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The 'ABC' of respiratory disorders among adult Indigenous people: asthma, bronchiectasis and COPD among Aboriginal Australians – a systematic review

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ABSTRACT

Background Aboriginal Australians are reported to have higher presence of chronic respiratory diseases. However, comprehensive evidence surrounding this is sparse. Hence, a systematic review was undertaken to appraise the current state of knowledge on respiratory health in the adult Aboriginal Australians, in particular among the three most common respiratory disorders: asthma, bronchiectasis and chronic obstructive pulmonary disease (COPD).

Methods A systematic review of primary literature published between January 2012 and October 2022, using the databases *PubMed* and *Scopus*, was conducted. Studies were included if they reported adult Aboriginal Australian prevalence's or outcomes related to asthma, bronchiectasis or COPD, and excluded if adult data were not reported separately, if Aboriginal Australian data were not reported separately or if respiratory disorders were combined into a single group. Risk of bias was assessed by both Joanne Briggs Institute checklists and Hoys' bias assessment. Summary data pertaining to prevalence, lung function, symptoms, sputum cultures and mortality for each of asthma, bronchiectasis and COPD were extracted from the included studies.

Results Thirty-seven studies were included, involving approximately 33 364 participants (71% female). Eighteen studies reported on asthma, 21 on bronchiectasis and 30 on COPD. The majority of studies (94%) involved patients from hospitals or respiratory clinics and were retrospective in nature. Across studies, the estimated prevalence of asthma was 15.4%, bronchiectasis was 9.4% and COPD was 13.7%, although there was significant geographical variation. Only a minority of studies reported on clinical manifestations (n=7) or symptoms (n=4), and studies reporting on lung function parameters (n=17) showed significant impairment, in particular among those with concurrent bronchiectasis and COPD. Airway exacerbation frequency and hospital admission rates including mortality are high.

Discussion Although risk of bias globally was assessed as low, and study quality as high, there was limited diversity of studies with most reporting on referred populations, and the majority originating from two centres in the Northern Territory. The states with the greatest Aboriginal Australian population (Victoria and New South Wales) reported the lowest number of studies and patients. This limits the generalisability of results to the wider Aboriginal Australian population due to significant environmental, cultural and

WHAT IS ALREADY KNOWN ON THIS TOPIC

⇒ Adult Aboriginal Australians are reported to have a higher prevalence of chronic respiratory diseases than non-Aboriginal Australians.
⇒ However, diagnoses are confounded by a high prevalence of smoking, respiratory comorbidities and significant geographical variation.
⇒ Despite emerging evidence in the literature to suggest the respiratory health burden is significantly higher among the adult Aboriginal Australians, to date, there is a sparsity of comprehensive evidence-based reviews on respiratory disease assessment in this population.

WHAT THIS STUDY ADDS

⇒ This comprehensive systematic review for the first time illustrates the current state of knowledge on respiratory health among adult Aboriginal Australians.
⇒ This review strengthens the notion that adult Aboriginal Australians suffer from an disproportionate burden of respiratory disorders giving rise to higher morbidity and mortality.

HOW THIS STUDY MIGHT AFFECT RESEARCH, PRACTICE OR POLICY

⇒ A wide array of diagnostic criteria are used in the research context to estimate the burden of respiratory disease, and more specific methods are needed to fully elaborate on disease prevalence and outcomes.
⇒ Further efforts are needed in order to implement preventative, diagnostic and management strategies specific to Aboriginal Australians and Indigenous people globally, with an ultimate goal to reduce the health disparity and to close the health gap secondary to respiratory disorders in this population.

socioeconomic variation across the population. Regardless, Aboriginal Australians appear to display a high prevalence, alongside quite advanced and complex chronic respiratory diseases. There is however significant heterogeneity of prevalence, risk factors and outcomes geographically and by patient population. Further collaborative efforts are required to address specific diagnostic and management pathways in order to close the health gap secondary to respiratory disorders in this population.

INTRODUCTION

Aboriginal Australians (Aboriginal and Torres Strait Islander peoples) account for approximately 3.8% of the total Australian population.[1] Similar to Indigenous populations globally, a history of colonisation, and dispossession of country, and culture have resulted in ongoing intergenerational trauma, racism and disadvantage which are reflected in contemporary health inequities (from here on 'Indigenous' is used to refer to global First Nations populations, while 'Aboriginal Australian' is used to specifically refer to Australia's First Nations population).[2] Broadly, Aboriginal Australians experience a burden of disease 2.2 times that of non-Aboriginal Australians.[3] There is however significant variation in the disease burden geographically as the Aboriginal Australian population is by no means a homogeneous group. Although most Aboriginal Australians reside in New South Wales (NSW) (35%), they make up only 3% of the local population, whereas 10% of the Aboriginal population resides in the Northern Territory (NT), yet accounts for 29% of the local population.[1] Furthermore, nationally, 19% of the Aboriginal population reside in remote or very remote areas. However, in the NT approximately 80% reside in these regions.[1 4] The burden of chronic respiratory diseases is noted to be significantly higher among Aboriginal people residing in remote and very remote regions, and has thus been reported to be significantly higher in the NT compared with NSW.[3]

The respiratory disease burden accounts for 10% of the gap in total disease burden between Aboriginal and non-Aboriginal Australians nationally, with Aboriginal Australians experiencing respiratory disease at 2.6 times the rate of non-Aboriginal Australians.[3] Chronic obstructive pulmonary disease (COPD) was ranked as the second highest contributor to disability-adjusted life years in 2018 among the Aboriginal Australian population, with an age adjusted prevalence 2.3 times higher than in non-Aboriginals.[3 5] Asthma and lung cancer are also significant contributors, ranked 11th and 10th, respectively, although in terms of years of life lost, lung cancer jumps to being ranked third (just ahead of COPD in fourth).[3] Asthma has a reported prevalence of 16%, 1.6 times higher than that of the non-Aboriginal population, although with potentially even greater associated morbidity among the Aboriginal population.[6] Similarly, bronchiectasis has been reported to be highly prevalent, and with a higher associated mortality rate among Aboriginal compared with non-Aboriginal Australians.[7 8] Possible reasons for this heightened respiratory morbidity among remote residing Aboriginal Australians have been postulated in the literature to be related to the greater proximity to bushfires which may cause exacerbations of respiratory conditions, a high level of household crowding, poor household infrastructure which gives rise to recurrent respiratory infections, alongside a high prevalence of smoking, and reduced access to healthcare services.[6 9 10]

In the last decade, there has been a slew of research boosting the state of knowledge around Aboriginal Australian respiratory health encompassing chronic respiratory disease, lung function and sleep health domains.[7 11–18] Although asthma and bronchiectasis tend to present commonly in childhood,[19–21] the sequalae from these, and the development of COPD typically occur through adulthood, accompanied by a rise in other risk factors such as smoking.[22] Given the high burden of chronic respiratory conditions reported in the literature, specifically for asthma, bronchiectasis and COPD, it is worthwhile to review the most recent evidence surrounding these three common disorders among Aboriginal Australians. Therefore, this systematic review sets out to describe the prevalence of and outcomes (including mortality and pulmonary function) associated with asthma, bronchiectasis and COPD among Aboriginal Australian adults.

METHODS

This systematic review followed the 'Preferred Reporting Items for Systematic Reviews and Meta-Analyses' (PRISMA) guidelines.[23] The project was pre-registered on the Open Science Framework (DOI: 10.17605/OSF.IO/FKZX8). The inclusion criteria were formulated based on the following PICOS tool questions[24]:

P (population): Aboriginal Australian adults.

