³⁰ 6. Supplementary Materials

Additional notes about interpretation of screening

For the title and abstract screening form, Q1 and Q2 were omitted from the protocol because 892 reviewers assessed records based only on their title and/or abstract. Additionally, Q1 was omitted 893 from the protocol to specify that included studies must describe primary research, allowing reviewers 894 to exclude review articles. For the full-text screening form, Q1 was added to identify non-English 895 language articles, articles for which the full text could not be obtained, and conference abstracts 896 that were considered too short (i.e., 500 words) to constitute a full-text report. Q2 and Q4 were 897 not in the protocol but were added so that the full text could be assessed based on the same two 898 questions used to assess the title/abstract. This was particularly pertinent for assessing records 899 that lacked an abstract. The order of questions was changed in the protocol so that reviewers first 900 assessed the records based on study design (Q3) and then population (Q5), intervention (Q6), and 901 outcome (Q7). This was done to maximize efficiency of the form, with the questions most likely to 902 be exclusionary occurring earlier in the form. If a reviewer answered "no" to any question between 903 Q1 and Q6, they did not have to answer subsequent questions. 904

For Q5, studies of populations identified by investigators as "veal" or "dairy" were excluded, but 905 studies of Holstein/Friesian cattle were not excluded provided the researchers did not use the term 906 "veal" or "dairy" cattle. Studies of Bos indicus and Bos taurus cattle were included. Studies of 907 calves persistently infected with BVDV prior to vaccination were excluded. For Q6, for a vaccine to 908 be considered "commercial", it had to have a commercial name (e.g., Bovi-Shield Gold). Autogenous 900 vaccines were also considered relevant; for a vaccine to be considered "autogenous", it had to be 910 made by a commercial company from a farm isolate and then used on the farm of origin. Studies of 911 preconditioning (i.e., vaccination occurring before weaning) were included provided that the only 912 difference between the intervention groups was vaccination (i.e., not weaned or bunk broken, etc.). 913

Search	Search String	Hits
Number		
1	Cattle/ or Cattle Diseases/	331164
2	(cow or cows or cattle or heiferS or steer or steers or bull or bulls or calf or calves or youngstockS or young-stockS or beef or veal or bovineS or bovinae or buiatric\$).ti,ab,kf	199453
3	1 or 2	396086
4	(respiratory disease\$ or respiratory tract disease\$ or respiratory virus\$ or respiratory tract virus\$ or shipping fever\$ or undifferentiated fever\$ or BRD or BRDC or pasteurellosis or pneumonia\$ or pleuropneumonia\$ or pneumonitis or pneumonitides).ti,ab,kf	194512
5	(herpesvirus ^{\$} or herpes virus ^{\$} or herpesviridae ^{\$} or herpes viridae ^{\$} or BoHV-1 or BoHV-1 or BHV-1 or BHV-1 or BHV or BHV or rhinotracheitis or rhinotracheitides or IBRV or IBR).ti,ab,kf	31859
6	((viral or virus or viruses) adj3 (diarrhoea\$ or diarrhea\$)).ti,ab,kf	4953
7	(BVD or BVDV or BVDV1 or BVDV2 or pestivirus or coronavirus or BCV).ti,ab,kf	12378
8	(respiratory syncytial virus\$ or BRSV or RSV).ti,ab,kf	15597
9	(parainfluenza3 or influenza3 or parainfluenza 3 or influenza 3 or parainfluenza three or influenza three or parainfluenza type 3 or influenza type 3 or parainfluenza type three or influenza type three or PI-3 or PI3).ti,ab,kf	13067
10	or/4-9	261171
11	3 and 10	11207
12	exp Bovine Respiratory Disease Complex/	719
13	herpesvirus 1, bovine/ or herpesvirus 5, bovine/	2137
14	exp Diarrhea Viruses, Bovine Viral/	2492
15	Coronavirus, Bovine/	244
16	Respiratory Syncytial Virus, Bovine/	378
17	Parainfluenza Virus 3, Bovine/	98
18	or/11-17	12192
19	exp immunization/ or exp vaccination/	162389
20	exp Vaccines/	211611
21	(vaccin ^{\$} or immunis ^{\$} or immuniz ^{\$} or innoculat ^{\$}).ti,ab,kf	357356
22	or/19-21	447049
23	18 and 22	2659
24	limit 23 to yr="2014 - Current"	373
25	Mannheimia haemolytica/	935
26	Haemophilus somnus/	59
27	Pasteurella multocida/	1838
28	(mannheimia haemolytica or mannheimia hemolytica or m haemolytica or m hemolytica or pasteurella	1889
20	haemolytica or pasteurella hemolytica or p hemolytica or mannheimios ³).ti,ab,kt	475
29 20	(naemopnius somn) or nemopnius somn) or nistopnius somn) or h somnus or h somni).ti,ab,kt	475
3U 91	(pasteurena muitocida or p muitocida or mycopiasma).ti,ab,ki	23548
31 20	0r/25-30	25515
32 22	3 and 22 and 31	627
33 24	24 OF 52	936
34	remove duplicates from 33	935

Table S1: Search results for MEDLINE, MEDLINE In-Process, and MEDLINE Daily Epub Ahead of Print, Search date: 05/07/18, Interface: OVID, Database coverage dates: 1946 to current.

Search	Search String	Hits
Number		
# 17	#16 OR #11	2452
# 16	#15 AND #9 AND #1	1912
# 15	#14 OR #13 OR #12	29528
# 14	TS=("pasteurella multocida" OR "p multocida" OR "mycoplasma")	26716
# 13	TS=("haemophilus somn*" OR "hemophilus somn*" OR "histophilus somn*" OR "h somnus" OR "h somni")	981
# 12	TS=("mannheimia haemolytica" OR "mannheimia hemolytica" OR "m haemolytica" OR "m	3388
	hemolytica" OR "pasteurella haemolytica" OR "pasteurella hemolytica" OR "p haemolytica" OR "p hemolytica" OR mannheimios*)	
# 11	#10 Timespan=2014-2018	694
# 10	#9 AND #8 AND #1	7024
# 9	TS=(vaccin [*] OR immunis [*] OR immuniz [*] OR innoculat [*])	182791
# 8	#7 OR #6 OR #5 OR #4 OR #3 OR #2	149754
# 7	TS=("parainfluenza3" OR "influenza3" OR "parainfluenza 3" OR "influenza 3" OR "parainfluenza three" OR "influenza three" OR "parainfluenza type 3" OR "influenza type 3" OR "parainfluenza type three" OR "influenza type three" OR "PI-3" OR "PI3")	2925
# 6	TS=("respiratory syncytial virus*" OR "BRSV" OR "RSV")	3995
# 5	TS=("BVD" OR "BVDV" OR "BVDV1" OR "BVDV2" OR "pestivirus" OR "coronavirus" OR "BCV")	25929
# 4	TS=(("viral" OR "virus" OR "viruses") NEAR/3 (diarrhoea* OR diarrhea*))	9129
# 3	TS=(herpesvirus* OR "herpes virus*" OR herpesviridae* OR "herpes viridae*" OR "BoHV-1" OR "BoHV1" OR "BHV1" OR "BHV1" OR "BHV1" OR "BoHV" OR "rhinotracheitis" OR "rhinotracheitides" OR "IBRV" OR "IBR")	35842
# 2	TS=("respiratory disease*" OR "respiratory tract disease*" OR "respiratory virus*" OR "respiratory tract virus*" OR "shipping fever*" OR "undifferentiated fever*" OR "BRD" OR "BRDC" OR "pasteurellosis" OR pneumonia* OR pleuropneumonia* OR "pneumonitis" OR "pneumonitides")	91773
# 1	TS=("cow" OR "cows" OR "cattle" OR heifer* OR "steer" OR "steers" OR "bull" OR "bulls" OR "calf" OR "calves" OR "youngstock*" OR "young-stock*" OR "beef" OR "veal" OR bovine* OR "bovinae" OR buiatric*)	738516

Table S2: Search results for Cambridge Agricultural and Biological Index, Search date: 05/07/18, Interface: Web of Science, Database coverage dates: 1910 to current. All search stings were conducted for all years (Timespan=All years) except search line 11 which was limited to 2014-2018

