BMJ Open

Availability and quality of publicly available health workforce data sources in Australia: A scoping review protocol

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-034400
Article Type:	Protocol
Date Submitted by the Author:	20-Sep-2019
Complete List of Authors:	Gillam, Marianne; University of South Australia, Department of Rural Health Leach , Matthew ; University of South Australia, Department of Rural Health Gonzalez-Chica, David; University of Adelaide, Discipline of General Practice, Adelaide Medical School Jones, Martin; University of South Australia, Department of Rural Health Muyambi, Kuda; University of South Australia, Department of Rural Health; Walsh, Sandra; University of South Australian - Whyalla Campus Muller, Jessica; University of South Australian - Whyalla Campus May, Esther; University of South Australia, Division of Health Sciences
Keywords:	Health workforce, Data sources, Scoping review

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

TITLE PAGE

Title: Availability and quality of publicly available health workforce data sources in Australia: A scoping review protocol.

Authors: Marianne H Gillam[1], Matthew J Leach[1], David Gonzales-Chica[2], Martin Jones[1], Kuda Muyambi[1], Sandra Walsh[1], Jessica Muller[1], Esther May[3]

Author Affiliations: [1]Department of Rural Health, University of South Australia, Adelaide, South Australia, Australia.[2]Adelaide Rural Clinical School/General Practice, Adelaide Medical School, University of Adelaide, Adelaide, South Australia, Australia.[3]Diviscion of Health Sciences, University of South Australia, Adelaide, South Australia, Australia.

Address for correspondence: Marianne H Gillam at the Department of Rural Health, Summit Health, Mt Barker, South Australia, Australia.

Phone: +61 8 8302 2584 Fax: +61 8 8302 1209

E-mail: marianne.gillam@unisa.edu.au.

Keyword: health workforce, data sources, scoping review

Total word count: 2326

ABSTRACT

Introduction

The health workforce is an integral component of the health care system. Comprehensive, high-quality data on the health workforce are essential to identifying gaps in health service provision, as well as informing future health workforce and health services planning, and health policy. While many data sources are used in Australia for these purposes, the quality of the data sources with respect to relevance, accessibility and accuracy is not clear.

Methods and analysis

This scoping review aims to identify and appraise publicly available data sources describing the Australian health workforce. The review will include any data source (e.g. registry, administrative database, survey) or document reporting a data source (e.g. journal article, report) on the Australian health workforce, which is publicly available and describes the characteristics of the workforce. The search will be conducted in ten bibliographic databases and the grey literature using an iterative process. Screening of titles and abstracts will be undertaken by two investigators, independently, using Covidence® software. Any disagreement between investigators will be resolved by a third investigator. Documents/data sources identified as potentially eligible will be retrieved in full-text and reviewed following the same process. Data will be extracted using a customised data extraction tool. A customised appraisal tool will be used to assess the relevance, accessibility and accuracy of included data sources.

Ethics and dissemination

The scoping review is a secondary analysis of existing, publicly available data sources and does not require ethics approval. The findings of this scoping review will further our understanding of the quality and availability of data sources used for health workforce and health services planning in Australia. The results will be submitted for publication in peer reviewed journals and presented at conferences targeted at health workforce and public health topics.

Strengths and limitations

- This is the first scoping review to map publicly available health workforce data sources in Australia.
- Data will be extracted using a customised data extraction tool.

- The customised appraisal tool is novel and will strengthen the application of the findings.
- Only data sources that are publicly available will be included.
- The results will provide an important resource for health planners, policy makers and researchers both nationally and internationally.

INTRODUCTION

The health workforce is a core element of any health care system. Large differences in the distribution of the health workforce currently exist within many countries, including Australia. This workforce maldistribution is evident in terms of both geographical location and skill-mix (1). For instance, in rural areas, there are major challenges regarding the accessibility, availability and appropriateness of health services (2). These restrictions on the accessibility of health services (i.e. services staffed by appropriately qualified health practitioners) have been shown to be associated with poorer health outcomes, including lower cancer survival rates and increased prevalence of diabetes complications (3).

Health workforce data can assist in addressing the health care needs of a population by informing health services and health workforce planning. These data can be used to (a) diagnose gaps in workforce supply, (b) ascertain workforce recruitment and retention issues, (c) uncover areas of workforce maldistribution, and (d) identify priority areas for research, and workforce education and training.

