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Supplementary Material

Chronic hepatitis B prevalence in Australian Aboriginal and Torres Strait Islander people before and after implementing a universal vaccination program: a systematic review and meta-analysis

Simon Graham[A,B,F], *Jennifer H. MacLachlan*[B,C], *Praveena Gunaratnam*[D] *and Benjamin C. Cowie*[B,C,E]

[A]London School of Hygiene and Tropical Medicine, Keppel Street, London WC1H 9SH, UK.

[B]The Peter Doherty Institute for Infection and Immunity, 792 Elizabeth Street, Melbourne, Vic. 3004, Australia.

[C]Faculty of Medicine, Dentistry and Health Sciences, University of Melbourne, Grattan Street, Parkville, Vic. 3010, Australia.

[D]Kirby Institute, Wallace Wurth Building, UNSW Sydney, Sydney, NSW 2052, Australia.

[E]Victorian Infectious Disease Service, Royal Melbourne Hospital, 300 Grattan Street, Parkville, Vic. 3050, Australia.

[F]Corresponding author. Email: grahams1@unimelb.edu.au

Table S1. Search strategies

Database	Years	Search strategy
Embase	1st January 1981 until 4th April 2018	#1 explode "Indigenous".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] #2 explode "Aborigin*".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word #3 explode "Australi*".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] #4 explode "Hepatitis B".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] #5 explode "hbsag".mp. [mp=title, abstract, heading word, drug trade name, original title, device manufacturer, drug manufacturer, device trade name, keyword, floating subheading word, candidate term word] #6 #1 or #2 #7 #4 or #5 #8 #3 and #6 #9 #7 and #8
Medline	1st January 1981 until 4th April 2018	#1 explode "Indigenous".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] #2 explode "Australi*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] #3 explode "Aborigin*".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] #4 explode "Hepatitis B".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] #5 explode "hbsag".mp. [mp=title, abstract, original title, name of substance word, subject heading word, keyword heading word, protocol

		supplementary concept word, rare disease supplementary concept word, unique identifier, synonyms] #6 #1 or #3 #7 #4 or #5 #8 #2 and #6 #9 #7 and #8
Web of Science	1st January 1981 to 4th April 2018	#1 explode "hepatitis B" Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years #2 explode "hbsag" Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years #3 explode "indigenous" Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years #4 explode "aborigin*" Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years #5 explode "Australi* Indexes=SCI-EXPANDED, SSCI, A&HCI, CPCI-S, CPCI-SSH, ESCI Timespan=All years #6 #1 or #2 #7 #4 or #5 #8 #3 and #6 #9 #7 and #8

Table S2. Information about the selection of participants, laboratory test used and sample size of each included studies.

Author, year published	Item	Further information
Burrell, 1983		
	Selection of participants	• Sample of Aboriginal people living in a remote area of South Australia • Analysis of blood bank data • No information was provided on how the Aboriginal sample was selected
	Laboratory test used	• Specimens were tested for HBsAg using radioimmimoassay (Austria II, Abbott Laboratories, or Gemma Coat, Travenol, Inc. • Positive HBsAg specimens were confirmed by neutralisation with HB-HBs antibody
	Sample size	• 327 Aboriginal adults
Britton, 1985		
	Selection of participants	• Pregnant women attending the antenatal clinic at King George V. Hospital in Sydney from 1st August 1983 to 30th July 1984.
	Laboratory test used	• Specimens were tested for HBsAg using radioimmimoassay (Austria II, Abbott Laboratories)
	Sample size	• 5,678 Aboriginal pregnant women
Holman, 1987		
	Selection of participants	• A random sample of 1,685 Aboriginal people aged 12 years or older in Western Australia were selected from the Community Health Register on 31st December 1985 • The sample was then stratified in six age-sex groups to obtain 250 in each group • The 1,685 people's names were given to community field officers to identify these individuals, explain the project and gain their consent to participate • Of the 1,685 Aboriginal people on the register, 1337 (79%) were identified. • Of the 1337, 2% refused to participate • Of the 1309 who did participate, blood specimens were collected and transported to Perth for HBV testing • 159 blood specimens were lost while being transported to the laboratory in Perth and these blood specimens were not re-collected from these individuals. • Final sample was 1,150

	Laboratory test used	• Specimens were tested using enzyme immunoassay kits (Abbott Laboratories, Chicago)
	Sample size	• 177 Aboriginal teenagers and 973 Aboriginal adults
Moore, 1987		
	Selection of participants	• Women who gave birth in the state of Western Australia (excluding the urban area of Perth) from 1st January 1983 to 28th February 1985 • Women were identified through the Western Australian Midwives Notification System which collect information on all births more than 20 weeks gestation. Information is collected by midwives. • The WA Midwives Notification System identified more Aboriginal births than the birth registration system • HBsAg testing data from the State Health Laboratory Service were used, which services all non-metropolitan hospitals in WA. • Aboriginal mothers from the midwives system were matched with their laboratory results the laboratory service to examine HBsAg testing results.
	Laboratory test used	• Western Australian State Health Laboratory Service. No information was provided the about the specific testing kit used.
	Sample size	• 817 Aboriginal pregnant women
Campbell, 1989		
	Selection of participants	• A seroepidemiological study of markers of infection with hepatitis B virus in Brewarrina, a town in north-western New South Wales • 41.5% of the towns residents were tested
	Laboratory test used	• Specimens were tested by enzyme immunoassay (Auszyme EIA: Abbott Laboratories, North Chicago)
	Sample size	• 375 Aboriginal people
Gill, 1989		
	Selection of participants	• Children aged 4-19 years attending district schools in Broome and Derby (remote area of Western Australia) were recruited in March 1989 • Parents who consented to their child being recruited were included
	Laboratory test used	• Specimens tested using enzyme immunoassay (Abbott laboratories, North Chicago, Illinois, USA)
	Sample size	• 186 Aboriginal children