Search	Search String	Hits
Number		
# 17	#16 OR #11	1185
# 16	#15 AND #9 AND #1	728
# 15	#14 OR #13 OR #12	27931
# 14	TS=("pasteurella multocida" OR "p multocida" OR "mycoplasma")	25520
# 13	TS=("haemophilus somn*" OR "hemophilus somn*" OR "histophilus somn*" OR "h somnus" OR "h somni")	608
# 12	TS=("mannheimia haemolytica" OR "mannheimia hemolytica" OR "m haemolytica" OR "m	2531
	hemolytica" OR "pasteurella haemolytica" OR "pasteurella hemolytica" OR "p haemolytica" OR "p hemolytica" OR mannheimios*)	
# 11	#10 Timespan=2014-2018	569
# 10	#9 AND #8 AND #1	3225
# 9	TS=(vaccin* OR immunis* OR immuniz* OR innoculat*)	352857
# 8	#7 OR #6 OR #5 OR #4 OR #3 OR #2	285001
# 7	TS=("parainfluenza3" OR "influenza3" OR "parainfluenza 3" OR "influenza 3" OR "parainfluenza three" OR "influenza three" OR "parainfluenza type 3" OR "influenza type 3" OR "parainfluenza type three" OR "influenza type three" OR "PI-3" OR "PI3")	17456
# 6	TS=("respiratory syncytial virus*" OR "BRSV" OR "RSV")	19453
# 5	TS=("BVD" OR "BVDV" OR "BVDV1" OR "BVDV2" OR "pestivirus" OR "coronavirus" OR "BCV")	15890
# 4	TS=(("viral" OR "virus" OR "viruses") NEAR/3 (diarrhoea* OR diarrhea*))	6409
# 3	TS=(herpesvirus* OR "herpes virus*" OR herpesviridae* OR "herpes viridae*" OR "BoHV-1" OR "BoHV1" OR "BHV1" OR "BHV1" OR "BHV1" OR "BoHV" OR "rhinotracheitis" OR "rhinotracheitides" OR "IBRV" OR "IBR")	37131
# 2	TS=("respiratory disease*" OR "respiratory tract disease*" OR "respiratory virus*" OR "respiratory tract virus*" OR "shipping fever*" OR "undifferentiated fever*" OR "BRD" OR "BRDC" OR "pasteurellosis" OR pneumonia* OR pleuropneumonia* OR "pneumonitis" OR "pneumonitides")	202222
# 1	TS=("cow" OR "cows" OR "cattle" OR heifer* OR "steer" OR "steers" OR "bull" OR "bulls" OR "calf" OR "calves" OR "youngstock*" OR "young-stock*" OR "beef" OR "veal" OR bovine* OR "bovinae" OR bulatric*)	526270

Table S3: Search results for Science Citation Index (SCI), Search date: 05/07/18, Interface: Web of Science, Database coverage dates: 1900-03/07/18. All search stings were conducted for all years (Timespan=All years) except search line 11 which was limited to 2014-2018

Search	Search String	Hits
Number		
# 17	#16 OR #11	57
# 16	#15 AND #9 AND #1	44
# 15	#14 OR #13 OR #12	1306
# 14	TS=("pasteurella multocida" OR "p multocida" OR "mycoplasma")	1232
# 13	TS=("haemophilus somn*" OR "hemophilus somn*" OR "histophilus somn*" OR "h somnus" OR "h somni")	20
# 12	TS=("mannheimia haemolytica" OR "mannheimia hemolytica" OR "m haemolytica" OR "m hemolytica" OR "pasteurella haemolytica" OR "pasteurella hemolytica" OR "p haemolytica" OR "p hemolytica" OR mannheimios*)	82
# 11	#10 Timespan=2014-2018	16
# 10	#9 AND #8 AND #1	222
# 9	TS=(vaccin [*] OR immunis [*] OR immuniz [*] OR innoculat [*])	27939
# 8	#7 OR #6 OR #5 OR #4 OR #3 OR #2	21011
# 7	TS=("parainfluenza3" OR "influenza3" OR "parainfluenza 3" OR "influenza 3" OR "parainfluenza three" OR "influenza three" OR "parainfluenza type 3" OR "influenza type 3" OR "parainfluenza type three" OR "influenza type three" OR "PI-3" OR "PI3")	1648
# 6	TS=("respiratory syncytial virus*" OR "BRSV" OR "RSV")	1496
# 5	TS=("BVD" OR "BVDV" OR "BVDV1" OR "BVDV2" OR "pestivirus" OR "coronavirus" OR "BCV")	1180
# 4	TS=(("viral" OR "virus" OR "viruses") NEAR/3 (diarrhoea* OR diarrhea*))	427
# 3	TS=(herpesvirus* OR "herpes virus*" OR herpesviridae* OR "herpes viridae*" OR "BoHV-1" OR "BoHV1" OR "BHV-1" OR "BHV1" OR "BHV" OR "BoHV" OR "rhinotracheitis" OR "rhinotracheitides" OR "IBRV" OR "IBR")	2543
# 2	TS=("respiratory disease*" OR "respiratory tract disease*" OR "respiratory virus*" OR "respiratory tract virus*" OR "shipping fever*" OR "undifferentiated fever*" OR "BRD" OR "BRDC" OR "pasteurellosis" OR pneumonia* OR pleuropneumonia* OR "pneumonitis" OR "pneumonitides")	14462
# 1	TS=("cow" OR "cows" OR "cattle" OR heifer* OR "steer" OR "steers" OR "bull" OR "bulls" OR "calf" OR "calves" OR "youngstock*" OR "young-stock*" OR "beef" OR "veal" OR bovine* OR "bovinae" OR buiatric*)	39545

Table S4: Search results for Conference Proceedings Citation Index Science (CPCI-S), Search date: 04/07/18, Interface: Web of Science, Database coverage dates: 1990-03/07/18. All search stings were conducted for all years (Timespan=All years) except search line 11 which was limited to 2014-2018

Search	Search String	Hits
Number		
#1	NOFT(cow OR cows OR cattle OR heifer* OR steer OR steers OR bull OR bulls OR calf OR calves OR youngstock* OR "young-stock*" OR beef OR veal OR bovine* OR bovinae OR buiatric*)	352207
#2	NOFT("respiratory disease*" OR "respiratory tract disease*" OR "respiratory virus*" OR "respiratory tract virus*" OR "shipping fever*" OR "undifferentiated fever*" OR BRD OR BRDC OR pasteurellosis OR pneumonia* OR pleuropneumonia* OR pneumonities)	20219
#3	NOFT(herpesvirus* OR "herpes virus*" OR herpesviridae* OR "herpes viridae*" OR BoHV-1 OR BoHV1 OR BHV-1 OR BHV1 OR BHV OR BoHV OR rhinotracheitis OR rhinotracheitides OR IBRV OR IBR)	9692
#4	NOFT((viral OR virus OR viruses) NEAR/3 (diarrhoea* OR diarrhea*))	2816
#5	NOFT (BVD OR BVDV OR BVDV1 OR BVDV2 OR pestivirus OR coronavirus OR BCV)	3826
#6	NOFT("respiratory syncytial virus*" OR BRSV OR RSV)	1541
#7	NOFT (parainfluenza3 OR influenza3 OR "parainfluenza 3" OR "influenza 3" OR "parainfluenza three" OR "influenza three" OR "parainfluenza type 3" OR "influenza type 3" OR "parainfluenza type three" OR "influenza type three" OR PI-3 OR PI3)	1387
#8	S7 OR S6 OR S5 OR S4 OR S3 OR S2	35909
#9	NOFT(vaccin* OR immunis* OR immuniz* OR innoculat*)	57207
#10	S9 AND S8 AND S1	1632
#11	(S9 AND S8 AND S1) AND pd(20140101-20181231)	220
#12	NOFT("mannheimia haemolytica" OR "mannheimia hemolytica" OR "m haemolytica" OR "m hemolytica" OR "pasteurella haemolytica" OR "pasteurella hemolytica" OR "p haemolytica" OR "p hemolytica" OR mannheimios*)	1239
#13	NOFT("haemophilus somn*" OR "hemophilus somn*" OR "histophilus somn*" OR "h somnus" OR "h somni")	325
#14	NOFT ("pasteurella multocida" OR "p multocida" OR mycoplasma)	8563
#15	S14 OR S13 OR S12	9808
#16	S15 AND S9 AND S1	423
#17	S16 OR S11	602

Table S5: Search results for AGRICOLA, Search date: 05/07/18, Interface: ProQuest, Database coverage dates: 1970 to current.