Government and non-government agencies collect workforce data for various purposes. However, the quality of these data sources with respect to relevance, accessibility and accuracy is not entirely clear, partly because a comprehensive review of Australian health workforce data sources has not been performed to date. Mapping available data sources by way of a scoping review may help further our understanding of the quality of these data sources, and their potential utility for health workforce and health services planning in Australia. This may in turn facilitate better data utilisation, highlight areas where there is unnecessary duplication of effort, and identify areas where data are lacking (4).

Information on the health workforce can be gathered from primary and secondary data sources. For the purpose of this review, primary data sources are those that have been collected specifically for health workforce use. They can include professional registries, administrative databases and workforce surveys. Secondary data sources, on the other hand, provide second-hand information on the health workforce, often drawing data from multiple sources; reviews and discussion papers are examples of this category. Both primary and secondary data sources can be helpful in informing health workforce and health services planning. Accordingly, the objective of this scoping review will be to identify and appraise publicly available primary and secondary data sources describing the Australian health workforce.

METHODS AND ANALYSIS

Design

This scoping review will use an adaption of the approach proposed by Peters et al. (5), which extends the Arksey and O'Malley framework (6). The approach will be modified to map data sources rather than map literature. The approach will consist of the following stages: identifying review questions, determining the selection criteria and search strategy, undertaking extraction, charting, appraisal and reporting of the results. Each stage is further described below.

Identifying review questions

Primary research question: Which health workforce data sources are publicly available and can be used to inform health workforce and health services planning in Australia?

Secondary research questions:

1. Which primary data sources are available to inform the health workforce and health services planning in Australia?
2. Which secondary data sources are available to inform the health workforce and health services planning in Australia, and which data sources do they draw from?
3. To what extent are primary data sources used to inform the health workforce and health services planning in Australia?
4. What is the quality of health workforce data sources in terms of relevance, accessibility and accuracy?

Determining selection criteria

Data source: This review will include any data source (e.g. registry, administrative database, survey) or document reporting a data source (e.g. journal article, report), published or unpublished, which meets the following inclusion criteria:

- Data source is publicly available,
- Data can be extracted on the Australian health workforce (at the national, state and/or regional level), and
- Data source describes the characteristics of the health workforce (e.g. type of health worker, demographic profile [e.g. age, sex, geographical location]).

Data sources will be limited to those containing data collected from the year 2000 onwards. This will ensure the source is likely to be accessible, and is still pertinent for health service

planning purposes (e.g. while recent data may be used to calculate current workforce estimates, older data may be used to calculate trends over time).

Concept: The key concept of this review is the health workforce. This refers to any discipline that provides health services (e.g. nursing, medicine, physiotherapy, chiropractic), in any setting (e.g. private practice, community centre, hospital, residential facility), and in any industry (e.g. health care, social assistance, education, public health).

Context: The context of this review is Australia. This may include data reported at the national, state and/or regional level.

Search strategy

The search will be conducted using an iterative process. This will include the following steps (5):

1. Conduct an initial search of at least one bibliographic database and one grey literature source to identify key words used in the title, abstract, description and/or index terms of identified sources/documents (note: this step has been completed).
2. Perform a search of all available databases and grey literature sources using the keywords and index terms defined in step 1.
3. Remove duplicates from the identified sources/documents
4. Screen title / abstract / description of identified sources / documents for eligibility.
5. Access data sources / obtain full-text versions of documents considered eligible in step 4, and screen for eligibility.
6. Search for other relevant sources / documents in the reference lists of all identified sources / documents, and screen for eligibility by following steps 4 and 5.

The first two steps will be conducted by a single investigator. Steps 3-6 will be undertaken by two investigators, independently, using Covidence® software (www.covidence.org). Any disagreement between investigators will be resolved by a third investigator.

Information resources

Bibliographic databases: Studies reporting Australian workforce data will be sourced through: MEDLINE, EMBASE, EMCare, Scopus, Web of Science, InfoRMIT, Joanna Briggs Institute, PsycInfo, EconLit, and The Cochrane Library.

Grey literature: Unpublished documents, or those published in non-commercial form, will be identified using: Google, Google Scholar, and the World Health Organisation website. The following websites also will be interrogated for eligible data sources: professional

associations (e.g. Australian Association of Social Work), universities/institutes (e.g. Flinders University National Institute of Labour Studies), government agencies (e.g. Medicare Benefits Schedule, Australian Bureau of Statistics, Health Workforce Australia/Australian Department of Health, Australian Institute of Health and Welfare), workforce/registration agencies (e.g. Australian Health Practitioner Regulation Agency [AHPRA]), registries (e.g. metadata online registry) and pertinent survey/project sites (e.g. MABEL survey).