I (intervention/exposure): Asthma, bronchiectasis or COPD.

C (Comparison): Aboriginal Australians without evidence of asthma, bronchiectasis or COPD.

O (Outcome): Prevalence, hospitalisations, mortality, parameters of pulmonary function tests (PFTs).

S (Study design): Published or early access primary studies written in English.

Information sources

Two databases were used for this literature review—*PubMed* and *Scopus*. Databases were searched for English language literature published between 1 January 2012 and 1 October 2022 in order to obtain a current depiction of the topic. In addition to the database search, the reference lists of all retained articles, which had their full text reviewed, were searched for relevant literature, as were the reference lists for any review articles identified.

Eligibility criteria

Studies were included if they reported data on Aboriginal Australian prevalence or outcomes from asthma, bronchiectasis or COPD. Studies were excluded if they

were case studies/series, reviews, editorials/comments, protocol or method papers, immunological or pharmacological studies including vaccination, or coronavirus disease based. Furthermore, studies which did not report on Aboriginal Australian participants/outcomes separately did not report on adult participants separately, reported on broad 'respiratory/pulmonary disease' without defining what this included, or if this included diseases other than COPD, bronchiectasis or asthma, or did not report specific values related to COPD, bronchiectasis or asthma were excluded.

Search strategy

Within *PubMed* and *Scopus*, the following keywords were used: (((Aboriginal) OR (Indigenous) OR (First Nations) OR (Aboriginal and Torres Strait Islander people (ATSI)) AND (Australian) AND ((lung health) OR (lung disease) OR (Pulmonary health) OR (pulmonary disease) OR (respiratory health) OR (respiratory disease) OR (COPD) OR (bronchiectasis) OR (asthma) OR (lung function) OR (pulmonary function))) NOT (American) NOT (Alaskan) NOT (children) NOT (paediatric).

Selection process

All records from each database were downloaded to a comma-separated values file and any duplicates were removed. TPH and SH (in the authors' list) screened titles and abstracts for inclusion with disagreements addressed through discussion. Articles assessed as eligible had their full text reviewed by TPH and SH (in the authors' list) to assess for final inclusion in the systematic review. Reference lists for these articles were then assessed for potential inclusion via title and abstract and in turn had their full text and references reviewed if eligible (figure 1).

Data collection

Data collected from papers, which fit inclusion, were study type, recruitment, location, timeframe, sample size, Aboriginal proportion within sample, sex, age, respiratory disease prevalence/incidence, respiratory disease outcomes, global initiative for obstructive lung disease (GOLD) staging and other major findings as deemed pertinent. These were tabulated for each article reviewed and articles reviewed grouped by major topic (asthma, bronchiectasis or COPD). In cases where data were reported as 95% CIs, this was translated into SD for this review, and medians/IQRs were approximated to mean±SD via the method used by Wan *et al*.[25] In cases of sought data missing from the studies, relevant spaces were left blank in the tables, and these studies were excluded from related summary statistics. Summary statistics were reported for each disease overall (asthma, bronchiectasis and COPD), for each distinct geographical region and for community-based compared with clinic-based datasets.

During data collection, it was noted that some locations had a significant concentration of studies, with either confirmed or potentially overlapping datasets—notably studies from the top-end health service (TEHS) and from Central Australia. In each region, a single hospital and respiratory service sees patients, and therefore the potential for individual patients to re-present at multiple timepoints and be present in seemingly unrelated studies is high due to the comorbidities associated with chronic conditions. These studies have been included within the tables of this review for completeness and signposted at the foot of the table. However, summary descriptive statistics of age, sex distribution, smoking status and disease prevalence have used either the study with the largest number of participants, or, if the largest study did not

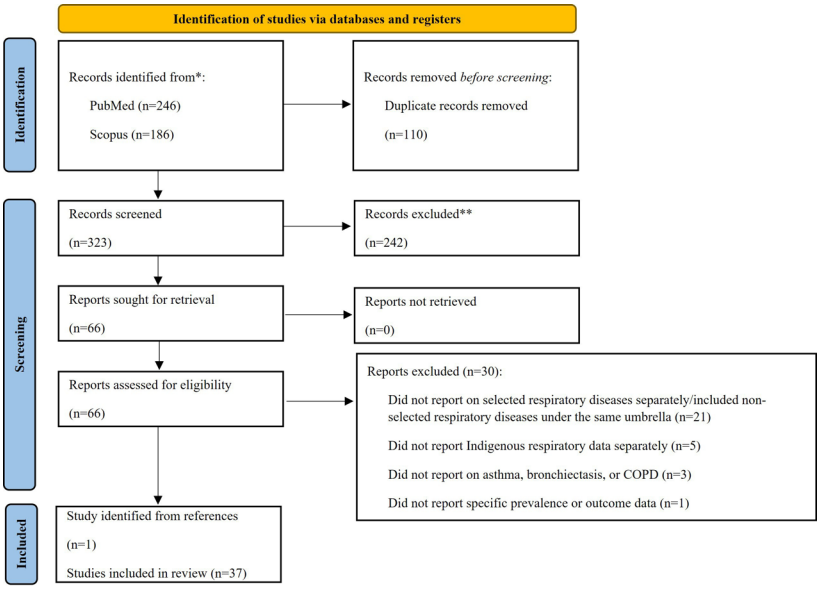

Figure 1 Preferred Reporting Items for Systematic Reviews and Meta-Analyses (PRISMA) flow diagram of included studies. COPD, chronic obstructive pulmonary disease.

contain all relevant data, a smaller study with the most relevant data was used. In each case, the references from which the statistics come have been noted in text.

Methodological quality and bias assessment

Methodological quality assessment was conducted using the Joanna Briggs Institute (JBI) critical appraisal tools.[26] Due to the range of studies assessed in this systematic review, multiple checklists were used: the checklists for Analytical Cross-sectional Studies, Cohort Studies, Case-control Studies, Quasi-experimental Studies, Economic Evaluations and Prevalence Studies. However, due to the overlapping or unclear design nature of several studies, there was no way to clearly categorise which checklist was most appropriate for every study. In these cases, the checklist used was agreed through discussion and consensus. Broadly, the checklists appraise issues relating to recruitment, exposures, confounding factors, reliability of outcome measures, follow-up timeframe and statistical analyses (exact questions differ based on the tool used, and the full list may be viewed in online supplemental file 1). Each question was answered as 'Yes', 'No', 'Unclear' or 'Not applicable'. TPH, SH, SM, HJ and HBS (in the authors' list) were randomly assigned studies to appraise, such that each study was appraised by two authors independently, and no authors appraised studies for which they were authors/coauthors. In cases of discrepancies in answers between the two authors, a third author (LM, SH or TPH (in the authors' list)) appraised the relevant paper and question to achieve consensus. If inconsistency remained, the relevant question was answered as 'Unclear'. Quality of the included studies was coded as 'high' (>80% of 'Yes' answers), 'moderate' (50%–80% 'Yes' answers) or 'low' (<50% 'Yes' answers).

Bias assessment was conducted via the appraisal tool developed by Hoys *et al*.[27] Within this tool, questions 1 to 4 assess external validity, and questions 5 to 10 assess internal validity. Questions are answered as '1', indicating a high risk of bias, or '0', indicating no risk of bias, summed to give an ultimate score of 0 to 10, which was categorised as low risk of bias (0–3), moderate risk bias (4–6) or high risk (7–10) (online supplemental file 2).