Vaccine	Abreviation
SINGLE AGENTS	
Placebo or Nothing	NAC
Presponse (aka Presponse SQ)	А
Presponse HM	В
Bovi-Shield IBR-PI3 (aka Bovi-Shield MLV)	\mathbf{C}
IBR/PI-3 MLV (incl. Coopers IBR-PI3) incl intranasal	D
Pyramid 4	E
Reliant IBR	F
Pyramid 5	G
Bovi-Shield Gold	Н
Rispoval	I
Bovi-Shield 4	J
PASTVAC	K
Poly-Bac B	L
PRECON-PH	M
Somubac	IN O
Pneumo-Star	0
Sommu-Star	P
	Q P
Vice PMH	R
Posho IPP PVD	с Т
No brand name 4 day progine (IBB_BVDV_DI 2V_BPSV_MIV)	T
IBP/DL3/Sompuson	V
I bt A deficient Mannhaemia haemolutica	v W
modified Pasteurella haemolutica hiotype A serotype 1 leukotoxin vaccine	X
live lyophilized Pasteurella haemolytica serotype 1 intradermal (A H Robbins Co.)	Y Y
Bovi-Shield Gold One Shot	Z
COMBINATION INTERVENTIONS	
Pasteurella haemolutica vaccine + glycoprotein IV (gIV) of BHV-1 + Fermicon 7/Somnugen	PHBHSOM
Bovilan RP + Fermicon 7/Somnugen	BOVSOM
glycoprotein IV (gIV) of BHV-1 vaccine + Fermicon 7/Somnugen	BHSOM
Pasteurella haemolytica + Bovilan RP + Fermicon 7/Somnugen	PHBOVSOM
Presponse + Bovilan	PRESBOV
Bovi-Shield IBR-PI3-BRSV + Ultrabac 7/Somubac	BS3SOM
Bovi-Shield 4 + Ultrabac 7/Somubac	BS4SOM
Titanium 5 L5 + Presponse HM + MLV IBR, BVDV, PI-3V, and BRSV vaccine	T5PRE
Express 3 + Pulmo-guard PHM-1 + Fermicon 7/Somnugen	EXPMHSOM
Bovi-Shield $4 + \text{One Shot} + \text{Fermicon 7/Somnugen}$	BS40NESOM
Titanium $5 + $ Titanium BRSV	T5BRSV
Titanium 5 + Titanium BRSV + LktA-deficient Mannhaemia haemolytica	T5BRSVLKT
Leukotox, IM, $1 \operatorname{dose} + \operatorname{Reliant} \operatorname{IBR}$	LEUKOIBR
Pyramid 5 + Zelnate + Presponse SQ	P5ZELPRE
Express 5 twice + Bar-Vac 7/Somnus + Pulmo-guard PHM-1	EX5SOMPHM
Pyramid 5 + Bar-Vac 7/Somnus + Pulmo-guard PHM-1	P5SOMPHM
Presponse + Pyramid FP 5 + Ultrabac 7/Somubac	PREP5SOM
Pulmo-Guard PMH1 + Pyramid FP 5 + Ultrabac 7/Somubac	PMHP5SOM
Pulmo-Guard PMH1 + Pyramid 4	PMHP4
Bovalan-4K + Presponse	BOVA4PRE
Endovac-Bovi + Horizon 1 + VAC 3	ENDHOR3
Autogenous + Horizon $1 + VAC 3$	AUTOHORIV3
Horizon 1 + VAC 3 $A + A = A + B + B = A + B = A + B + B = A + B + B = A + B + B = A + B + B + B + B = A + B + B + B + B + B + B + B + B + B +$	HIVAC3
Autogenous + IBK/PI-3/BK5V MLV	AUTONONAME3
commerciany available hyperimmune serum of dovine origin + $1BK/BVDV/PI-3 MLV + Haemophilus$	HYPEK3SOM
SOUTHUS DACUELIII IDD /DVDV /DL 2 MIV + Ucomonhilus commus bostoric	NONAMECOM
IDR/DVDV/PI-0 NILV + <i>nuemophinus somnus</i> Dacterin Horizon IV (DDSV, DI 2, DVDV, IDD) + Haemophilus compress bestorin	INOINAMESOM HCOM
$Prosponso \perp Horizon IV (BRSV, PI 3, BVDV, IBP) + Haemonhilus sommus bacterin$	HOOM DDFUCOM
1 response + 1012011 (DIGV, 1-5, DVDV, 1DI) + 1102000000000000000000000000000000000	F REHISOM BRSVDRFSOM
r_{10} , r_{00} $+$ r_{10} , r	DIDALITEDOM

Vaccine	Abreviation
BRSV Vac + IBR-PI3/Somnugen	BRSVIBRSOM
BRSV Vac + Coopers IBR-PI3	BRSVCOOP
Nasalgen (IBR) + Jencine $(BVDV)$	NAJEN
Encon-P, 2 doses + Nasalgen (IBR) + Jencine B $(BVDV)$	ENNAJEN
Somnugen, injected, $1 \operatorname{dose} + \operatorname{Nasalgen}(\operatorname{IBR}) + \operatorname{Jencine}(\operatorname{BVDV})$	NAJENSOM
Pyramid 4, 2 doses + Vision 7 Somnus with Spur + Presponse	P4SOMPRE
Pyramid IBR, 2 doses + Vision 7 Somnus with Spur + Presponse	PIBRSOMPRE
Somnugen, injected, 1 dose + modified live virus intranasal vaccine for IBR/PI-3 (like V but apparently	SOMIBR
two products)	
Pasteurella bacterins + IBR/PI-3 vaccine	PAIBR
IBR/PI-3 vaccine [unclear if this is MLV or not] (could be V but the paper isn't clear about MLB or killed)	IBRPI
Vitamin E	Ignored as a treatment
Chromium (Metalosate)	Ignored as a treatment

Table S6: Single and combined vaccination products used in the studies included in the review.

Refid	Citation	Study ID	Country	Setting	Year	Pens	Concurrent treatments
72	(van Donkersgoed	v	Canada	University/	1990	NR	Nothing
	et al 1993)			Research			
	ct al. 1556)			feedlot			
73	(Harland		Canada	Commor	1080	NP	Antiparasitic treatment(s) Implants
10	(11a11a110)		Uallaua	cial	1000	INIC .	(hormonos) Antibiotics : ovutotroguelino
	et al. 1992)			free allest	1990		(Limmenes), Antibiotics . Oxyterracycline
		A 1	C 1	reedlot	1000	4	(Liquamycin LA)
75	(Thorlakson	Auction calves	Canada	Commer-	1988-	4	Nothing reported
	et al. 1990)			cial	1989		
				feedlot			
76	(Bateman 1988)		Canada	University/	1987	\mathbf{NR}	No other treatments
				Research			
				feedlot			
77	(Martin		Canada	Unspecified	1980	NR	Nothing
	et al. 1984)			feedlot			
414	(Grooms		USA	University/	2003	1	Antiparasitic treatment(s), Implants
	et al. 2014)			Research			(hormones)
				feedlot			()
509	(Kirkpatrick		USA	Unspecified	NR	NB	Antiparasitic treatment(s) Vaccine(s):
000	$(1 \times 1 \times 2008)$		0.011	foodlot	1110	1110	7 way clostridial bactorin toxoid
	et al. 2008)			leediot			(Clostridium
							(Clostridium
							chauveoi-septicum-novyisordellii-
	(*****		~ ·	~			perfringens type C-perfringens type D)
513	(Wildman		Canada	Commer-	2002-	6	Antiparasitic treatment(s), Implants
	et al. 2008)			cial	2003		(hormones), Antibiotics : "Animals in the
				feedlot			first 4 replicates received parenteral
							metaphylactic long-acting oxytetracycline
							(Tetradure LA 300; Merial Canada), 30
							mg/kg BW, IM, and animals in replicates 5
							and 6 received parenteral metaphylactic
							tilmicosin (Micotil: Provel Division Eli
							Lilly Canada, Guelph, Ontario) "
577	(Frank et al. 2003)		USΔ	University/	NR	16	Antiparasitic treatment(s) Vaccine(s):
511	(Plank et al. 2005)		UDA	Dagaarah	1110	10	Electroid 7 (Cleatridial massing)
				feedlet			Electroid 7 (Clostildiai vaccilie)
FOF		D 1 1 /:	TICA	reedlot	ND	0	
595	(Frank et al. 2002)	Prophylactic	USA	Unspecified	NR	8	Antiparasitic treatment(s), Antibiotics:
		flortenicol		feedlot			flortenicol (40 mg/kg SC), Vaccine(s):
							Electroid 7 (Clostridial)
608	(O'Connor	Feedlot A	Canada	Unspecified	1998	\mathbf{NR}	Antibiotics : oxytetracycline
	et al. 2001)			feedlot			
622	(Gummow &		South	Unspecified	1995	NR	Antiparasitic treatment(s), Implants
	Mapham 2000)		Africa	feedlot			(hormones)
772	(Ribble		Canada	Commer-	1985-	36	Antiparasitic treatment(s), Implants
	et al. 1988)			cial	1986		(hormones)
	00 000 10000)			feedlot	1000		(101110100)
808	(Purdy		USA	University/	NR	NB	Antiparasitic treatment(s) Vaccine(s):
000	(1 uluy)		0.011	Bosoarch	1110	1110	Convog CSNS (Clostridium vagaino)
	et al. 1960)			feedlat			Convac CSIVS (Closuridium vaccine)
0.0.0	(0.6		TICA	feedlot	ND	ND	NT -11 1
836	(Conter		USA	University/	NR	NR	Nothing reported
	et al. 1983)			Research			
				feedlot			
863	(Wohler &		USA	\mathbf{NR}	\mathbf{NR}	\mathbf{NR}	Nothing reported
	Baugh 1980)						
1024	(White		USA	Back-	2015	1	Antiparasitic treatment(s), Antibiotics:
	et al. 2017)			grounding			gamithromycin (Zactran)
	/			vard			- • • • /
1115	(Rogers		USA	Commer-	2015-	15	Antiparasitic treatment(s). Antibiotics:
	(1.2016)		~ ~ * *	cial	2016		tilmicosin
				feedlot	2010		
				1000100			