Campbell, 1991		
	Selection of participants	• Infants and children aged 0-16 were screened for HBV in a small community in western New South Wales. This represented 95% of infants/children in this small community • Aboriginal children in this town outnumbered non-Aboriginal children by 2.7:1 • For school aged children information was collected from the child in the presence of a teacher and for infants aged less than 5 years, information was provided by a parent
	Laboratory test used	• Specimens were tested by enzyme immunoassay (Auszyme EIA: Abbott Laboratories, North Chicago)
	Sample size	• 297 Aboriginal people
Van Buynder, 1991		
	Selection of participants	• Randomly selected Aboriginal children and adults were selected from three Aboriginal communities in the Northern Territory who volunteered for a renal disease study
	Laboratory test used	• Specimens tested using Wellcozyme HBsAg enzyme immunoassay (Wellcome Diagnostics, Dartford, England)
	Sample size	• 327 Aboriginal adults and 180 Aboriginal children
Gardner, 1992		
	Selection of participants	• Children aged 5-7 years attending selected schools in the Northern Territory were recruited. • Consent forms were sent to parents, 70-90% of consent forms were returned to the school and 5% refused to allow their child to participate • The children's wider family were asked to complete a survey • Overall, 1,104 children were included in the study
	Laboratory test used	• Finger prick blood samples were collected in micro serum separation tubes (Microtainer, Becton Dickson, Rose Park, SA) and the sera separated within 24 hours. • Specimens were tested using enzyme immunoassay for HBsAg (Auszyme, Abbott Diagnostics, Sydney, NSW) at the Institute of Medical and Veterinary Science Adelaide.
	Sample size	• 439 Aboriginal people
Hart, 1993		
	Selection of participants	• Adult attendees of an urban sexual health clinic in Adelaide from 1988-1991

	Laboratory test used	• Blood specimens tested for HBsAg using enzyme immunoassay (Auszyme Monoclonal, Abbott Laboratories)
	Sample size	• 2,555 Aboriginal adults
Patterson, 1993		
	Selection of participants	• Participants selected from a small town in New South Wales (total pop. 3,086) • All Aboriginal people in the town were offered testing and a random selection of non-Aboriginal people were sent letters in the post • Recruitment noticed were placed in a local newspaper • Blood specimens were collected at schools, hospitals, community health centre, medical centre, and private homes
	Laboratory test used	• Radio-immunoassays for HBsAg was carried out using Austria-11 and CORAB (Abbott Laboratories, Chicago, IL, USA)
	Sample size	• 236 Aboriginal adults (1983-1984) • 212 Aboriginal adults (1987-1988)
Hanna, 1995		
	Selection of participants	• Aboriginal pregnant women were recruited from 10 communities in northern Queensland • Children fully vaccinated for HBV, poliomyelitis and measles were included
	Laboratory test used	• Specimens were tested for enzyme immunoassay using Monolisa anti-HBs 2nd generation; Sanofi Diagnostic Pasteur, Inc at the Royal Brisbane Hospital, Queensland
	Sample size	• 97 Aboriginal pregnant women
Hanna, 1997		
	Selection of participants	• Aboriginal children aged 3-7 years and Aboriginal pregnant women aged 15-45 years were recruited in northern Queensland • Children had to receive three-doses of HBV vaccination in infancy with the first dose given within 7 days of birth to be included
	Laboratory test used	• Specimens tested using a commercially available kit (MurexHBsAg, Murex Diagnostics Ltd, Dartford, England)
	Sample size	• 211 Aboriginal pregnant women and 239 Aboriginal children
Butler, 1997		

	Selection of participants	• All prisoners aged 17-73 years entering the prison were invited to join a HBV survey • All Prisoners were offered HIV and HBV testing • 28% consented to be tested for HBV and hepatitis C
	Laboratory test used	• Specimens were tested using HBsAg-enzyme immunoassay (Murex, Dartford), positive results were confirmed by HBs reverse passive haemagglutination assay (Serodia, Tokyo)
	Sample size	• 12 Aboriginal prisoners
Malcolm, 1999		
	Selection of participants	• The study was initiated because the Tropical Public Health Unit was notified of five new HBsAg positive teenagers who all lived in the same Aboriginal community • Aboriginal people aged 26-30 were included in the study • All residence born between 1981 and 1985 (inclusive) were identified through the community health centre records and their vaccination status was obtained from the Queensland Health database and from records held at the local hospital • Individuals with an incomplete HBV vaccination record (not having all three doses) were follow up and a blood specimen was taken
	Laboratory test used	• Specimens tested using commercially available enzyme immunoassay kits (AxSYM, Abbott Laboratories, Abbott Park, Illinois)
	Sample size	• 102 Aboriginal teenagers
O'Sullivan, 2004		
	Selection of participants	First method: • Used stored sera from 45 laboratories around Australia from July 1996 to May 1999. • Included equal number of males and females of individuals aged 1-59 years. • 81 specimen were insufficient for HBsAg and 19 had a weak positive result for HBsAg Second method: • Pregnant females aged 20-39 years from 1998-2000
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 266 Aboriginal pregnant women
Romanes, 2006		

	Selection of participants	• Women aged 15-47 years who gave birth at the Royal Darwin Hospital from January to December 2003 and were recorded into the CareSys patient system • The laboratory testing and result were collected from the hospital pathology laboratory or CDC notification dataset from 2003 or medical records from the Childhood Immunisation Database indicating HBIG was given to the infant in 2003 • 94.3% (1407/1515) births in 2003 were screened for HBV
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 540 Aboriginal pregnant women
Panaretto, 2006		
	Selection of participants	• Aboriginal pregnant females aged 15-40 who were attending an Aboriginal Health Service in northern Queensland (Townsville) were recruited • STI and HBV testing occurred in the first trimester
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 456 Aboriginal pregnant females
Schultz, 2007		
	Selection of participants	• Audit of hospital records in 2003 at the Royal Darwin hospital and in 2005 at the Alice Springs hospital for pregnant women who gave birth • Hospital records of >98.7% of women who gave birth in the above years were identified and included • HBsAg testing and results were identified in >95.4% of women who gave birth
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 973 Aboriginal pregnant women
Schultz, 2008		• No laboratory testing information was reported
	Selection of participants	• Analysis of hospital records • Pregnant females who gave birth in two hospitals in the Northern Territory • 71% of all Aboriginal births occur in these two hospitals annually • >95.4% of HBsAg testing results were available for the study • 90% of pregnant females giving birth at the 2 hospitals were tested for HBsAg

