs assessing the protective effects of N95 respirators and medical masks against respiratory infectious diseases. (A) Meta-analysis of the effect of wearing N95 respirators and medical masks for protection against respiratory infectious diseases. (B) Subgroup analysis of the effect of wearing N95 respirators and medical masks for protection against respiratory infectious diseases. RCTs, randomized controlled trials; OR, odds ratio; CI, confidence interval; OSs, observational Studies.