Refid	Citation	Study ID	Country	Setting	Vear	Pons	Concurrent treatments
11.05	(Dellar	Study ID	UCA	II.	ND	0	$\frac{1}{1}$
1105	(Balley		USA	University/	NK	8	Antiparasitic treatment(s), vaccine(s):
	et al. 2016)			Research			Vision 7 with SPUR (Clostridial)
				feedlot			
1287	(Richeson		USA	University/	2009-	8	Antiparasitic treatment(s), Antibiotics:
	et al. 2015)			Research	2010		tilmicosin (Micotil), Vaccine(s); Covexin-8
	ee all 1 010)			foodlot	-010		(Clostridium vaccino)
1000	(D		TICA	Comment	0019	15	Antineneritie treatment(e) Invelopte
1288	(Rogers		USA	Commer-	2013-	15	Antiparasitic treatment(s), implants
	et al. 2015)			cial	2014		(hormones), Antibiotics: tilmicosin
				feedlot			(Micotil), monensin (in feed), tylosin (in
							feed)
1631	(Rogers		USA	Commer-	2007	12	Antiparasitic treatment(s). Implants
	et al 2009)			cial			(hormones) Antibiotics: tilmicosin
	et al. 2000)			foodlot			(Micotil) mononsin (in food) tylosin (in
				leediot			(WICOUI), monentsin (in reed), tyrosin (in
	(~		_	reed)
1632	(Wildman		USA	Commer-	2004	5	Antiparasitic treatment(s), Implants
	et al. 2009)			cial			(hormones), Antibiotics: tilmicosin (Micotil
				feedlot			300)
1650	(Perrett		Canada	Commer-	2005-	10	Antiparasitic treatment(s). Implants
	et al 2008)			cial	2006	-	(hormones) Antibiotics: oxytetracycline
	ct al. 2000)			foodlat	2000		(Totac dure I A 200)
1 200			TICA	reediot	1007	1 5	(letradure LA 500)
1792	(MacGregor		USA	Commer-	1997-	15	Antiparasitic treatment(s), Implants
	et al. 2003)			cial	1998		(hormones)
				feedlot			
1974	(Malcolm-Callis		USA	University/	NR	3	Antiparasitic treatment(s), Vaccine(s):
	et al. 1994)			Research			Barvac 7 (Clostridial)
	ee all 1001)			foodlot			
1070	Winimlat		Canada	Ileculot	ND	11	Λ ntinopositio theotheopt(a)
1979	(wright		Canada	University/	Νħ	11	Antiparasitic treatment(s)
	et al. 1994)			Research			
				feedlot			
2038	(Koevering		USA	University/	1991 -	16	Antiparasitic treatment(s), Vaccine(s):
	et al. 1992)			Research	1992		4-way Clostridial bacterin
				feedlot			·
2050	(Mille 1001)		USA	Unspecified	NR	NB	Vaccino(s): Site guard (clostridial)
2003	(111115 1331)		UDA	facility	INIC	1110	vaccine(s). Site-guard (clostifular)
0000		1000 / 1	TICA	reediot	1000	ND	
2060	(Bechtol	1988 study	USA	Commer-	1988	NR	Antiparasitic treatment(s), Implants
	et al. 1991)			cial			(hormones), Vaccine(s): 4-way Clostridial
				feedlot			bacterin
2078	(McLean		USA	University/	1988-	8	Antiparasitic treatment(s), Vaccine(s):
	et al. 1990)			Research	1989		7-way clostridial
	ee all 1000)			foodlot	1000		i naj ciobilida
9140	$(I_{\rm int} at al 1000)$		Canada	Common	1007	7	Antinopositio treatment(s) Implants
2140	(Jim et al. 1966)		Canada	Commer-	1987-	1	Antiparasitic treatment(s), implants
				cial	1988		(hormones), Antibiotics: oxytetracycline
				feedlot			(Oxymycine LA, Oxymycine LP),
							Vaccine(s): TASVAX (Clostridial)
2165	(Smith et al. 1986)		USA	University/	1984-	12	Antiparasitic treatment(s), Vaccine(s):
	,			Research	1985		Leptospira pomona bacterin. Clostridia
				foodlot			chauvoje centicum novuj and cordellij
				leediot			Le esterio
01 = 0	(77)			D (ND	ND	baceterin
2176	(Thomas		England	Beet	NR	NR	Nothing reported
	et al. 1986)			rearing			
				farm			
2215	(Morter		USA	Unspecified	1983	4	Antiparasitic treatment(s), Vaccine(s):
	et al 1984)			feedlot			7-way clostridial bacterin toxoid
2255	(Mortor &		USA	Unspecified	NP	6	Antiperesitic treatment(s) Implants
2200	Amatuta 1002)		UDA	fandlat	1111	v	(homeones) Veccine(a), IM homeones
	Amstutz 1983)			reedlot			(normones), vaccine(s): IN neptavalent
				~			clostridial bacterin-toxoid
2281	(Bennett 1982)		USA	Commer-	1978 -	28 or 46	Antiparasitic treatment(s), Implants
				cial	1979		(hormones), Antibiotics : chlorotetracycline
				feedlot			in feed

Refid	Citation	Study ID	Country	Setting	Year	Pens	Concurrent treatments
2282	(Morter		USA	Unspecified	NR	NR	Antiparasitic treatment(s). Implants
	et al. 1982)		0.011	feedlot			(hormones), Vaccine(s); Electroid 7
	oo an 100 -)			loodiot			(Clostridial)
2297	(Amstutz		USA	Unspecified	1979	NR	Implants (hormones)
	et al. 1981)		0.011	feedlot			
2339	(Griffin		USA	University/	NR	6	Antiparasitic treatment(s). Implants
-000	et al. 1979)		0.011	Research	1.10	°	(hormones)
	ee al. 1010)			feedlot			(normonos)
3305	(Schunicht		Canada	Commer-	1999-	10	Antiparasitic treatment(s) Implants
0000	et al (2003)		Canada	cial	2000	10	(hormones) Antibiotics · oxytetracycline
	ee al. 2000)			feedlot	2000		$(\text{Tetradure I} A_{-300})$
4016	(McKaig &		USΔ	NR	NR	NB	Nothing reported
4010	(Wervarg & Taylor 2015)		0.071	IVIC	1110	1110	Nothing reported
4166	(Frank of al 2002)	No prophylactic	USA	Unspecified	NR	8	Antiparasitic treatment(s) Vaccine(s):
4100	(Frank et al. 2002)	florfonicol	USA	foodlot	1110	0	Floatroid 7 (Cloctidial)
4167	(O'Connor	Foodlot P	Canada	Increasified	1009	ND	Implants (hormonos) Antibiotics
4107	(0 Connor)	reediot D	Canada	faadlat	1990	ININ	implants (normones), Antibiotics :
	et al. 2001)			leedlot			domeas C, tilmingsin if hadre torgenerature
							degrees C; thinkcosin it body temperature
41.00	(O)C	Es allat C	Consta	II	1000	ND	greater than 40 degrees C.
4168	(O'Connor	Feedlot C	Canada	Unspecified	1998	NR	No other treatments
41.00	et al. 2001)	1000 / 1	TTCA	feedlot	1000	ND	NT (1)
4169	(Bechtol	1989 study	USA	Commer-	1989	NR	Nothing
	et al. 1991)			cial			
			<i>a</i> ,	feedlot	1000		
4170	(Thorlakson	Ranch calves	Canada	Commer-	1988-	11	Antiparasitic treatment(s), Implants
	et al. 1990)			cial	1989		(hormones), Vaccine(s): Tasvax (Clostridial)
	(0			feedlot			
5003	(Stilwell		Portugal	Unspecified	2003	1: "All calves	Nothing reported
	et al. 2008)			feedlot		are kept in	
						the same open	
						barn with	
						slated	
						concrete	
						floor."	
5005	(Van Donkersgoed	Trial $\#1$	Canada	Custom	1988-	\mathbf{NR}	Implants (hormones), Antibiotics:
	et al. 1990)			feedlot	1989		oxytetracycline (Liquamycin LA),
							Vaccine(s): Clostribac 7
5006	(Van Donkersgoed	Trial #3	Canada	University/	1987 -	\mathbf{NR}	Nothing
	et al. 1990)			Research	1988		
				feedlot			
5007	(Van Donkersgoed	Trial $#4$	Canada	Commer-	1988	\mathbf{NR}	Antiparasitic treatment(s), Implants
	et al. 1990)			cial			(hormones), Vaccine(s): Tasvax 8
				feedlot			(Clostridial)
5008	(Van Donkersgoed	Trial $\#5$,	Canada	Commer-	1988 -	NR	Antiparasitic treatment(s), Antibiotics:
	et al. 1990)	Yearlings		cial	1989		oxytetracycline (Liquamycin LA),
				feedlot			Vaccine(s): Tasvax 8 (Clostridial)
5009	(Van Donkersgoed	Trial $\#5$, Calves	Canada	Commer-	1988 -	NR	Antiparasitic treatment(s), Implants
	et al. 1990)			cial	1989		(hormones), Vaccine(s): Tasvax 8, Coopers
				feedlot			IBR-PI3, some calves got Somnugen, some
							calves got Presponse

Table S7: Characteristics of studies of the prevention of BRD incidence using vaccines included in the review. NR = not reported.