	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 973 Aboriginal pregnant women
Einsiedel, 2008		
	Selection of participants	• Study located at the Alice Springs hospital (regional area of the Northern Territory). • ~70% of the patients that use this hospital are Aboriginal • ~40% of all deaths in the region occur at this hospital • Examined the pathogens and infective foci of patients 15 years or older who had died during admission to the hospital from 1st January 2000 to 31st December 2005 • Used morbidity codes entered into the hospital's patient system. These codes follow the International classification of diseases, 10th version • An infection related death was defined as either the principle or an additional cause of admission
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 209 Aboriginal adults
Gilles, 2008		
	Selection of participants	• Medical notes of all prisoners were audited over a week by a physician in May 2006 • 84% of prisoners included in the audit were tested for HBsAg • 92% were male prisoners
	Laboratory test used	• HBsAg positivity was determined by a laboratory test by reviewing electronic or paper based records of the prisoner, however the specific laboratory test was not reported
	Sample size	• 155 Aboriginal prisoners
van der Poorten, 2008		
	Selection of participants	• 12-19 year old people in custody (young offenders) in New South Wales • 68% consented to give a blood specimen and complete the survey. Reasons included not liking needles or not believing the blood would not be used to test for drug use as the main purpose of the study was to examine hepatitis C infection. • Excluded violent offenders, those at court, those who had mental health problems or were having substance withdrawals on the day the survey was conducted

		• The two above factors could have resulted in underestimating HBsAg infection
	Laboratory test used	• Reported hepatitis C laboratory testing information only (enzyme Immunoassay Abbott AxSYM, Abbott Diagnostics, Abbott Park, Illinois, USA)
	Sample size	• 179 Aboriginal young offenders
Wood, 2008	Selection of participants	• All women who gave birth in the Northern Territory (NT) and were registered on the Midwives Data Collection System • HBsAg testing and results from the NT Government Pathology Service were linked to the MDCS to match pregnant women and their HBV results • Only 18% (1061/5788) records were matched
	Laboratory test used	• Specimens tested at the Northern Territory Government Pathology Service but no specific laboratory testing information was reported
	Sample size	• 522 Aboriginal pregnant women
Carroll, 2010		
	Selection of participants	• Clinical audit of adults who had an adult health check at one Aboriginal Health Service • Only 48% who had an adult health check were tested for HBsAg (107 of 220 were tested for HBsAg)
	Laboratory test used	• Specimens tested by Sullivan Nicolaides Pathology however the specific laboratory test was not reported
	Sample size	• 107 Aboriginal adults
Carroll, 2010		
	Selection of participants	• A clinical audit of the patient system at one Aboriginal Medical Service in Queensland of adult who had an Adult Health Check which included HBV testing in 2008
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 107 Aboriginal adults
Dent, 2010		
	Selection of participants	• Serosurvey of Aboriginal children in one community who had been vaccinated at birth for HBV in 1989-1990 • Blood specimens of these 15-16 year olds were collected between May –July 2005 • HBV status of their mothers is unknown

		• 48 teenagers were identified for recruitment but 11 could not be located
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 37 Aboriginal teenagers
Templeton, 2010		
	Selection of participants	• Clinical audit was conducted on all male detainees at Juvenile Justice Centre in regional New South Wales • The Centre has an ongoing STI/BBV outreach education and screening program offered by the local sexual health clinic in Dubbo • Audit was conducted between November 2000 and November 2004 • 107 males were tested on 130 occasions during the study period • Inmates with a high risk of infection were more likely to consent to testing. • Under-reporting of symptoms. Some males presented with symptoms that were suggestive of STI infection however the medical officer did not test or treat these males before the commencement of the study
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 101 Aboriginal inmates
Aratchige, 2012		
	Selection of participants	• Statistical analysis of Northern Territory Notifiable Diseases System from 1991 to 2011
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 70,338 Aboriginal adults
Liu, 2012		
	Selection of participants	• Data linkage study using two data registers to calculate HBsAg among pregnant women giving birth in the Northern Territory. • The Northern Territory Perinatal Register and the Northern Territory Notifiable Diseases System • Study limited the inclusion criteria to women who gave birth in a public hospital as 99% of Aboriginal pregnant women give birth as public patients. • Aboriginal women accounted for 52.6% of the final cohort • Excluded women born overseas (n=2,024) or not usually a resident of the Northern Territory

		• Women were classified as having chronic HBV is they had at least one linked records that was not classified as an acute infection
	Laboratory test used	• This was a data linkage study. No laboratory testing information was reported
	Sample size	• 4,508 Aboriginal pregnant women
Einsiedel, 2013		
	Selection of participants	• Retrospective review of all positive blood cultures from adult patients (aged 15 years or older) that were admitted into the Alice Springs Hospital between 1st January 2001 to 31 June 2007.
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 558 Aboriginal adults
Harrod, 2014		
	Selection of participants	• Patients attending four Aboriginal Health Services (1 in each of the following states, New South Wales, Queensland, South Australia, Victoria. • Data were extracted from the patient system of 15-54 year olds from 8th January 2009 to 11th July 2013 • Pathology testing and results were extracted from the patient system • Patients needed to be tested for HBcAB, HBsAg and HBsAB to be included in the study. Therefore only 865 of 17180 (5%) Aboriginal people met this criteria • Pregnant women were identified through the patient system
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 865 Aboriginal adults and 329 Aboriginal pregnant women
Reekie, 2014		
	Selection of participants	• Analysis used data from the National Prison Entrants Bloodborne Virus Survey in 2004, 2007 and 2010 • Over a two week period the survey is conducted in 29 prisons across Australia (from 4 states) • Recruits all new prisoners • Response rate was 76% across the three years • Prisoners were excluded if they recorded their injecting drug use status as unknown
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 1072 Aboriginal prisoners