Preliminary search terms

1. Health workforce OR health workforce planning OR health services OR health services planning OR provider-population ratio OR workforce supply.
2. [AHPRA registered health professionals]: Aboriginal and Torres Strait Islander Health Practitioner OR Chinese Medicine Practitioner OR Chiropractor OR Dental Practitioner OR Medical Practitioner OR Medical Radiation Practitioner OR Nurse OR Midwife OR Occupational Therapist OR Optometrist OR Osteopath OR Paramedic OR Pharmacist OR Physiotherapist OR Podiatrist OR Psychologist.
3. [Unregistered health professionals, as described in the Australian Bureau of Statistics (ABS) or Australian and New Zealand Standard Classification of Occupations (ANZSCO) list]: Audiologist OR Complementary Health Therapist OR Counsellor OR Dietician OR Orthotist/Prosthetist OR Massage Therapist OR Speech Pathologist OR Sonographer OR Social Worker OR Professional Carer OR Dental Assistant.
4. 2 OR 3
5. 1 AND 4

Data extraction and charting

A customised data extraction tool was developed for this review (Table 1). The tool will be used to extract information from eligible data sources/documents, including name of agency, data type, aim, years, and workforce type (Table 1). Data extraction will be performed by two investigators, independently. The extracted data will be compared and any disagreements will be resolved by discussion. In the event that the two investigators cannot reach consensus, a third investigator will be consulted to resolve the dispute. Table 2 presents an example of how the data will be charted, using the AHPRA data source as an exemplar.

Critical appraisal

The quality of included data sources will be assessed using a customised critical appraisal tool informed by the Data Quality Assessment Tool for Administrative Data framework (7). The tool comprises ten items, captured under three themes: relevance (including discipline [type of health worker] coverage, variables of interest, recency, frequency of data collection,

and reference time period), accessibility (including access to the dataset, and access to data) and accuracy (including representativeness, geographical coverage, and missing data). Each item will receive a score ranging between 1 and 3, with total scores ranging from 10 (low quality) to 29 (high quality) (Table 3). Two investigators will appraise each included data source, independently. If any disagreement cannot be resolved by discussion, a third investigator will be consulted to arbitrate the decision.

Reporting of results

The reporting of the scoping review will be informed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (8). The results of the search, and each screening step, will be presented in a PRISMA flowchart. The findings from the charting and appraisal tools will be summarized and presented in tabular form. The relationships between the primary and secondary data sources will be illustrated in a diagram.

Patient and Public Involvement (PPI) statement

This research was done without patient involvement. Patients were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients were not invited to contribute to the writing or editing of this document for readability or accuracy.

DISCUSSION

The health workforce plays a pivotal role in the provision of health care, and is therefore a fundamental component of the health care system. However, these human resources are costly, contributing between 9% and 80% (mean 42%) of total health care expenditure, globally (9). In an era of health care rationalisation, the quantity and composition of the heath workforce needs to be adequately justified and prioritised.

Comprehensive, high-quality data on the health workforce can assist in informing health policy, as well as health workforce and health services planning. This is critical to ensuring that the health care needs of the population are adequately met. Such data may also assist in improving healthcare efficiency by ensuring that services are delivered in a timely and appropriate manner to the people who need them.

While many workforce data sources are used in Australia, to our knowledge, there has not been a comprehensive review or appraisal of these health workforce data sources. To address

this knowledge gap, we will conduct a scoping review to identify, and assess the quality of, publicly available data sources describing the Australian health workforce. Results from this review can be used to inform health workforce and health services planning, as well as policy development, to help overcome barriers to the provision of accessible, available and appropriate health services for all Australians.

The scoping review will provide a comprehensive mapping of available health workforce data sources in Australia. The insights gained from this review will help identify areas where data sources are performing well, and where they could be improved, so they can better inform policy. The results will be relevant for international comparison and further research in this field.

Ethics and dissemination

The data sources are publicly available so the study will not require ethics approval. The results will be published in peer reviewed journals relevant to health workforce and public health and presented at conferences.

Author contributions: EM and MG conceptualised the project. MG and ML drafted the manuscript. MG, ML, MJ, DG, SW, KM, JM and EM contributed to the development of the research questions, study design, and reviewed and edited the manuscript for important intellectual content. All authors approved the final manuscript.

Funding: This study was supported by infrastructure provided by the Department of Rural Health, University of South Australia.

Conflict of interest: The authors have no conflict of interest to declare.