REFID	Citation	StudyID	Status	Fate of BRD cases diagnosed at arrival
72	(van Donkersgoed	None	Not included in meta-analysis	Treated for BRD, randomly assigned to experimental
	et al. 1993)		Ŭ	group after initial treatment on day 0
73	(Harland et al. 1992)	None	Not included in meta-analysis	Excluded from study, treated for BRD
75	(Thorlakson	Auction	Included in meta-analysis	NR
	et al. 1990)	calves		
76	(Bateman 1988)	None	Included in meta-analysis	NR
77	(Martin et al. 1984)	None	Not included in meta-analysis	Not reported
414	(Grooms et al. 2014)	None	Not included in meta-analysis	Not reported
509	(Kirkpatrick	None	Not included in meta-analysis	Not reported
000	et al. 2008)	1.0110	100 moradoa in mora analysis	
513	(Wildman et al. 2008)	None	Not included in meta-analysis	Not reported
577	(Frank et al. 2003)	None	Not included in meta-analysis	Not reported
595	(Frank et al. 2002)	Prophylactic	Not included in meta-analysis	Not reported
	(114111 00 411 2002)	florfenicol	1.00 moradoa m mora analysis	roo reperiod
608	(O'Connor et al. 2001)	Feedlot A	Not included in meta-analysis	Not reported
622	(Gummow & Markam 2000)	None	Not included in meta-analysis	Not reported
779	$(\mathbf{P};\mathbf{b},\mathbf{b},\mathbf{c},\mathbf{c},\mathbf{c},\mathbf{l},1088)$	None	Not included in mote englysis	Not reported
112	(Ribble et al. 1988)	None	Not included in meta-analysis	Not reported
000	(F undy et al. 1980)	None	Included in meta-analysis	Net we exted
830	(Confer et al. 1983)	None	Included in meta-analysis	Not reported
803	(Wonler & Baugh 1980)	None	Included in meta-analysis	Not reported
1024	(White et al. 2017)	None	Not included in meta-analysis	Not reported
1115	(Rogers et al. 2016)	None	Not included in meta-analysis	Excluded from study
1165	(Bailey et al. 2016)	None	Not included in meta-analysis	Received antibiotic treatment
1287	(Richeson et al. 2015)	None	Included in meta-analysis	Not reported
1288	(Rogers et al. 2015)	None	Included in meta-analysis	Excluded from study
1631	(Rogers et al. 2009)	None	Not included in meta-analysis	Not reported
1632	(Wildman et al. 2009)	None	Not included in meta-analysis	Not reported
1650	(Perrett et al. 2008)	None	Not included in meta-analysis	Not reported
1792	(MacGregor et al. 2003)	None	Not included in meta-analysis	Not reported
1974	(Malcolm-Callis et al. 1994)	None	Not included in meta-analysis	Not reported
1979	(Wright et al. 1994)	None	Included in meta-analysis	Not reported
2038	(Koevering et al. 1992)	None	Not included in meta-analysis	Not reported
2059	(Mills 1991)	None	Not included in meta-analysis	Not reported
2060	(Bechtol et al. 1991)	1988 study	Not included in meta-analysis	Not reported
2078	(McLean et al. 1990)	None	Included in meta-analysis	Received antibiotic treatment
2140	(Jim et al. 1988)	None	Not included in meta-analysis	Excluded from study, received antibiotic treatment,
			U U	kept in same pen as study calves
2165	(Smith et al. 1986)	None	Not included in meta-analysis	Excluded from study, received antibiotic treatment
2176	(Thomas et al. 1986)	None	Included in meta-analysis	Not reported
2215	(Morter et al. 1984)	None	Not included in meta-analysis	Excluded from study
2255	(Morter & Ametutz 1082)	None	Not included in meta-analysis	Excluded from study
2221	(Bonnott 1099)	Nono	Not included in mote analysis	Not reported
2201	(Monton ot ol 1082)	None	Not included in meta-analysis	Fireluded from study
2202	(Morter et al. 1982)	None	Not included in meta-analysis	Excluded from study
2291	(Amstutz et al. 1981)	None	Included in meta analysis	Not reported
2005	(Grimm et al. 1979)	None	Net is sheded in meta-analysis	Not reported
3305	(Schunicht et al. 2003)	None	Not included in meta-analysis	Not reported
4016	(McKaig & Taylor 2015)	None	Included in meta-analysis	Not reported
4166	(Frank et al. 2002)	No	Not included in meta-analysis	Not reported
	· /	prophylactic florfenicol	U T	-
4167	(O'Connor et al 2001)	Feedlot R	Not included in mote analysis	Received antibiotic treatment
4168	(O'Connor et al 2001)	Feedlot C	Included in meta-analysis	Not reported
4169	(Bechtol et al. 2001)	1989 study	Not included in meta-analysis	Not reported
1105	(Beenior et al. 1991)	1000 study	not menueu in meta-anarysis	

REFID	Citation	StudyID	Status	Fate of BRD cases diagnosed at arrival
4170	(Thorlakson	Ranch calves	Not included in meta-analysis	Randomly assigned to experimental group after
	et al. 1990)			initial treatment on day 0
5003	(Stilwell et al. 2008)	None	Included in meta-analysis	No sick animals at arrival
5005	(Van Donkersgoed et al. 1990)	Trial $\#1$	Not included in meta-analysis	Received antibiotic treatment
5006	(Van Donkersgoed et al. 1990)	Trial $#3$	Not included in meta-analysis	Excluded from study, received antibiotic treatment
5007	(Van Donkersgoed et al. 1990)	Trial $#4$	Not included in meta-analysis	Not reported
5008	(Van Donkersgoed et al. 1990)	Trial #5, Yearlings	Not included in meta-analysis	Excluded from study, received antibiotic treatment
5009	(Van Donkersgoed et al. 1990)	Trial $\#5$, Calves	Not included in meta-analysis	Excluded from study, Received antibiotic treatment

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Table S8: Fate of Bovine Respiratory Disease (BRD) cases diagnosed at arrival in studies relevant to the review.

REFID	Citation	Study	Status	BRD Outcome Definition
72	(van	None	Not included in	"The case definition of bovine respiratory disease (BRD)
	Donkersgoed		meta-analysis	included the presence of fever (rectal temperature greater than
	et al. 1993)			or equal to 40 degrees C), depression, and clinical signs
				restricted to the respiratory system."
73	(Harland	None	Not included in	"Calves were selected as BRD cases when they appeared
	et al. 1992)		meta-analysis	depressed or inappetent, and/or if they had symptoms
				attributable to the respiratory system, and they had to have a
	(rectal temperature greater than or equal to 40.0 degrees C."
75	(Thorlakson	Auction	Included in	Morbidity with temperature greater than 39.5 degrees C.
-	et al. 1990)	calves	meta-analysis	
76	(Bateman	None	Included in	"Calves were monitored for visual signs of respiratory disease
	1988)		meta-analysis	(depression, anorexia, gauntness, or polypnea) and if upon
				examination found to be febrile (greater than 59.5 degrees C),
77	Montin	None	Not included in	Net reported
11	(101a11111)	None	mote analysis	Not reported
414	(Grooms	None	Not included in	Not reported
111	et al (2014)	1 tone	meta-analysis	
509	(Kirkpatrick	None	Not included in	"Calves were observed for signs of BRD by experienced farm
	et al. 2008)		meta-analysis	personnel and treated according to subjective assessments of
				severity of illness and rectal temperature greater than 39.7
				degrees C (103.5 degrees F)."
513	(Wildman	None	Not included in	Undifferentiated Fever: "A diagnosis of UF was made when an
	et al. 2008)		meta-analysis	animal showed evidence of depression, as characterized by lack
	,			of response to stimulation, reluctance to move, and/or abnormal
				posture/carriage of the head; a lack of abnormal clinical signs
				referable to body systems other than the respiratory system; a
				rectal temperature greater than 40.5 degrees C; and no previous
				treatment history for UF/BRD."
577	(Frank	None	Not included in	Respiratory tract disease: "Clinical signs included nasal or
	et al. 2003)		meta-analysis	ocular discharge, labored breathing, lethargy, and emaciated
				body condition. Calves that had clinical signs of RTD were
				taken to a processing facility, and those with a rectal
				temperature greater than 39.7 degrees C received medical
505	(Frank	Prophylactic	Not included in	"Signs monitored included negal or equipr discharge labored
595	(FTAIR)	forfonicol	mote analysis	broathing lethargy and emaciated hody condition. Stors that
	(t al. 2002)	norienteoi	incta-analysis	had signs of BTD were moved to a processing facility and those
				with rectal temperature greater than 39.7 degrees C received
				antibiotics."
608	(O'Connor	Feedlot A	Not included in	Not reported
	et al. 2001)		meta-analysis	
622	(Gummow &	None	Not included in	"The case definition included one or more of the symptoms of
	Mapham		meta-analysis	listlessness, anorexia, dyspnoea, hyperpnoea, coughing,
	2000)			mucopurulent discharge from the eyes or nostrils and the
				absence of symptoms of disease of any other organ system."
772	(Ribble	None	Not included in	Not reported
	et al. 1988)		meta-analysis	
808	(Purdy	None	Included in	"A point system was used, with one point being recorded for
	et al. 1986)		meta-analysis	each of the following: ocular discharge, nasal discharge, gaunt
				appearance, or depression. If a calf was assigned 2 points it was
				isolated and its rectal temperature was recorded. If the
				temperature exceeded 40 degrees C, 2 more points were
				assigned. A call with 4 points or more was considered sick and antibiotic therapy was instituted "
	1	1		antibiotic therapy was instituted."