Davies, 2017		
	Selection of participants	• Retrospective analysis of HBV testing from one laboratory in the Northern Territory from January 1991 to December 2011 • This laboratory provides 97.9% of all HBV notifications in the Northern Territory • Laboratory data was linked to the Northern Territory Department of Health's Client Master Index (CMI) to identify all the HBV test per person and to obtain Aboriginal status • CMI is a central identification module for all clinical information systems of all Northern Territory government health services • Excluded individuals that did not have a matched Aboriginal status
	Laboratory test used	• No laboratory testing information was reported
	Sample size	• 11,730 Aboriginal adults
Deng, 2017		
	Selection of participants	• Data linkage analysis using data from the New South Wales Perinatal Data Collection and the New South Wales Notifiable Conditions Information Management System for January 1994 to December 2012 • Only included women who gave birth to there first child and were residents in NSW only between the ages of 10-55 years • Assumed all women who did not have a linked HBV notification were negative • All women with a linked notification of acute HBV were excluded
	Laboratory test used	• This was a data linkage study. No laboratory testing information was reported
	Sample size	• 11,738 Aboriginal pregnant women

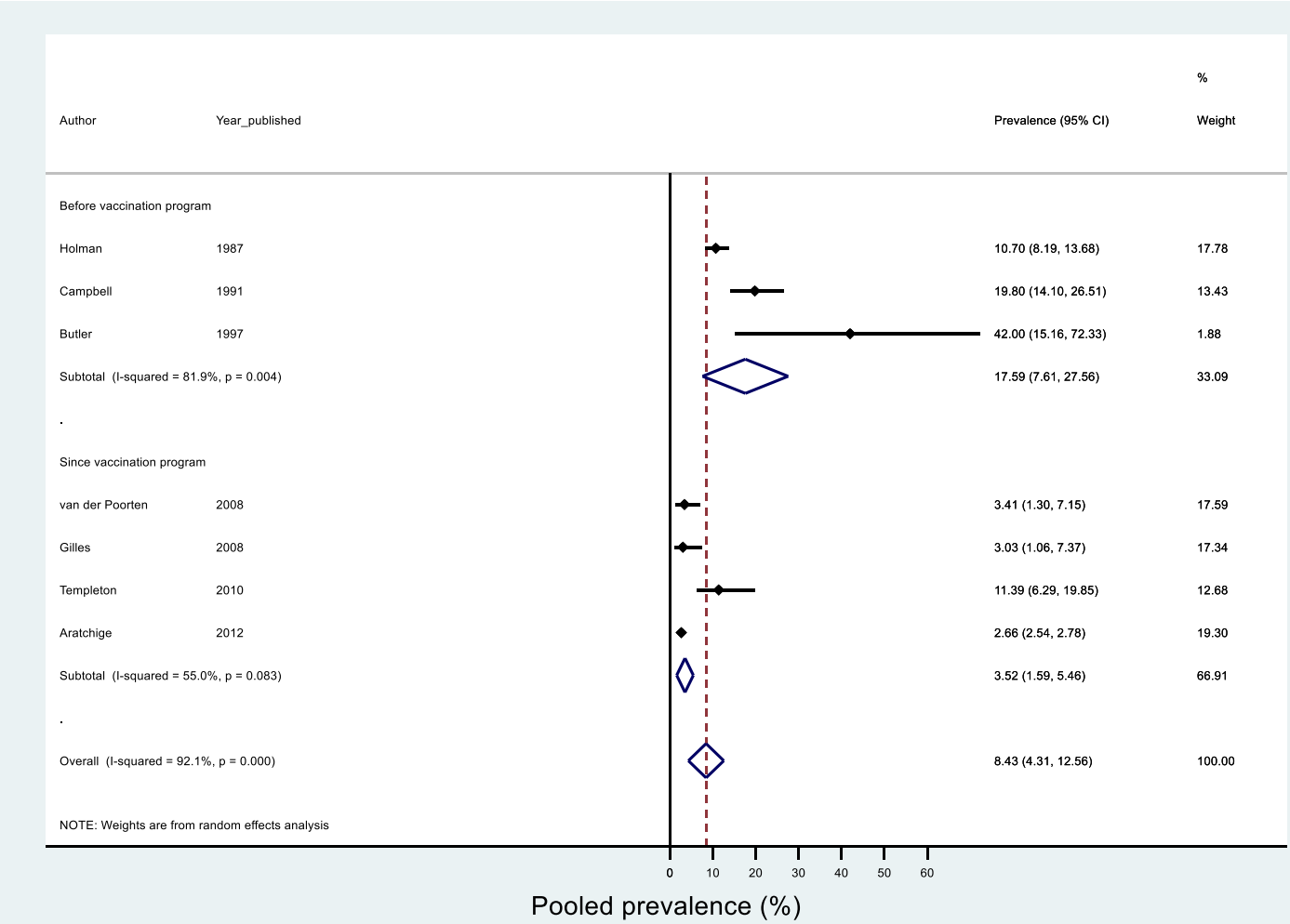

Fig. S1. HBsAg prevalence among Aboriginal males before compared to since 2000.