Ethics, patient and public involvement

The authors acknowledged the rights of the Aboriginal people involved in the studies included under this review and aimed to conduct and report in accordance with the National Health and Medical Research Council guidelines for reporting of health research involving Aboriginal people.[28] In the public involvement perspective, we sincerely appreciate the direction and advice, especially in relation to the Aboriginal peoples' context represented in this review by the senior coauthor Associate Professor Linda Ford, NT, Aboriginal Australian woman, Mak Mak Marranunggu descendent from the Delissaville, Wagait Larrakia Aboriginal Land Trust and the Gurudju Aboriginal Land Trust, NT, of Australia, in this work. Patients however were not involved in the planning or design of this study.

RESULTS

Overview

Thirty-seven articles were included in this review, covering approximately 33 364 participants[29–36] (71% female)[29–34 36] (exact number not available due to potential overlap of participants between multiple studies, therefore the largest distinct studies in each region were used to define total participant numbers) (figure 1). The majority of studies drew from the NT Aboriginal Australian population (n=23, 62.2%), with 15 (40.5%) from the TEHS region, 7 (18.9%) from the Central Australian (CA) region and 1 (2.7%) from across the NT as a whole. The remaining studies came from WA (n=6, 16.2% (two from the northern remote Kimberley region, 4 incorporating all of WA)), Queensland (QLD) (n=2, 5.4% (1 from North (N.) QLD, 1 from South (S.) QLD)), South Australia (SA) (n=2, 5.4%), Victoria (n=1, 2.7%), NSW (n=1, 2.7%) and 2 Australia wide studies (n=2, 5.4%). The number of Aboriginal participants included in each study ranged from 23 to 14 184 (median 333—excluding one study which reported on number of pregnancies, one which reported on number of cardinal events and one which reported on number of hospitalisations as opposed to number of patients), with 30.6%–100% female (median 52.4% excluding studies with 100% female). Eighteen (48.6%) reported on asthma, 21 (56.8%) on bronchiectasis and 30 (81.0%) on COPD (online supplemental file 3, outline of studies included for analysis). Average quality of studies was rated as 72%, with 17 studies (46%) being rated as 'high' quality (online supplemental file 1). However, disagreement between reviewers on the JBI critical appraisal tools was common, with 32% of questions recording a disagreement.

One study (3%) was assessed as having a moderate risk of bias, while the remainder were assessed as having a low risk of bias. However, almost all studies were assessed as having issues relating to external validity, which was largely due to these studies including Aboriginal participants from only a single selected region (ie, TEHS or Victoria) or setting (ie, presented to hospital or respiratory clinic) while the target population appeared to be broadly 'Aboriginal Australians'. Many noted in their limitations section that the results might not be generalisable to the whole of the Australian Aboriginal population due to the limited diversity of the cohort.

Asthma

Of the 18 studies which reported on asthma (including the three studies which combined asthma and COPD),[15 37 38] 3 reported community cross-sectional data,[35 36 39] 2 reported on pregnant women,[31 32] 7 reported on patients from a hospital cohort,[37 38 40–44] and 6 reported on patients referred to the respiratory health service (table 1).[7 14 15 30 45 46]

Table 1 Study overview of patients in asthma studies

Ref.	Location	N	Age (years)	Ever smoker (%)	Asthma (%)	Comorbid chronic respiratory diseases		Asthma-specific outcomes
						COPD (%)	Bronchiectasis (%)	
14	TEHS*	380; 55.8% female	57.3±13.2	93	32.6	100	49.9	–
15	TEHS*	150; 58.2% female	49±12.9	54.6	49	49	19	–
7	TEHS*	258; 59.3% female	54±14.9	74.4	17.1	64.7	100	–
45	TEHS*	258 (total); 49.6% female	58.4±12.1	90.8	32.2	100	31.8	–
	TEHS*	176 (without bronchiectasis); 52.8% female	59.3±11.7	93.6	31.6	100	0	–
	TEHS*	82 (with bronchiectasis); 42.7% female	56.6±12.6	84.6	33.3	100	100	–
46	TEHS*	742 (total); 56.9% female	51.3±12.3	83.4	16.6	25.5	15.9	–
	TEHS*	123 (with BDR); 52% female	52.2±10.6	88.6	100	36.2	18.6	–
40	TEHS*	59; 52.5% female	56.3±9.8	88.1	24.1	100	13.8	–
41	TEHS*	494; 56.1% female	43.8±16.9	43.9	12.4	14	–	–
42	Central AU*	1451; 55.3% female	45.2±15.8	58.9	6.1	11	9.8	HTLV-1 $+^{ve}$ 0.67/patient) HTLV-1 $-^{ve}$ (0.19/patient)
43	Central AU*	36 (bronchiectasis case); 30.6% female	43.5±71.4	38.9	16.7	11.1	100	–
	Central AU*	36 (control); 30.6% female	46.1±75.6	55.6	5.6	2.8	0	–
44	Central AU*	80 (bronchiectasis case); 60% female	–	63.8	1.3	10	100	–
30	N. QLD	1117; 62% female	54.7±14.1	77	34	35	4	–
31	S. QLD†	4675; 100% female	<20: 11% 20–34: 75.7% ≥35: 13.3%	59.9	23.9	–	–	Neonatal death: 2.21 (1.16–4.21) LBW: 1.45 (1.22–1.73) Preterm birth: 1.38 (1.18–1.61) NICU admission: 1.40 (1.22–1.61)
39	Kimberley	328; 56.4% female	51.8±9.3	68.3	21	4.9	–	–

Continued

Table 1 Continued

Ref.	Location	N	Age (years)	Ever smoker (%)	Asthma (%)	Comorbid chronic respiratory diseases		Asthma-specific outcomes
						COPD (%)	Bronchiectasis (%)	
32	WA‡	12323; 100% female	≤19: 23.8% 20–24: 25.2% 25–29: 32.4% ≥30: 18.7%	50.3	11	–	–	Neonatal death: 1.02 (0.58–1.78), Adj. 1.07 (0.61–1.88) LBW (1500–2499 g): 1.13 (0.99–1.29), Adj. 1.08 (0.94–1.24) Preterm (33–36 kg): 1.03 (0.89–1.18), Adj. 0.99 (0.86–1.14) NICU/SCN: 1.23 (1.10–1.38), Adj. 1.05 (0.94–1.18) Emergency C-section: 1.29 (1.15–1.45), Adj. 1.27 (1.13–1.44) Placental abruption: 1.70 (1.16–2.49), Adj. 1.59 (1.07–2.35) Threatened preterm labour: 1.55 (1.37–1.75), Adj. 1.58 (1.39–1.79)
37	WA	499; 43.1% female	53±13	70	27.9	27.9	–	–
36	NSW	999 (registered); 61.9% female	56±7.8	59	23.9	–	–	–
	NSW	949 (unregistered); 51.6% female	58.3±9.3	52.2	10.8	–	–	–
35	Victoria	339	–	33.9	31.2	–	–	–
38	Australia	–	–	–	34	34	–	–

*These studies show either strong potential or confirmed overlap with other datasets within their respective regions.
†Outcomes reported as relative risk ratio adjusting for smoking status, presence of gestational diabetes or pre-eclampsia and parity. Reference used was non-Aboriginal women without asthma.
‡Outcomes reported as univariate and adjusted odds ratio (adjusted for maternal age, smoking in pregnancy, remoteness of residence, disadvantage, maternal mental illness, maternal pre-existing medical conditions and parity). Reference used was Aboriginal women without asthma.
Adj, adjusted; AU, Australia; BDR, bronchodilator response; COPD, chronic obstructive pulmonary disease; HTLV-1, human T-lymphotropic virus type 1; LBW, low birth weight; NICU, neonatal intensive care unit; N. QLD, North Queensland; Ref, reference; SCN, special care nursery; S. QLD, South Queensland; TEHS, top-end health service; WA, Western Australia.