REFID	Citation	Study	Status	BRD Outcome Definition
836	(Confer	None	Included in	"Health status was determined by the assignment of points to
	et al. 1983)		meta-analysis	clinical signs of disease as follows: 2 points, absolute anorexia; 2
				points, rectal temperature of 40 degrees C or greater; 1 point,
				nasal discharge; 1 point, ocular discharge; 1 point, severe
				depression. An animal with four or more of seven possible points
				on a given day was considered sick and treated with antibiotics
				for 4 days."
863	(Wohler &	None	Included in	Not reported
	Baugh 1980)		meta-analysis	
1024	(White	None	Not included in	BRD morbidity (clinical signs observed by human and REDI
	et al. 2017)		meta-analysis	(remote early disease identification) system)
1115	(Rogers	None	Not included in	"Standard feedlot protocol specified that cattle must have a
	et al. 2016)		meta-analysis	rectal temperature of greater than or equal 104 degrees F (40
	,			degrees C), and any 1 of the following clinical signs of BRD,
				including depression, lowered head carriage, nasal and/or ocular
				discharge, coughing, stiff gait or depressed ruminal fossa to
				qualify for treatment for respiratory disease."
1165	(Bailey	None	Not included in	"Calves displaying symptoms of BRD, based on criteria from the
	et al. 2016)		meta-analysis	DART system (Pharmacia Upjohn Animal Health, Kalamazoo,
				MI; Step et al., 2008), were removed from pens and evaluated.
				Each calf with clinical signs of BRD was weighed, rectal
				temperature was measured, and a clinical illness score was
				assigned (scale: 1 to 4; 1 equals normal, 4 equals moribund).
				Calves that presented a clinical illness score greater than 1 and a
				rectal temperature greater than 40 degrees C were treated with
				therapeutic antibiotics according to label directions (first
				incidence - Baytril, Bayer Animal Health, Shawnee Mission, KS;
				second incidence - Nuflor, Merck Animal Health, Summit, NJ)."
1287	(Richeson	None	Included in	"Cattle observed with greater than or equal to 2 visual signs of
	et al. 2015)		meta-analysis	BRD were removed from their pen, restrained and rectal
				temperature (RT) was determined using a digital thermometer.
				Calves with RT greater than or equal to 104 degrees F (40
				degrees C) were considered morbid and were treated with an
				antimicrobial according to a pre-determined protocol specific for
				the current study."
1288	(Rogers	None	Included in	"Standard feedlot protocol specified that cattle must have a
	et al. 2015)		meta-analysis	rectal temperature of greater than or equal to 104 degrees F (40
				degrees C), and clinical signs of BRD, including depression,
				lowered head carriage, nasal and/or ocular discharge, coughing,
1.091	(D	N	N. + :	sum gait, or depressed ruminal lossa, to qualify for treatment."
1631	(Rogers	None	Not included in	A diagnosis of BRD was made when a call demonstrated
	et al. 2009)		meta-analysis	clinical signs of depression (e.g. unresponsive to activity in the
				pen, lowered head, dropped ears, inappetance), absence of signs
				ascribed to other body systems, and a rectai temperature of 104 degrees $F_{c}(40 \text{ degrees } C)$ on higher "
1632	Wildman	None	Not included in	UE (undifferentiated fever/BRD): "A diagnosis of UE was made
1052	(vv numan ot al 2000)	None	mote analysis	when an animal showed evidence of depression as characterized
	ct al. 2009)		incua-anarysis	by lack of response to stimulation, reluctance to move and/or
				abnormal posture/carriage of the head a lack of abnormal
				clinical signs referable to body systems other than the
				respiratory system: a rectal temperature greater than 104.5
				degrees F (40.3 degrees C) and no previous treatment history for
				UF/BRD."

REFID	Citation	Study	Status	BRD Outcome Definition
1650	(Perrett	None	Not included in	Undifferentiated fever (UF): "A diagnosis of UF was made when
1000	$\left(1 \text{ eff}(0)\right)$		meta-analysis	an animal showed evidence of depression as characterized by
	ct al. 2000)		incea-analysis	lack of response to stimulation, reluctones to move and/or
				abrormal posture (corrige of the head, a lask of abrormal
				abiormal posture/carriage of the head; a fack of abiormal
				clinical signs referable to systems other than the respiratory
				system; a rectal temperature greater than 105.0 degrees F (40.6
				degrees C); and no previous treatment history for BRD with no
				fever (NF)."
1792	(MacGregor	None	Not included in	"Calves were observed daily for signs of respiratory disease
	et al. 2003)		meta-analysis	(depression, lack of rumen fill, and ocular or nasal discharge).
				Calves classified as morbid had at least one of these signs and a
				rectal temperature greater than or equal to 103.5 degrees F."
1974	(Malcolm-	None	Not included in	"Calves with BRD symptoms (i.e. nasal discharge, labored
	Callis		meta-analysis	breathing, lethargy and/or emaciated body condition) were
	et al 1994)		j	removed from their pens and weighed. If rectal temperature of
				103 degrees F or greater was obtained sick calves were treated
				with antibiotics "
1070	Wnight	Nono	Included in	"Priofic store were observed following the morning feeding and
1979	(Wright	None	meta analusia	briefly, steers were observed following the morning feeding and
	et al. 1994)		meta-analysis	late in the alternoon, for signs of hasal discharge, ocular
				discharge, gaunt appearance, depression or other signs including
				coughing, irregular, labored or rapid breathing, and shivering.
				One point was assigned for each of the symptoms observed.
				Rectal temperature was recorded for steers receiving two or
				more points. If rectal temperature was greater than or equal to
				40 degrees C the steer was classed as morbid and treated
				according to established protocol for the EBRC."
2038	(Koevering	None	Not included in	"Calves were monitored twice daily for sickness (rectal
	et al. 1992)		meta-analysis	temperature greater than 104 degrees F or visually depressed.)"
2059	(Mills 1991)	None	Not included in	"The number of ill calves removed (sick pulls) from the pen on
			meta-analysis	the basis of exhibiting respiratory clinical signs"
2060	(Bechtol	1988 study	Not included in	"All calves exhibiting signs of coughing, depression, dullness,
	et al. 1991)		meta-analysis	anorexia, labored breathing or excessive nasal discharge were
	,		, i i i i i i i i i i i i i i i i i i i	removed from the pens for individual examination and
				treatment. Based on these clinical signs, a diagnosis of
				undifferentiated BRD was made and antibiotic therapy was
				administered "
2078	(McLean	None	Included in	"Signs used to diagnose the disease were excessive nasal
2010	$\left(\frac{11010000}{10000}\right)$		meta-analysis	discharge coughing labored breathing lethargy reluctance to
	ct al. 1550)		incea-analysis	ast and a rootal temperature exceeding 104 degrees F."
2140	(Jim	None	Not included in	"A diagnosis of undifferentiated boying requiretory disease was
2140	(JIII at al. 1088)	None	Not included in	A diagnosis of undimerentiated bovine respiratory disease was
	et al. 1900)		meta-analysis	inade if the following criteria were satisfied. 1) the individual
				animal treatment record showed no history of treatment for
				sickness, 2) the rectai temperature was greater than or equal to
				104 degrees F , 3) there were no clinical signs referable to organ
				systems other than the respiratory tract, 4) there were no
				clinical signs indicating possible advanced lung pathology such
				as obvious weakness, dyspnea, or severe dehydration."
2165	(Smith	None	Not included in	"If the body temperature exceeded 104 degrees F the animal
	et al. 1986)		meta-analysis	was considered sick. Animals could also be classified as sick
				based on clinical signs."
2176	(Thomas	None	Included in	Not reported
	et al. 1986)		meta-analysis	
2215	(Morter	None	Not included in	"The judgment of the investigators of the clinical condition of
	et al. 1984)		meta-analysis	the calf, not just a temperature of 104 degrees F or greater
			J	determined initiation of antimicrobial treatment."
2255	(Morter &	None	Not included in	"Some steers with rectal temperatures of less than 104 degrees
12200	Amstutz		meta-analysis	F but other clinical signs of RRD were put on treatment "
	1983)		incoa anary 515	, sur other entitiest signs of bitb were put on treatment.
2281	(Bennott	None	Not included in	"Animals with rootal temporatures in average of 102.5 decrease F
2201	1082)	TIOLE	moto analusia	or those with persisting signs of aligned disease."
	1904)		meta-analysis	or mose with persisting signs of chilical disease