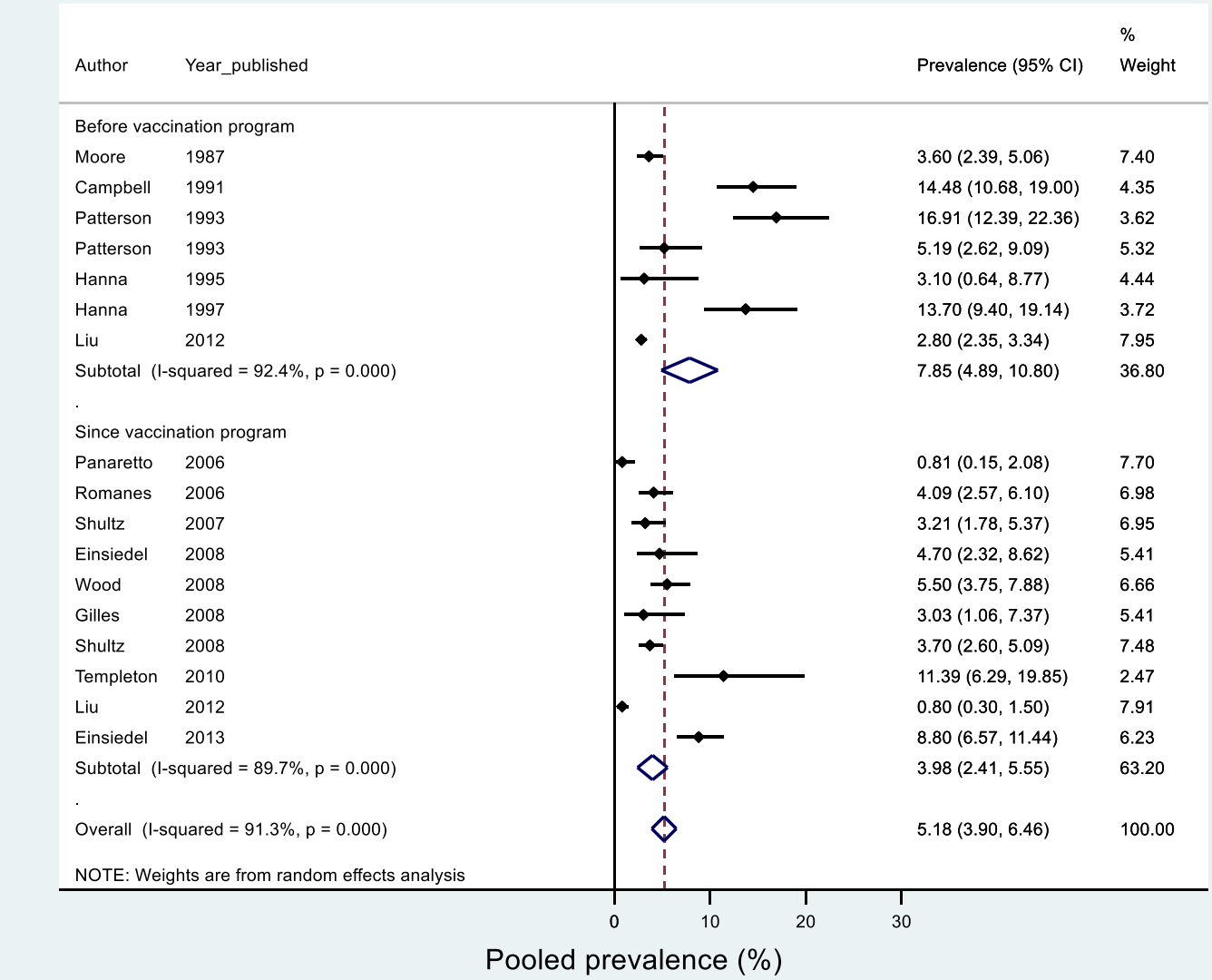

Fig. S2. HBsAg prevalence among Aboriginal people before compared to since 2000 in regional areas. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.