Outside of the pregnancy cohorts for which the majority of participants were aged <30 years, the combined mean age of participants was 52.3±15.5 years, which varied by geography, with participants from CA studies with a mean of 45.2±15.8 years,[42] Kimberley region patients 51.8±9.3 years,[39] TEHS region participants 51.3±12.3 years,[46] N. QLD participants 54.7±14.1 years[30] and NSW participants 57.1±8.6 years,[36] while no age was reported for the Victorian prevalence survey. Excluding the studies reporting on pregnancy, the majority of participants were female (56.3%).[30 36 37 39 42 46] A history of smoking was common, with a mean 55.7% of participants reporting ever smoking,[30–32 35–37 39 42 46] which ranged from 33.9%[35] to 93%[14] with a notably lower prevalence in Victoria compared with all other regions (NSW 56%,[36] WA excluding Kimberley region 51%,[32] Kimberley region 68%,[39] S. QLD 60%,[31] N. QLD 77%,[30] CA 58.9%[42] and TEHS 83.4%[46]).

Three studies used self-reported asthma to define prevalence,[35 36 39] one used a combination of self-report and hospital admissions data,[32] one used bronchodilator response (BDR),[46] one used either BDR or electronic medical records (EMR) documentation for the presence of asthma[44] and the remaining 12 used hospital admissions or entries on patients' EMR.[7 14 15 30 31 37 38 40–43 45] Excluding the three studies which combined COPD and asthma, and potentially overlapping studies, the average prevalence of asthma was 15.4%.[30–32 35 36 39 42 46] The prevalence in CA appeared lowest at 6.1%,[42] compared with 25.9% in QLD,[30 31] 21% in the Kimberley region[39] and 11.7% in greater WA,[32] 31.2% in Victoria,[35] 17.5% in NSW[36] and 16.6% in the NT, TEHS.[46] One TEHS study reported the BDR of patients and sought to exclude potential confounders of asthma,[46] including radiographic evidence of bronchiectasis or COPD, or spirometry suggesting COPD—after excluding these, the prevalence of asthma dropped from 16.6% to 5%.

Considering community datasets and clinical datasets separately, the community-based studies recorded a combined mean age of participants of 56.4±8.9, of which 52.9% were female, 54.5% reported smoking and asthma prevalence was 19.7%.[35 36 39] The clinical-based studies, on the other hand, recorded a combined mean age of participants of 49.8±15.1,[30 42 46] of which 57.9% were female (excluding pregnancy studies),[30 42 46] 55.8% reported smoking and asthma prevalence was 15.1%.[30–32 42 46]

Hospitalisations specific to asthma were only reported in a single study,[42] which noted a higher rate in those with asthma and human T-lymphotropic virus type 1 (HTLV-1) seropositive status (0.67/patient/year) compared with those seronegative (0.19/patient/year). The two pregnancy studies reported significant effects of maternal asthma on infant and labour outcomes, although the S. QLD study used non-Aboriginal women without asthma as reference,[31] while the WA study used Aboriginal women without asthma as reference,[32] and the confounders adjusted for differed. However, asthma appeared to show a consistent association with neonatal intensive care admission in both studies, while the WA study showed increased odds of emergency caesarean section, emergency preterm labour and placental abruption.

PFT parameters were reported exclusively for patients with asthma in only a single study,[46] which used BDR to define asthma (online supplemental file 4). Among those patients with a significant BDR, percentage predicted values of FEV_1 and FVC were low, with a reduced FEV_1/FVC ratio (51±13%, 62±12% and 0.65±0.13, respectively). Eight other studies reported on PFTs for the broader cohort,[7 14 15 30 39 40 44 45] although only three of these reported BDR (prevalence of 29% in the NT, TEHS cohorts and 3.1% in the WA cohort),[14 39 45] three reported diffusing capacity of carbon monoxide (NT, TEHS combined mean 62±26% and N. QLD mean 81±24%)[14 15 30] and two reported total lung capacity (combined mean 73±22%).[14 15]

Bronchiectasis

Of the 21 studies which reported on bronchiectasis, one reported community cross-sectional data,[42] one reported on patients receiving domiciliary oxygen therapy (DOT)[47] while the remainder reported on referred populations, either to a respiratory service (n=11,[7 14 15 30 45 46 48–52]) or hospital (n=8,[8 40 43 44 53–56]) (table 2).

The combined mean age of participants included in these studies was 49.8±15.1 years,[30 42 46 56] which varied by geography, with participants from NT, CA studies with a mean of 45.2±15.8 years,[42] Kimberley region patients 49.9±10.4 years,[56] NT, TEHS region participants 51.3±12.3 years,[46] and N. QLD participants 54.7±14.1 years.[30] There was a majority of female participants within the sampled populations, accounting for 57.7% of the total number of participants. A history of smoking was common, with a mean 70.6% of participants reporting ever smoking which ranged from 38.9%[43] to 93%,[14] with a lower prevalence in NT, CA compared with other regions (58.9%[42] vs 77% in N. QLD,[30] 82% in Kimberley[56] and 83.4% in TEHS[46]).

Overall prevalence of bronchiectasis was 9.4%, with significant geographical variation. In the NT, TEHS CT study, the prevalence of bronchiectasis was 23%,[51] in the largest NT, CA study, it was 9.8%[42] and in the N. QLD study 4%.[30] Patients with confirmed bronchiectasis were a mean age of 51.4±14.7 years,[7 8 56] with 54.2% female.[7 8 56]

Considering community datasets and clinical datasets separately, the single community-based study recorded a combined mean age of participants of 45.2±15.8, of which 55.3% were female, 58.9% reported smoking and bronchiectasis prevalence was 9.8%.[42] The clinical-based studies, on the other hand, recorded a combined mean age of participants of 54.3±24.1,[30 51 56] of which 60.9% were female,[30 51 56] 79.7% reported smoking and bronchiectasis prevalence was 31.1%.[30 51]

In the NT, TEHS bronchiectasis was commonly associated with concurrent presence of COPD, with presence of COPD noted in anywhere from 8%[50] to 50%[14]