REFID	Citation	Study	Status	BRD Outcome Definition
2282	(Morter	None	Not included in	"The criteria for establishing a diagnosis of BRD were serous
	et al. 1982)		meta-analysis	nasal discharge, respiratory rate, general attitude, gait and
				rectal temperature of 104.0 degrees F or higher."
2297	(Amstutz	None	Not included in	"A rectal temperature of 104 degrees F or greater and/or the
	et al. 1981)		meta-analysis	clinical condition of the animal indicated that antibiotic therapy
				should be initiated."
2339	(Griffin	None	Included in	"All calves were observed daily, calves showing early signs of
	et al. 1979)		meta-analysis	BRD; cough, mild anorexia, changes in attitude and gait,
				dyspnea, and serious occulonasal discharges were removed from
				the pen for examination. Animals with a rectal temperature
				greater than 39.4 degrees C were treated by the following
				regimen."
3305	(Schunicht	None	Not included in	"In this study, the case definition for UF (undifferentiated fever)
	et al. 2003)		meta-analysis	was a lack of abnormal clinical signs referable to body systems
				other than the respiratory system and an elevated rectal
				temperature of greater than 40.5 degrees C."
4016	(McKaig &	None	Included in	Not reported
	Taylor 2015)		meta-analysis	
4166	(Frank	No	Not included in	"Signs monitored included nasal or ocular discharge, labored
	et al. 2002)	prophylactic	meta-analysis	breathing, lethargy, and emaciated body condition. Steers that
		florfenicol		had signs of RTD (respiratory tract disease) were moved to a
				processing facility, and those with rectal temperature greater
	1010			than 39.7 degrees C received antibiotics."
4167	(O'Connor	Feedlot B	Not included in	Not reported
41.00	et al. 2001)		meta-analysis	
4108	(0 Connor)	reediot C	mote enclusio	Not reported
4160	(Bochtol	1080 study	Not included in	Not reported
4105	(Decision)	1909 Study	meta-analysis	Not reported
4170	(Thorlakson	Banch calves	Not included in	Body temperature greater than 39.5 degrees C. "A diagnosis of
1110	et al. 1990)		meta-analysis	undifferentiated BRD was made on these 'pulled' calves if, on
				the first examination by animal health staff, the animal had no
				clinical signs which indicated that organ systems other than the
				respiratory system were involved. Most, but not all, cases of
				BRD were febrile (greater than 39.5 degrees C) on examination."
5003	(Stilwell	None	Included in	"Clinical signs used in the selection of BRD affected animals
	et al. 2008)		meta-analysis	were: isolation from herdmates, decreased appetite, depression
				(first signs detected by herdsman) and dyspnea, cough, nasal and
				ocular discharge and hyperthermia (greater than 39.5 8 degrees
				C), that resulted from the vet-conducted physical examination.
				Only animals showing all of these signs (albeit with different
				severities) were included in the BRD-affected group."
5005	(Van Donkers-	Trial #1	Not included in	"The case definition of first time treatment for BRD was as
	goed		meta-analysis	follows: 1) a rectal temperature greater than or equal to 40.0
	et al. 1990)			degrees C (fever); 2) an appearance that was subjectively
				different from perimates; and 3) the absence of clinical signs
				autoutable to any organ system other than the respiratory
5006	(Van Donkorg	Trial #3	Not included in	"The case definition of first time treatment for RPD was as
5000	good	$\frac{111a1}{\#}$	mota analysis	follows: 1) a roctal temporature greater than or equal to 40.0
	d t = 1 1000		meta-analysis	degrees C (fover): 2) an appearance that was subjectively
	(al. 1990)			different from permates: and 3) the absence of clinical signs
				attributable to any organ system other than the respiratory
				system."
5007	(Van Donkers-	Trial #4	Not included in	"The case definition of first time treatment for BRD was as
	goed		meta-analysis	follows: 1) a rectal temperature greater than or equal to 40.0
	et al. 1990)			degrees C (fever); 2) an appearance that was subjectively
	Í Í			different from penmates; and 3) the absence of clinical signs
				attributable to any organ system other than the respiratory
				system."

REFID	Citation	Study	Status	BRD Outcome Definition
5008	(Van Donkers-	Trial #5,	Not included in	"The case definition of first time treatment for BRD was as
	goed	Yearlings	meta-analysis	follows: 1) a rectal temperature greater than or equal to 40.0
	et al. 1990)			degrees C (fever); 2) an appearance that was subjectively
				different from penmates; and 3) the absence of clinical signs
				attributable to any organ system other than the respiratory
				system."
5009	(Van Donkers-	Trial #5,	Not included in	"The case definition of first time treatment for BRD was as
	goed	Calves	meta-analysis	follows: 1) a rectal temperature greater than or equal to 40.0
	et al. 1990)			degrees C (fever); 2) an appearance that was subjectively
				different from penmates; and 3) the absence of clinical signs
				attributable to any organ system other than the respiratory
				system."

Table S9: Definitions of Bovine Respiratory Disease (BRD) reported by authors of studies relevant to the review.

REFID	Citation	Random	Sequence	Baseline	Intended	Missing	Mismeasured	Selective
		Sequence	Concealment	Imbalances	Interventions	Outcome Data	Outcomes	Outcome Reporting
72	(van	No	Probably yes	No	Low	Low	Low	Some
	Donkersgoed et al. 1993)	information random		information				concerns
73	(Harland	No	No	No	Low	Low	Low	Some
	et al. 1992)	information random	information	information				concerns
75	(Thorlakson et al. 1990)	Probably no	Probably yes	No information	Low	Low	Low	Some concerns
76	(Bateman 1988)	No information random	Probably yes	No information	Low	Low	Low	Some concerns
77	(Martin et al. 1984)	No information	Probably yes	No information	Low	High	Some concerns	Some concerns
41.4	(0	random			т	т	т	C
414	(Grooms et al. 2014)	Yes	Probably yes	Probably no	Low	Low	Low	Some concerns
509	(Kirkpatrick	Yes	Probably yes	No	Low	Low	Low	Some
513	(Wildman et al. 2008)	Yes	Probably yes	No	Low	Low	Low	Some
577	(Frank ot al. 2003)	NC	NC	NC	NC	NC	NC	NC
595	(Frank ot al. 2002)	No	Probably yes	No	Low	Low	Low	Some
608	(O'Connor ot al. 2001)	No	Probably yes	No	Low	Low	Some	Some
622	(Gummow &	No	Probably yes	No	Low	Low	Low	Some
022	Mapham 2000)	information random	1 100abiy yes	110	20.	10.	101	concerns
772	(Ribble et al. 1988)	Probably no	Probably yes	No information	Low	Low	Low	Some concerns
808	(Purdy	No	Probably yes	No	Low	Low	Low	Some
	et al. 1986)	information random		information				concerns
836	(Confer	No	Probably yes	No	Low	Low	Low	Some
	et al. 1983)	information random		information				concerns
863	(Wohler & Baugh 1980)	No	Probably yes	No information	Low	Low	Low	Some concerns
1024	(White et al. 2017)	Yes	Probably yes	No	Low	Some concerns	Low	Some concerns
1115	(Rogers et al. 2016)	Yes	Probably yes	No	Low	Low	Low	Some concerns
1165	(Bailey et al. 2016)	No information random	Probably yes	No	Low	Low	Low	Some concerns
1287	(Richeson et al. 2015)	No information random	Probably yes	Probably no	Low	Some concerns	Low	Some concerns
1288	(Rogers et al. 2015)	Yes	Probably yes	No	Low	Low	Low	Some
1631	(Rogers	No	Probably ves	No	Low	Low	Low	Some
~~-	et al. 2009)	information						concerns
1632	(Wildman et al. 2009)	Yes	Probably yes	No	Low	Low	Low	Some concerns

REFID	Citation	Random	Sequence	Baseline	Intended	Missing	Mismeasured	Selective
		Sequence	Concealment	Imbalances	Interventions	Outcome	Outcomes	Outcome
		1				Data		Reporting
1650	(Perrett	Yes	Probably yes	No	Low	Low	Low	Some
	et al. 2008)							concerns
1792	(MacGregor	Yes	Probably yes	No	Low	Some	Low	Some
	et al. 2003)			information		concerns		concerns
1974	(Malcolm-Callis	No	Probably yes	No	Low	Low	Low	Some
	et al. 1994)	information at		information				concerns
		all						
1979	(Wright	No	Probably ves	Probably no	Low	Low	Low	Some
	et al. 1994)	information	5 5 5 5	J				concerns
	,	random						
2038	(Koevering	No	Probably yes	Probably yes	Low	Low	Low	Some
	et al. 1992)	information at	0 0	0 0				concerns
	,	all						
2059	(Mills 1991)	No	Probably yes	No	Low	Low	Some	Some
	· /	information		information			concerns	concerns
		random						
2060	(Bechtol	Yes	Probably yes	No	Low	Low	Low	Some
	et al. 1991)			information				concerns
2078	(McLean	No	Probably yes	No	Low	Low	Low	Some
	et al. 1990)	information		information				concerns
		random						
2140	(Jim	Probably no	Probably yes	No	Low	Low	Low	Some
	et al. 1988)			information				concerns
2165	(Smith	No	Probably yes	Probably no	Low	Low	Some	Some
	et al. 1986)	information					concerns	concerns
		random						
2176	(Thomas	No	Probably yes	No	Low	Low	Low	Some
	et al. 1986)	information at		information				concerns
		all						
2215	(Morter	Yes	Probably yes	No	Low	Low	Some	Some
	et al. 1984)			information			concerns	concerns
2255	(Morter &	Yes	Probably yes	No	Low	Low	Some	Some
	Amstutz 1983)			information	_		concerns	concerns
2281	(Bennett 1982)	No	Probably yes	Probably yes	Low	Low	Some	Some
		information at					concerns	concerns
		all	5 1 11		-	-	-	a
2282	(Morter	Yes	Probably yes	No	Low	Low	Low	Some
0007	et al. 1982)	37		information	т	T	q	concerns
2297	(Amstutz	Yes	Probably yes	Probably yes	Low	Low	Some	Some
0000	et al. 1981)	NT		NT	т	C	concerns	concerns
2339	(Grimn = 1.1070)	INO	Probably yes	NO	Low	Some	Low	Some
	et al. 1979)	information		information		concerns		concerns
2205	(Cohumicht	random	Duch chlar woo	No	Low	Low	Low	Como
3303	(Schunicht	ies	r tobably yes	NO	LOW	LOW	LOW	Some
4016	(McKnig l	Voc	Probably you	No	Low	Somo	Low	Some
4010	(MCRaig & Taylor 2015)	168	r robably yes	information	LOW	concorns	LOW	concorns
4166	(Frank	No	Probably yes	No	Low	Low	Low	Some
4100	(11 and (11	110	1 lobably yes	information	LOW	LOW	LOW	concerns
4167	$(\Omega^{2}Connor)$	No	Probably yes	No	Low	Low	Some	Some
4107	(0, 0, 0, 0, 0)	NO	i iobably yes	information	LOW	LOW	concerns	concerns
4168	(O'Connor	No	Probably ves	No	Low	Low	Some	Some
1100	(0,0001)	1.0	1 1000001y yes	information	10m	TOW	concerns	concerns
4169	(Bechtol	No	Probably yes	No	Low	Low	Some	Some
1100	et al. 1991)	information at	1 105001y yes	information	2011	1011	concerns	concerns
		all						2011001110