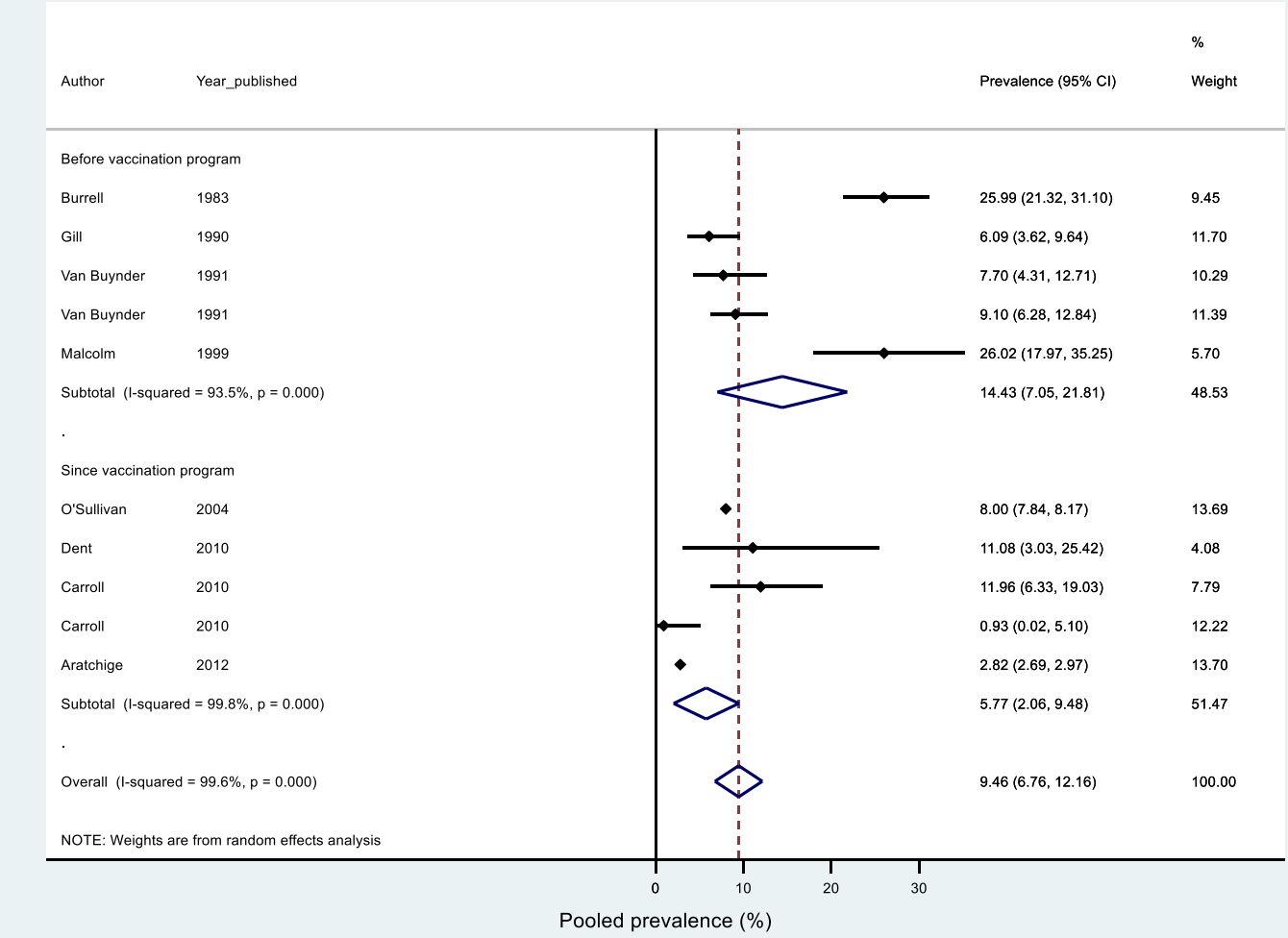

Fig. S3. HBsAg prevalence among Aboriginal people before compared to since 2000 in remote areas. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.

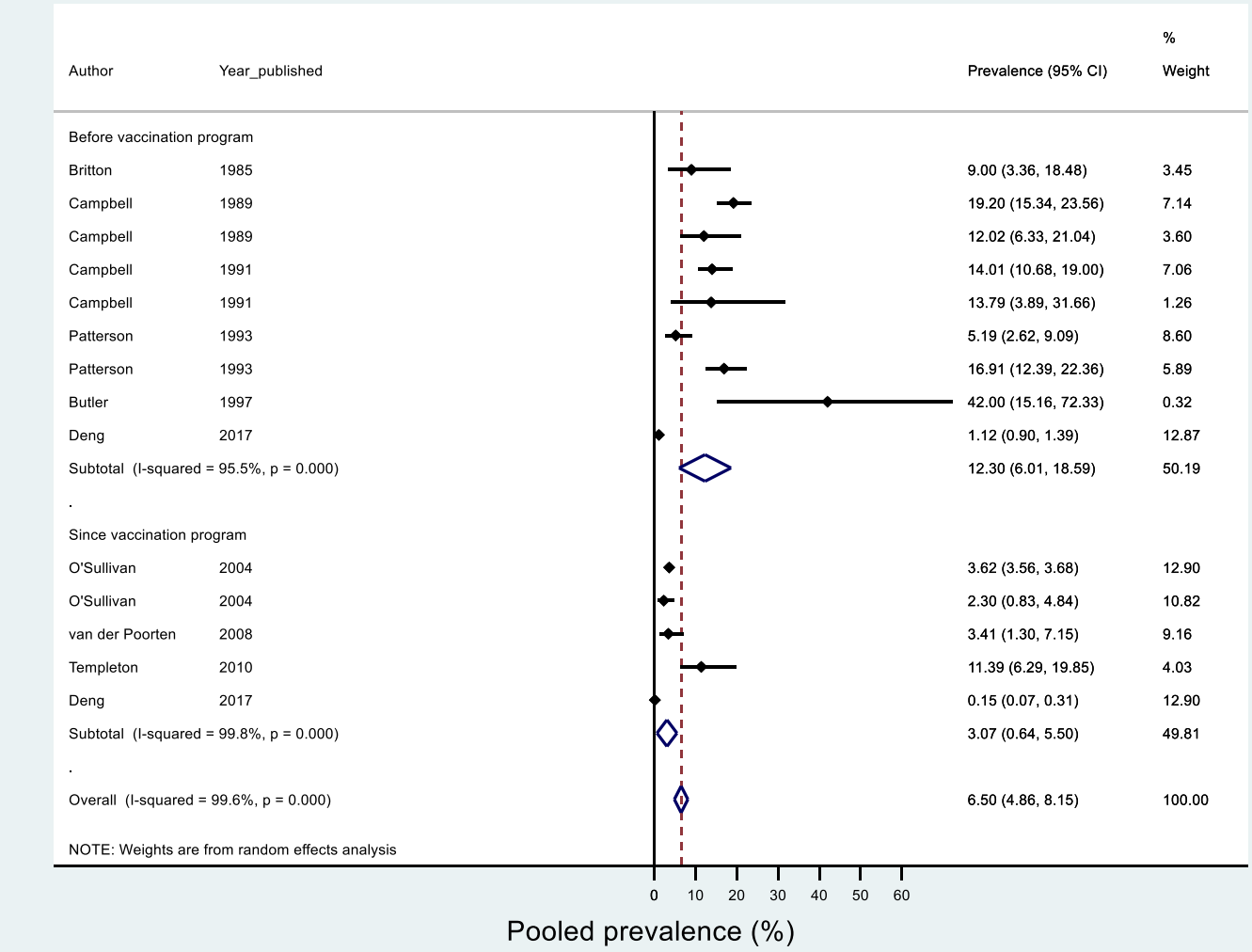

Fig. S4. HBsAg prevalence among Aboriginal people before compared to since 2000 in New South Wales. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.