Table 2 Study overview of patients in bronchiectasis studies

Ref.	Location	N	Age (years)	Ever smoker (%)	Bronchiectasis (%)	Comorbid chronic respiratory diseases		Bronchiectasis-specific outcomes
						COPD (%)	Asthma (%)	
14	TEHS*	380; 55.8% female	57.3±13.2	93	49.9	100	–	
15	TEHS*	150: 58.2% female	49±12.9	54.6	19	49	49	–
7	TEHS*	258; 59.3% female	54±14.9	74.4	100	64.7	17.1	28.7% at least one exacerbation in last year; 36.1% at least one hospitalisation in last year and of those 1.3±0.8 hospitalisations/year; 4.3% mortality
45	TEHS*	258 (total); 49.6% female	58.4±12.1	90.8	31.8	100	32.2	
	TEHS*	82 (with bronchiectasis); 42.7% female	56.6±12.6	84.6	100	100	33.3	2±1.5 exacerbations/ year; 2±1.5 hospitalisations/year; 9.8% mortality
48	TEHS*	238 (via GOLD); 47% female	54.7±13.7	92	22	100	–	
	TEHS*	238 (via GLI); 48% female	52.7±13.7	93	22	100	–	
49	TEHS*	115; 50.4% female	50.4±11.1	89.6	22.3	39.3	–	
50	TEHS*	485; 55.9% female	50.95±16.5	86	17	31	–	
46	TEHS*	742; 56.9% female	51.3±12.3	83.4	15.9	25.5	16.6	
51	TEHS*	402; 59% female	53.5±40.8	87	23	35	–	
52	TEHS*	212 (total); 54% female	53.1±13.4	91	35	51	–	
	TEHS*	40 (bronchiectasis cases); 58% female	53.1±10.8	87	100	0	–	
	TEHS*	35 (COPD and bronchiectasis cases); 31% female	51.6±7.7	97	100	100	–	
47	TEHS*	45; 37.8% female	61±12.4	–	15.6	48.9	–	
40	TEHS*	59; 52.5% female	56.3±9.8	88.1	13.8	100	24.1	
42	Central AU*	1451; 55.3% female	45.2±15.8	58.9	9.8	11	6.1	HTLV-1 $+^{ve}$ (1.95/patient) HTLV-1 $-^{ve}$ (0.87/patient) hospitalisations/year; 23.3% mortality
8	Central AU*	85; 42.4% female	43.7±12.3	67.5	100	–	–	36% mortality
53	Central AU*	74; 50% female	51±12.1	–	10.8	9.5	–	Bronchiectasis adjusted odds of mortality: aOR 5.92 (95% CI 1.13 to 30.9)
43	Central AU*	36 (bronchiectasis cases); 30.6% female	43.5±71.4	38.9	100	11.1	16.7	55.5% mortality

Continued

Table 2 Continued

Ref.	Location	N	Age (years)	Ever smoker (%)	Bronchiectasis (%)	Comorbid chronic respiratory diseases		Bronchiectasis-specific outcomes
						COPD (%)	Asthma (%)	
54	Central AU*	840; 42.6% female	47.7±15.1	–	12.4	3.6	–	18.5% mortality
44	Central AU*	80 (bronchiectasis cases); 60% female	–	63.8	100	10	1.3	61.3% at least one hospitalisation in last year; 38.8% mortality
55	Central AU*	415; 54.6% female	39.9±14.6	54	6.5	–	–	
30	N. QLD	1117; 62% female	54.7±14.1	77	4	35	34	
56	Kimberley†	23; 41% female	49.9±10.4	82	100	–	–	26.1% mortality

*These studies show either strong potential or confirmed overlap with other datasets within their respective regions.
†Data reported for Aboriginal and non-Aboriginal patients combined—however, the majority of patients were Aboriginal (23/32).
aOR, adjusted OR; AU, Australia; COPD, chronic obstructive pulmonary disease; GLI, Global Lung Function Initiative; GOLD, Global Initiative for Obstructive Lung Disease; HTLV-1, human T-lymphotropic virus type 1; N. QLD, North Queensland; Ref., reference; TEHS, top-end health service.

of bronchiectasis cases. In NT, CA, however, HTLV-1 was consistently noted as a significant risk factor for bronchiectasis with HTLV-1 infection increasing the odds of bronchiectasis (adjusted OR 2.9 (95% (CI) 2 to 4.3)) and a high proviral load (≥1000 copies per 10^5 peripheral blood lymphocytes) increasing the risk even further (adjusted OR 7.08 (95% CI 2.67 to 18.74) and adjusted OR 12.41 (95% CI 3.84 to 40.15)). Four studies reported on severity of bronchiectasis, of which three reported the FACED score (which incorporates FEV_1, age, *Pseudomonas aeruginosa* colonisation, radiological extension and dyspnoea) (mild: 32.6, 50.9%–75.3%; moderate: 41.8%–24.7%; severe: 7.3% and 0%—one study reported only the proportion of patients with a mild score)[7 8 14] and one reported the global severity score (5.58±3.92).[44]

Exacerbations and/or hospitalisations were reported in six studies. However, this was reported specifically for patients with bronchiectasis in four studies.[7 14 42 45] In the non-hospitalised cohorts, exacerbations specific to bronchiectasis were recorded as a mean 2±1.5/person/year[7] or 28.7% of patients with bronchiectasis reporting an exacerbation in the past year.[45] Hospital admissions were reported to be between 1 and 2 per person per year. Among the studies reporting solely on patients with bronchiectasis, mortality varied significantly, ranging from 4.3% to 55.5%, with a median of 31.1%.[7 8 43–45 56]

Seven studies reported on sputum cultures (online supplemental file 5).[7 8 14 43–45 56] Prevalence of cultured species varied significantly, with *Haemophilus influenzae* and *P. aeruginosa* overall the most frequently identified (33.4%–28.5%, respectively), although this ranged from 4.2% to 70% for *H. influenzae*, and 15.6% to 50% for *P. aeruginosa*. Frequency of each cultured species appeared to be higher in the NT, CA studies,[8 43 44] compared with the NT, TEHS region.[7 14 45]

Fifteen studies reported on patients' PFT results, of which five reported on a cohort with 100% bronchiectasis prevalence,[7 8 44 45 52] although only one excluded patients with evidence of comorbid COPD (online supplemental file 4).[52] In the single study which excluded patients with COPD, percent predicted values of FEV_1 and FVC, and FEV_1/FVC ratio were 51±11%, 54±10% and 0.71±0.1, respectively, while among patients with either confirmed or potential COPD, these values were significantly lower with a combined mean of 36±17%, 49±17% and 0.59±0.18, respectively.[7 8 44 45 52]

Chronic obstructive pulmonary disease

Of the 30 studies which reported on COPD (including the three studies which combined asthma and COPD),[15 37 38] a single study reported community cross-sectional data,[39] while the remainder reported on referred populations (table 3). Fourteen studies reported on patients presenting to hospital,[29 33 37 38 40–44 53 54 57–59] 12 on patients referred to a respiratory health service,[7 14 15 30 45 46 48–52 60] and one each on patients using DOT,[47] patients newly diagnosed with lung cancer,[34] and patients diagnosed