REFID	Citation	Random	Sequence	Baseline	Intended	Missing	Mismeasured	Selective
		Sequence	Concealment	Imbalances	Interventions	Outcome	Outcomes	Outcome
						Data		Reporting
4170	(Thorlakson	No	Probably yes	No	Low	Low	Low	Some
	et al. 1990)	information random		information				concerns
5003	(Stilwell	No	Probably yes	Probably yes	Low	Low	Low	Some
	et al. 2008)							concerns
5005	(Van Donkers-	Yes	Probably yes	No	Low	Low	Low	High
	goed			information				
	et al. 1990)							
5006	(Van Donkers-	No	Probably yes	No	Low	Low	Low	High
	goed	information		information				
	et al. 1990)	random						
5007	(Van Donkers-	No	Probably yes	No	Low	Low	Low	High
	goed	information		information				
	et al. 1990)	random			_	_	_	
5008	(Van Donkers-	No	Probably yes	No	Low	Low	Low	High
	goed			information				
K 000	et al. 1990)		D 1 11	27	Ŧ	T	T	TT: 1
5009	(Van Donkers-	No	Probably yes	No	Low	Low	Low	High
	goed			information				
	et al. 1990)							

Table S10: Risk of bias for studies included in the review. NC = not conducted because no numerical results were reported.



Probability of failure

Figure S1: Distributions of the probability of response for each treatment.

Comparison	Number of studios	Pandomization	Plinding	Agross studios bios	Improvision	Hotorogonoity
	Number of studies	Maion concome	Sama aanaanna	Across.studies.bias	Major concerns	Ne components
A:NAU DOVA ADDE NA C	2	Major concerns	Some concerns	Undetected	Major concerns	No concerns
BOVA4PRE:NAC	1	Major concerns	Major concerns	Undetected	Major concerns	No concerns
I:NAC	2	Some concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:O	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:P	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:Q	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:R	1	Major concerns	No concerns	Undetected	Major concerns	No concerns
NAC:Z	1	Major concerns	No concerns	Undetected	Major concerns	No concerns
O:P	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
O:Q	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
P:Q	1	Major concerns	Some concerns	Undetected	Major concerns	No concerns
R:Z	1	Major concerns	No concerns	Undetected	Major concerns	No concerns
A:BOVA4PRE	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
A:I	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
A:O	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
A:P	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
A:Q	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
A:R.	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
A·Z	ů.	Major concerns	No concerns	Undetected	Major concerns	No concerns
BOVA4PRE:I	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
BOVA/PRE:O	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
BOVAPREP	0	Major concerns	Some concerns	Undetected	Major concerns	No concorns
DOVA ADDE.O	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
BOVAPRER	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
DOVATI NE:R	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
DUVA4PKE:Z	0	Major concerns	no concerns	Undetected	Major concerns	No concerns
1:0	0	Major concerns	Some concerns	Undetected	major concerns	ino concerns
I:P	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
1:Q	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
I:R	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
I:Z	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
O:R	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
O:Z	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
P:R	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
P:Z	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
Q:R	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
Q:Z	0	Major concerns	Some concerns	Undetected	Major concerns	No concerns
H:NAC	1	Some concerns	Some concerns	Undetected	Major concerns	No concerns
L:NAC	1	Some concerns	Some concerns	Undetected	No concerns	Major concerns
M:NAC	1	Some concerns	Major concerns	Undetected	Major concerns	No concerns
NAC:PRESBOV	1	Some concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:T	1	Some concerns	Some concerns	Undetected	Major concerns	No concerns
NAC:Y	1	Some concerns	Major concerns	Undetected	Major concerns	No concerns
A-G:AUTONONAME3	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
A-G:H	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
A-G:L	0	Some concerns	Some concerns	Undetected	Some concerns	Some concerns
A-G·M	0	Some concerns	No concerns	Undetected	Major concerns	No concerns
A-G:NAC	0	Major concerns	No concerns	Undetected	Major concerns	No concerns
A-G:PRESBOV	Ő	Some concerns	Some concerns	Undetected	Major concerns	No concerns
A-G:T	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
A-G·Y	0	Some concerns	No concerns	Undetected	Major concerns	No concerns
AUTONONAME3.H	0	Some concorns	Some concorns	Undetected	Major concerns	No concerns
AUTONONAMES	0	Some concorns	Some concorns	Undetected	Major concerns	No concerns
AUTONONAMES.D	0	Some concerns	Major concerns	Undetected	Major concerns	No concerns
AUTONONA ME9.NAC	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
AUTONONAME9.DDECDOV	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
AUTONONAMES: PRESBUV	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
AUTONONAMES I	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
AUTONONAME3: Y	0	Some concerns	Major concerns	Undetected	Major concerns	No concerns
H:L	0	Some concerns	Some concerns	Undetected	No concerns	Major concerns
H:M	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
H:PRESBOV	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
H:T	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
H:Y	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
L:M	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
L:PRESBOV	0	Some concerns	Some concerns	Undetected	No concerns	Major concerns
L:T	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
L:Y	0	Some concerns	Some concerns	Undetected	Some concerns	Some concerns
M:PRESBOV	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
M:T	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
M:Y	0	Some concerns	Major concerns	Undetected	Major concerns	No concerns
PRESBOV:T	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
PRESBOV:Y	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns
T:Y	0	Some concerns	Some concerns	Undetected	Major concerns	No concerns

Table S11: Risk of bias for randomization, blinding, across-study bias, imprecision, and heterogeneity.

Question	Response and action
Title and abstract screening Q1) Based on the title/abstract, does the study describe primary research involving assessment of vaccines for the prevention of BRD in feedlot cattle?	Yes/Unclear (proceed to next question)
Ω^{2}) Based on the title/abstract, is there a concurrent comparison	No (exclude) No, but is a relevant review (exclude) Yes/Unclear (proceed to full-text assessment)
group (i.e., controlled trial with natural or deliberate disease expo- sure or analytical observational study)?	
	No (exclude)
Q1) Is the full text available in English?	Yes (proceed to next question) No (not in English) (specify language) (exclude) No (unable to obtain .pdf) (exclude) No (conference abstract, less than 500 words) (ex-
	clude)
Q2) Based on the full text, does the study involve primary research on the assessment of vaccines for the prevention of BRD in feedlot cattle?	Yes (proceed to next question)
	No (exclude)
Q3) Correct study design: Is the study a field trial (where an investigator is allocating animals to groups) with naturally occurring BRD?	Yes (proceed to the next question)
	No Challenge study (Indicate the organism(s) studied) (exclude)
	No - Observational study (Indicate the organism(s) studied) (exclude)
Q4) Based on the full text, is there a concurrent comparison group?	Yes (proceed to next question) No (exclude)
Q5) Correct population: Is the study population weaned calves in a non-grazing situation with naturally occurring BRD, i.e., feedlot cattle?	Yes (proceed to next question)
	No (exclude)
Q6) Correct Interventions and Comparator: Does the study assess the use of a commercially available monovalent or polyvalent vaccine for one of the following organisms (<i>Mannheimia haemolytica, Pas-</i> <i>teurella heamolytica, Pasteurella multocida, Histophilus somni</i> or <i>Mycoplasma bovis</i> , bovine herpesvirus, bovine viral diarrhea virus, bovine respiratory syncytial virus, and parainfluenza type 3 virus)?	Yes (proceed to next question)
	No (exclude)
Q7) Correct outcome: Does the study report the risk of BRD in the study groups?	Yes (proceed to data extraction)
	No (exclude)

Table S12: Screening questions, response options and resulting actions for title/abstract and full-text screening.

	Mean	Median	Min	Max	0.025 quantile	0.975 quantile
NAC	0.61	0.67	0.00	1.00	0.07	0.98
Pyramid $5 + Presponse SQ$	0.57	0.63	0.00	1.00	0.00	1.00
Bovalan-4K + Presponse	0.62	0.70	0.00	1.00	0.02	1.00
Presponse	0.63	0.71	0.00	1.00	0.04	0.99
Bovi-Shield Gold	0.60	0.67	0.00	1.00	0.02	1.00
Rispoval	0.69	0.79	0.00	1.00	0.05	1.00
Poly-Bac B	0.87	0.97	0.00	1.00	0.14	1.00
PRECON-PH	0.65	0.75	0.00	1.00	0.02	1.00
Somnu-Star	0.59	0.66	0.00	1.00	0.01	1.00
Resbo IBR-BVD	0.66	0.76	0.00	1.00	0.02	1.00
LLPH	0.64	0.74	0.00	1.00	0.02	1.00
Bovi-Shield Gold One Shot	0.56	0.60	0.00	1.00	0.01	1.00
Autog	0.65	0.76	0.00	1.00	0.01	1.00
Presponse + Bovilan	0.54	0.58	0.00	1.00	0.01	0.99
Somnu-Star PH	0.59	0.67	0.00	1.00	0.01	1.00
Once PMH	0.55	0.58	0.00	1.00	0.01	1.00
Pneumo-Star	0.55	0.58	0.00	1.00	0.01	1.00

Table S13: Summary of probability of treatment response.