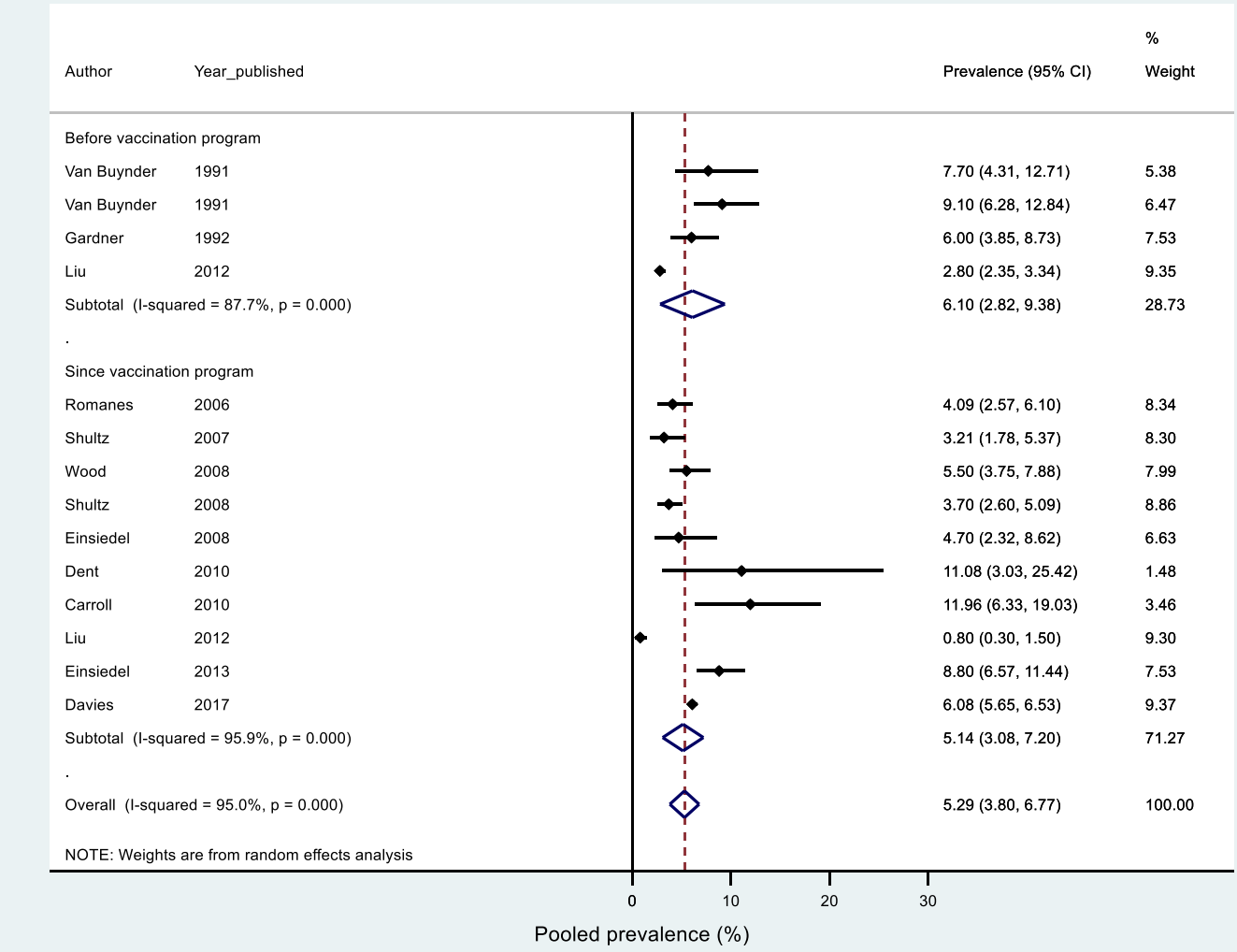

Fig. S5. HBsAg prevalence among Aboriginal people before compared to since 2000 in the Northern Territory. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.