Table 3 Study overview of patients in COPD studies

Ref.	Location	N	Age (years)	Ever smoker (%)	COPD (%)	Comorbid chronic respiratory diseases		COPD-specific outcomes
						Asthma (%)	Bronchiectasis (%)	
14	TEHS*	380; 55.8% female	57.3±13.2	93	100	32.6	49.9	1.18±1.61 exacerbations/year; 0.87±1.26 hospitalisations/year; 8% mortality
15	TEHS*	150; 58.2% female	49±12.9	54.6	49	49	19	–
7	TEHS*	258; 59.3% female	54±14.9	74.4	64.7	17.1	100	
61	TEHS*	297; 48.2% female	48±12.5	50.5	29	–		
45	TEHS*	258; 49.6% female	58.4±12.1	90.8	100	32.2	31.8	2±1.5 exacerbations/year; 1.8±1.1 hospitalisations/year; 11.2% mortality
	TEHS*	176 (without bronchiectasis); 52.8% female	59.3±11.7	93.6	100	31.6	0	2±1.5 exacerbations/year; 1.5±0.8 hospitalisations/year; 11.9% mortality
	TEHS*	82 (with bronchiectasis); 42.7% female	56.6±12.6	84.6	100	33.3	100	2±1.5 exacerbations/year; 2±1.5 hospitalisations/year; 9.8% mortality
60	TEHS*	240; 46.7% female	54.7±13.6	91.7	100	–	–	
48	TEHS*	238 (via GOLD); 47% female	54.7±13.7	92	100	–	22	16% mortality
	TEHS*	238 (via GLI); 48% female	52.7±13.7	93	100	–	22	15% mortality
49	TEHS*	115; 50.4% female	50.4±11.1	89.6	39.3	–	22.3	11.3% mortality
50	TEHS*	485; 55.9% female	50.95±16.5	86	31	–	17	
46	TEHS*	742; 56.9% female	51.3±12.3	83.4	25.5	16.6	15.9	
51	TEHS*	402; 59% female	53.5±40.8	87	35	–	23	
52	TEHS*	212 (total); 54% female	53.1±13.4	91	51	–	35	
	TEHS*	74 (COPD cases); 49% female	56.2±7.6	97	100	–	0	
	TEHS*	35 (COPD and bronchiectasis cases); 31% female	51.6±7.7	97	100	–	100	
47	TEHS*	45; 37.8% female	61±12.4	–	48.9	–	15.6	
40	TEHS*	59; 52.5% female	56.3±9.8	88.1	100	24.1	13.8	3.6±6.2 hospitalisations/year
41	TEHS*	494; 56.1% female	43.8±16.9	43.9	14	12.4	–	
42	Central AU*	1451; 55.3% female	45.2±15.8	58.9	11	6.1	9.8	HTLV-1 $+^{ve}$ (0.48/patient) HTLV-1 $-^{ve}$ (0.43/patient) hospitalisations/year; 23.3% mortality
53	Central AU*	74; 50% female	51±12.1	–	9.5	–	10.8	

Continued

Table 3 Continued

Ref.	Location	N	Age (years)	Ever smoker (%)	COPD (%)	Comorbid chronic respiratory diseases		COPD-specific outcomes
						Asthma (%)	Bronchiectasis (%)	
43	Central AU*	36 (bronchiectasis cases); 30.6% female	43.5±71.4	38.9	11.1	16.7	100	
	Central AU*	36 (controls); 30.6% female	46.1±75.6	55.6	2.8	5.6	0	
54	Central AU*	840; 42.6% female	47.7±15.1	–	3.6	–	12.4	
44	Central AU*	80 (bronchiectasis cases); 60% female	–	63.8	10	1.3	100	
	Central AU*	160 (controls); 60% female	–	71.3	3.8	0	0	
29	NT	14,184†; 56% female	15–29: 45.1 30–39: 24.3 40–49: 15.6 50–59: 8.3 ≥60: 6.7	–	10.9	–	–	Hospitalisations/year: low care: 3.4±6.73; medium care: 1.3±5.34; high care: 1±4.35 Mortality: how care: 5.08%; medium care: 1.96%; high care: 2.08%
30	N. QLD	1117; 62% female	54.7±14.1	77	35	34	4	
39	Kimberley	328; 56.4% female	51.8±9.3	68.3	4.9	21	–	
57	WA	3431	54±15.4	–	29.9	–	–	29.3% mortality
37	WA	499; 43.1% female	53±13	70	27.9	27.9	–	
33	WA	3184; 50.9% female	25–34: 4.6 35–44: 12.9 45–54: 20.4 55–64: 26.7 65–74: 22 75–84: 13.4		Male: 17.6 Female: 23.4	–	–	
34	SA	777; 51.7% female	57.7±15.6	–	10.7	–	–	
58	SA	88; 46.6% female	51±13	–	15.9	–	–	
59	Australia	146 (urban/regional); 39% female	57±8.8	–	16	–	–	
	Australia	113 (remote); 43% female	55±13.6	–	4	–	–	
38	Australia	–	–	–	34	34	–	

*These studies show either strong potential or confirmed overlap with other datasets within their respective regions.
†Hospitalisations and mortality reported for patients with COPD.
AU, Australia; COPD, chronic obstructive pulmonary disease; GLI, Global Lung Function Initiative; GOLD, Global Initiative for Obstructive Lung Disease; HTLV-1, human T-lymphotropic virus type 1; N. QLD, North Queensland; Ref., reference; SA, South Australia; TEHS, top-end health service; WA, Western Australia.

with obstructive sleep apnoea.[61] The combined mean age of participants was 52.5±15.3 years,[30 34 39 42 46 57] which varied by geography, with participants from the largest NT, CA study with a mean of 45.2±15.8 years,[42] Kimberley region participants 51.8±9.3 years,[39] from the largest NT, TEHS region study 51.3±12.3 years,[46] SA participants 57.7±15.6 years[34] and WA participants 54±15.4 years.[57] There was a small majority of females within the sampled populations, accounting for 55.3% of the total number of participants.[29 30 33 34 39] A history of smoking was common, with a mean 70.3%[30 37 39 42 46] of participants reporting ever smoking which ranged from 38.9%[53] to 93%.[14]

One study reported on cardinal events of COPD from a cohort including heart failure and type 2 diabetes mellitus events, giving a frequency of COPD within this cohort of 29.9%,[57] another two reported on hospital admissions for COPD, asthma, diabetes mellitus, arterial hypertension, heart failure or cardiovascular events giving a frequency of COPD/asthma admissions of 34%[38] and 10.9%,[29] while five studies reported solely on patients with COPD from within a larger cohort.[14 40 45 48 60] Nine studies from the NT, TEHS[7 15 46 48–52 60] and four from NT, CA[43 44 53 54] drew participants from the same or an overlapping pool of study participants for each of their studies (ie, Aboriginal patients presenting to the respiratory health service 2012–2020, or Aboriginal patients presenting to NT, CA hospital with a diagnosis of bronchiectasis 2000–2013). Thus, to ensure multiple patients were not counted multiple times, we included the following five studies to estimate the total prevalence of COPD.[29 30 33 34 39] Across these studies, the total prevalence was 13.7%, and across all studies under review ranged from 3.8% in a NT, CA 'control' group[44] to 48.9% among patients using DOT.[47]

Considering community datasets and clinical datasets separately, the single community-based study recorded a combined mean age of participants of 51.8±9.3, of which 56.4% were female, 68.3% reported smoking and COPD prevalence was 4.9%.[39] The clinical-based studies,[29 30 33 34] on the other hand, recorded a combined mean age of participants of 55.9±14.8,[30 34] of which 55.3% were female,[29 30 33 34] 77% reported smoking[30] and COPD prevalence was 13.9%.[29 30 33 34]

The method of defining COPD differed between studies and location, with five extracting this information from the participants EMR,[30 41 42 44 47 58 61] one using radiology and/or an FEV_1/FVC ratio of <0.70,[46] one using self-reported chronic bronchitis, emphysema or COPD,[39] three using International Classification of Diseases (ICD) codes from hospital admissions,[29 33 34] and one which did not define how COPD was determined.[59] Notably, within one study which included only patients with COPD and used spirometry criteria to define COPD, it was reported that of those included, 70% had a previous clinical diagnosis of COPD.[48] Patients with confirmed COPD were a mean age of 57.3±13.2, with 55.8% female.[14]