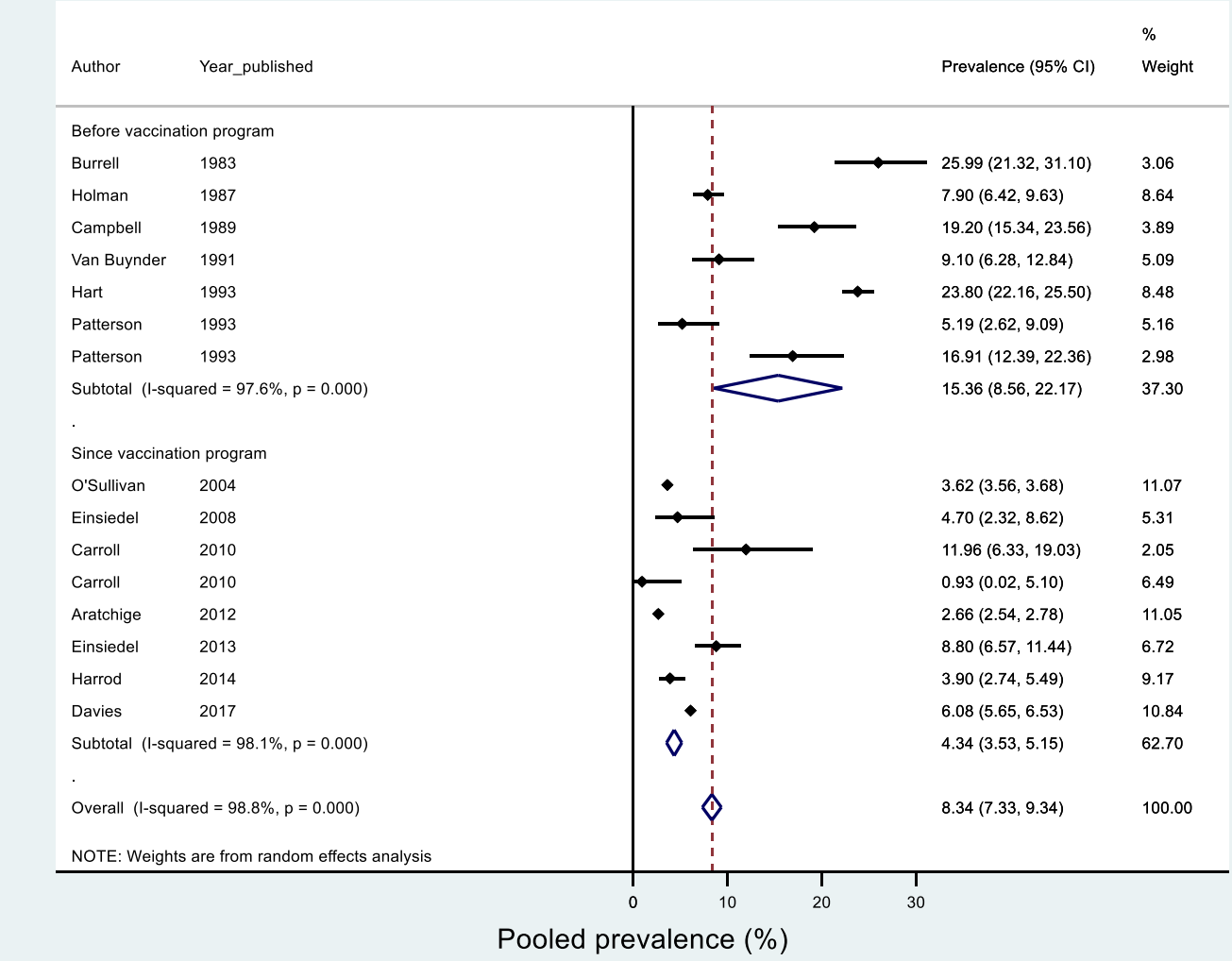

Fig. S6. HBsAg prevalence among Aboriginal people before compared to since 2000 in adults. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.

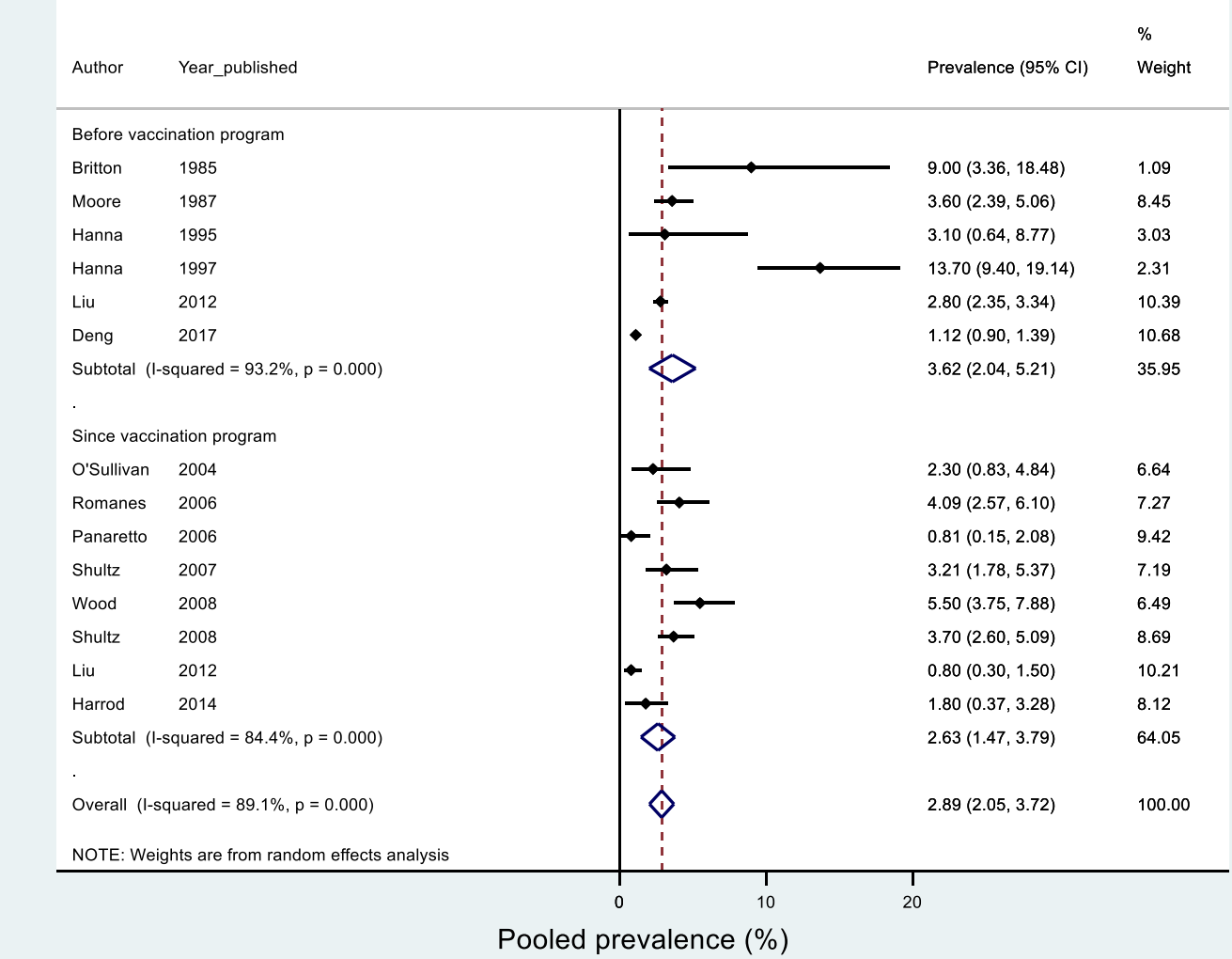

Fig. S7. HBsAg prevalence among Aboriginal people before compared to since 2000 in pregnant women. Note: a study may appear twice because it reported a HBsAg prevalence in two different populations or a HBsAg prevalence in two different time periods.