Excluding the studies which recruited only patients with bronchiectasis and for which COPD was a secondary outcome (n=3),[43–45] bronchiectasis was comorbid with COPD in an average 19.5% of cases, while asthma was reported comorbid with COPD in 23.6% of cases (excluding those studies which reported COPD and asthma together). The exacerbation rate specific to patients with COPD was reported in two overlapping studies[14 45] (mean 1.18±1.61/person/year and 2±1.5/person/year), while the hospital admission rate was reported in five (combined mean 2.27±6.02/person/year[14 29]). Among the studies reporting solely on patients with COPD, mortality was reported at a combined mean of 20.1% among respiratory health service referred cohorts,[14 42] and at 29.3% among the cardinal event hospitalisation cohort.[57] One study reported mortality and hospitalisations between groups of patients who were low users of primary healthcare, medium users and high users, noting significant differences in both mortality and hospitalisations between levels of primary healthcare use.[29] Among patients using DOT, COPD was not associated with increased odds of mortality (OR 0.09 (95% CI 0.01 to 1.59)),[47] nor was there an association between COPD and mortality among patients with lung cancer (adjusted HR 1.13 (95% CI 0.81 to 1.59)).[34] Symptoms related to COPD were reported in four studies (online supplemental file 6), with shortness of breath the most commonly reported symptom (mean 73.9%), although cough (productive or no), wheeze, fever and fatigue were reported by approximately one-third of patients. Two studies reported Medical Research Council dyspnoea scale and the majority of patients reported being at stages 0 or 1 (54.9%–53.3%).[14 39]

Fourteen studies reported on patients' PFT results, of which six reported on a cohort with 100% COPD prevalence,[14 40 45 48 52 60] and two excluded patients with bronchiectasis (online supplemental file 4).[45 52] In the largest study, which excluded comorbid bronchiectasis, percent predicted values of FEV_1 and FVC, and FEV_1/FVC ratio were 42.3±18.2%, 56.4±17.2% and 0.56±0.17, respectively,[14] while among patients with either confirmed or potential comorbid bronchiectasis these values were significantly lower with a combined mean of 39±16.7%, 53.9±16.6% and 0.56±0.12, respectively.[45]

In the three studies reporting GOLD staging, in the TEHS studies 64.9% were in the 'Severe' or 'Very severe' categories with little variation between the studies which reported specifically on patients with COPD,[40 48] or those reporting from a general cohort.[15] In the N. QLD study, by contrast only 26% of patients were in the 'Severe' or 'Very severe' categories,[30] while the Kimberley study reported an estimated population prevalence among Aboriginal adults aged over 40 of 2.4% in the 'Severe' or 'Very severe' categories (although they did not define the proportion within the study sample).[39]

DISCUSSION

In recent years, there has been an increasing emphasis on policies, funding and research aimed at 'closing the health gap' between Aboriginal and non-Aboriginal

Australians. To the best of the authors' knowledge, this is the first systematic review to compile the recent evidence of the respiratory disease burden in relation to asthma, bronchiectasis and COPD, and to provide an insight on outcomes among adult Aboriginal Australians. Overall asthma prevalence was estimated at 15.4%, bronchiectasis 9.4% and COPD 13.7% of included participants, with notable geographical variation. Coexistent bronchiectasis was present in anywhere between 4% and 50% of patients with COPD, while asthma prevalence was confounded by high levels of smoking, and overlap with COPD and/or bronchiectasis, and may be as low as 5%. Respiratory function impairment appeared to be substantial, with FEV_1 and FVC values averaging 43%–58% predicted in patients with COPD, 37%–50% in patients with bronchiectasis and 36%–54% in patients with both comorbid.

The majority of the studies included in this review were retrospective studies, involving study participants who had either been referred to a respiratory service, or who had presented to hospital with a respiratory diagnosis. The diagnoses used within the studies for each of the chronic respiratory conditions differed, ranging from patients self-reporting previously being told they have a condition, to high-resolution CT scan (online supplemental file 3). Furthermore, 72% of studies which matched inclusion criteria originated from the NT, within which most of the TEHS studies and NT, CA studies broadly examined participants drawn from their same respective cohorts although from differing angles and with differing methods between studies. The NT, although it has the highest relative proportion of Aboriginal Australians (~30%), contains less than 10% of the total Australian Aboriginal population.[1] Using the 2016 census as a baseline to estimate the adult (15–80 years of age) Aboriginal population and the number of participants included in the studies within this review (grouped by state, using the largest number for each distinct sampled population and summing within the same state), we see significant differences in the proportional enrolment of Aboriginal Australians per state/territory: Victoria 0.9%, NSW 1.1%, SA 3.1%, QLD 4.1%, WA 24.6%, NT 34.4% (no studies reported Tasmanian or Australian Capital Territory). Participant numbers for both the WA and NT proportions, are high due to the maternal asthma study including 12 323 Aboriginal pregnant women, and the remote NT community study including 14 184 participants with a primary healthcare visit or hospitalisation).[62] This is problematic as there are significant differences in environment and socioeconomic status between each jurisdiction—thus results from one study are not readily applicable to other areas. For example, from the included study participants, we note the lifetime history of smoking varies from 33.9% in Victoria up to 97% in some subgroups from studies in the TEHS.[35 52] Furthermore, there are differences in the level of remoteness and access to healthcare between Australian states and Territories—in the Australian Capital Territory there are no areas listed as remote or very remote according to the Australian Statistical Geographic Standard (ASGS) (ASGS 4 or ASGS 5),[4] and although there are in Victoria, less than 1% of the Aboriginal population report living in these areas, compared with the NT where 78.3% of the Aboriginal population live in remote or very remote areas.[1] Given that approximately 34% of the NT adult Aboriginal population was recruited in some form for these studies compared with 1% of the Victorian Aboriginal population, this demonstrates that research involving remote residing Aboriginal populations is quite plausible, despite common challenges related to the transient, under-resourced health workforce in remote communities.[63]

Anecdotally, Aboriginal patients with chronic airway diseases tend to be very symptomatic with shortness of breath a common presenting symptom; however, we identified only a single study which exclusively reported on the Aboriginal patient experience of COPD, and significantly more work is needed in this area.[40] Aboriginal patients appear to show differing symptoms compared with non-Aboriginal patients, with a significantly higher proportion reporting a cough (productive or otherwise) and fever, while more non-Aboriginal patients report shortness of breath, chest pain or dizziness during hospital presentations.[40] Both bronchiectasis and asthma diagnoses appear to be common among those who have a concurrent diagnosis of COPD, alongside a smoking history, which may explain some of the difference in symptoms/clinical presentation. The high prevalence of concurrent respiratory comorbidities and smoking is of particular concern in the accurate diagnosis of chronic airway diseases, alongside the high proportion of patients with a productive cough—especially for remote residents with limited access to advanced imaging and comprehensive PFTs. One study compared the clinical diagnosis of COPD to spirometric definitions (FEV_1/FVC <0.70 or < lower limit of normal) and found only 74% agreement,[48] while another noted approximately 20% of patients had a FEV_1/FVC <0.70 yet no evidence of airway disease on radiology.[50] A clinical diagnosis of COPD may encourage healthcare workers to prescribe inhaled medication including corticosteroids, which in the context of a high burden of bronchiectasis may be deleterious.[49] Although DOT appears to provide Aboriginal patients with the same benefits and outcomes as non-Aboriginal patients,[47] qualifying for and receiving DOT is challenging due to the high prevalence of smoking, and high level of remoteness among Aboriginal patients. Currently, evidence on pharmaceutical interventions and guidelines for COPD management and outcomes are lacking for Aboriginal Australians specifically. Furthermore, literature examining non-pharmaceutical interventions for COPD management has reported that these interventions are sparingly implemented, especially among Aboriginal people living more remotely.[64 65]

Patients presenting with bronchiectasis appeared to be slightly younger than patients presenting with COPD, and one study identified that bronchiectasis was significantly

more common among those residing in the remote or very remote communities than urban areas.[52] Among the wider adult non-Aboriginal Australian population, the true prevalence of bronchiectasis is not exactly known. The first report of Australian Bronchiectasis Registry reported data on 589 adults, largely drawn from tertiary centres, <1% of whom were identified as Aboriginal.[66] The exact method of defining bronchiectasis among Aboriginal patients differed slightly between studies and regions, with several studies from NT, TEHS including patients with chest X-ray evidence of bronchiectasis in the absence of a CT, while most studies from NT, CA included only patients with CT evidence, and the N. QLD study used EMRs. These differing definitions are not surprising, however, as Aboriginal Australians residing in remote communities have less access to specialised healthcare such as CT. Hence, health professionals are reliant on the limited data that are available in the diagnosis and management of respiratory conditions in this population. This could be considered a realistic testament that differing respiratory disease diagnostic management pathways should be established by using limited clinical data in this population, instead of placing reliance on what is established in non-Indigenous people, which may not be appropriate or relevant.[60]

PFT parameters among patients with bronchiectasis seem to show higher FEV_1 values compared with patients with COPD, yet a lower FVC and thus higher FEV_1/FVC ratio (46% vs 51%, 60% vs 54% and 0.58 vs 0.61 for COPD vs bronchiectasis, respectively), all of which are significantly lower when COPD/bronchiectasis coexist. Bronchiectasis appears to be more associated with a restrictive pattern of impairment in this population; however, significantly reduced values across all PFT parameters, and the lack of Aboriginal specific adult reference ranges potentially confound this interpretation. Another concern for the use of spirometry in the setting of a high burden of chronic lung disease is the validity of the spirometry's result. In one study among remote residing Aboriginal Australians, only 42% of tests were deemed acceptable for session quality.[15] The high prevalence of spirometric abnormalities, and lack of specific guidelines for the adult Aboriginal population makes it significantly harder to determine if a patient is presenting with a true restrictive impairment, a true obstructive impairment or indeed a mixed impairment—each of which requires different management strategies in day-to-day clinical decision-making. Due to the high prevalence of concurrent COPD and bronchiectasis, it could be considered as a different phenotypic disease in this Aboriginal population, especially when inhaled directed airway pharmacotherapy is considered.[49 51] Inhaled corticosteroids (ICSs) are generally recommended to be used with caution among patients with bronchiectasis and COPD.[67] In support of this, one study demonstrated that the proportion of patients with excessive yearly decline in FEV_1 was higher among patients with underlying COPD and bronchiectasis using ICS.[49] Thus, caution needs to be exercised when considering using ICS in this population in the management of airway disease—especially when bronchiectasis has not been excluded. Sputum microbiology among patients with bronchiectasis appears to vary by geographical location, yet relatively few studies in this review reported on sputum results, which are vital for directing appropriate therapeutic interventions.

Estimating the true prevalence of asthma among the Aboriginal Australian population is difficult due to confounding factors such as the high prevalence of underlying COPD or small airway disease,[51] the asthma/COPD overlap[68] and the high prevalence of smoking as observed within these studies. Australia wide, asthma prevalence is estimated at 10.7%, and it has been noted that among adults with asthma, the prevalence of smoking is higher than among non-smokers (14% vs 10.6%).[6] In the current study, the overall average prevalence of asthma identified was 15.4%, although markedly different methods were used to define asthma within each study. Furthermore, up to 30% of Aboriginal patients with COPD had asthma listed as a comorbidity.[7 30 39 40 42–46 53] One study aimed to break down the prevalence of asthma (defined as BDR) by excluding patients with radiological evidence of COPD and bronchiectasis, and those with a FEV_1/FVC <0.70, which resulted in a 5% prevalence as opposed to the original 16% prevalence identified.[46] This suggests that in up to two-thirds of patients with 'asthma', there may actually be another underlying airway disease that could mimic asthma, which is supported by similar evidence among Aboriginal Australian children.[19] Although BDR may be used to confirm a diagnosis of asthma, there was significant variation between studies—ranging from 3.1% to 35.7%.[39 45] Common symptoms of asthma, shortness of breath, cough and wheeze are also reported in approximately 90%, 20% and 5%, respectively, of Aboriginal patients with COPD.[40] Taking these factors together highlights the significant difficulty of defining 'asthma' in this population. Dedicated studies including spirometry, symptom assessment and radiology are desperately needed to disentangle asthma from other significant underlying respiratory disorders in order to direct appropriate therapeutic interventions.[69]

This review has highlighted the current literature evidence of the chronic respiratory health burden among adult Aboriginal Australians and has demonstrated that this population has a significant presence of advanced and complex chronic respiratory conditions contributing to higher overall morbidity and mortality. Nevertheless, despite the evidence to suggest Aboriginal Australians have a higher chronic respiratory disease burden, literature addressing this is less common compared with what is reported for non-Aboriginal people. Further ongoing collaborative efforts are required by relevant organisations and stakeholders alongside Aboriginal communities in order to advocate and promote culturally safe and appropriate prospective research, management and diagnostic methods for chronic respiratory diseases in an effort to reduce morbidity and mortality among

Aboriginal people, not only in Australia, but also globally, with an ultimate goal to close the respiratory health gap in this population.

Limitations

This review focused only on literature published in the last decade and assessed only asthma, bronchiectasis and COPD. Numerous studies were identified which grouped COPD/bronchiectasis/asthma together, in addition to other respiratory conditions and were thus excluded from this review. Moreover, almost all of the studies were retrospective studies with the inherent potential biases associated, and included patients already in contact with the health system for a respiratory condition. Furthermore, most studies were also cross-sectional in nature, and several of those, which included longitudinal follow-up, did so only for a limited timeframe. Finally, the majority of studies originated in the NT, and several studies incorporated patients from an overlapping sampling pool, limiting discretion and the strength of observations for the entire Aboriginal Australian population. Nevertheless, this study provides much needed insights into the most common respiratory disorders; asthma, bronchiectasis and COPD in adult Aboriginal Australians and could be considered as a steppingstone forward for future research.

CONCLUSION

This review has shown a high prevalence of asthma, bronchiectasis and COPD, alongside markedly reduced lung function parameters. There are significant differences in prevalence of chronic respiratory diseases and their outcomes across states/territories of Australia, likely underpinned by differing levels of remoteness and access to healthcare, housing conditions, smoking rates and rates of other endemic infections such as HTLV-1. Of concern is the lack of diagnostic and management guidelines for respiratory diseases among Aboriginal Australians, as well as the lack of normative values on spirometry where currently up to 90% of 'healthy' patients may record abnormal findings, which may lead to unnecessary or therapeutic interventions, and increased healthcare costs. Therefore, robust efforts are required in order to establish diagnostic and management strategies incorporating the best use of limited resources to reduce the morbidity and mortality related to respiratory disorders among adult Aboriginal Australians.

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