REFERENCES

1. Crettenden IF, McCarty MV, Fenech BJ, Heywood T, Taitz MC, Tudman S. How evidence-based workforce planning in Australia is informing policy development in the retention and distribution of the health workforce. Human resources for health. 2014;12:7.
2. Thomas SL, Wakerman J, Humphreys JS. Ensuring equity of access to primary health care in rural and remote Australia - what core services should be locally available? International journal for equity in health. 2015;14:111.
3. Smith KB, Humphreys JS, Wilson MG. Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research? The Australian journal of rural health. 2008;16(2):56-66.
4. Hurst K, Patterson DK. Health and social care workforce planning and development--an overview. Int J Health Care Qual Assur. 2014;27(7):562-72.
5. Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. International journal of evidence-based healthcare. 2015;13(3):141-6.

6. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32.
7. Iwig W, Berning M, Marck P, Prell M. Data quality assessment tool for administrative data. Federal Committee on Statistical Methodology, Washington, DC, Federal Committee on Statistical Methodology W, DC; 2013.
8. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of internal medicine. 2018;169(7):467-73.
9. Hernandez P, Drager S, Evans DB, Tan-Torres Edejer T, Dal Poz MR. Measuring expenditure for the health workforce: evidence and challenges. Geneva: World Health Organization, Evidence and Information for Policy; 2006.

Table 1 Data collection tool

Data Source	Details
Agency	Name of agency
Abbreviation	Abbreviation of agency name
Data type	Census/administrative/sample/longitudinal
Associated micro data	
Aim of data collection	
How data were collected	Online/paper/face-to-face/telephone
Years data were collected	
Geographic coverage	National/state/regional
Geographic level of reporting	Statistical level (e.g. Remoteness Area)
Sample size	Number of participants
Data capture	% participation / response rate
Workforce type/profession	
Age	Mean & SD / median & interquartile range / range
Sex	Sex ratio / % male / % female
Level of education	% with specified qualification
Hours of work	Full-time equivalent
Work setting	Hospital/community
Employment sector	Public/Private
Principal role	Clinician/administrative/educator/researcher
Other information	
Accessibility of information	
References/websites	

Table 2 Charting tool, comprising AHPRA data as an exemplar

Data Source	Details
Agency	Australian Health Practitioner Regulation Agency
Abbreviation	AHPRA
Data type	Administrative (registration of health professionals) + voluntary survey in conjunction with registration
Associated micro data	Not known
Aim of data collection	Registration of health professionals Collection of data required for workforce planning
How data was collected	Online/paper (1.5%)
Years data collected	Annually from 2010
Geographic coverage	National
Geographic level of reporting	Statistical level (e.g. Remoteness Area)
Sample size	678,938 health practitioners in 14 professions registered in Australia in 2016/17
Data capture	97% of registrants completed an online workforce survey at renewal
Workforce type/profession	Aboriginal and Torres Strait Islander Health Practitioners; Chinese Medicine Practitioners; Chiropractors; Dental Practitioners; Medical Practitioners; Medical Radiation Practitioners; Nurses; Midwives; Occupational therapists; Optometrists; Osteopaths; Paramedics; Pharmacists; Physiotherapists; Podiatrists; Psychologists
Age	Yes
Sex	Yes
Level of education	No yes
Hours of work	Yes
Work setting	No
Employment sector	No
Principal role	No

Other information	Reports demographics, employment status, indigenous status, country of qualification, principal role of main job, principal area of main job, registration category, endorsement/specialisation, working hours & work setting
Accessibility of information	Publicly available reports. Fees and charges applied on a cost recovery basis for data requests.
References/websites	https://www.ahpra.gov.au/About-AHPRA/What-We-Do/Data-access-and-research.aspx

Table 3 Critical appraisal tool

Item	Score
RELEVANCE	
Discipline (type of health worker) coverage *(1=1 discipline, 2=2-3 disciplines, 3=4 or more disciplines)*	
Variables of interest *(1=Minimum data[a] only, 2=Minimum data plus 2-3 additional variables[b], 3=Minimum data plus 4 or more additional variables[b])*	
Recency (as of 2019) *(1=Data are 10 or more years old, 2= Data are 5-9 years old, 3=Data are less than 5 years old)*	
Frequency of data collection *(1=Data collected every 4 or more years, 2=Data collected every 2-3 years, 3=Data collected at least annually)*	
Reference time period *(1=fixed, 2=user defined)*	
ACCESSIBILITY	
Access to dataset *(1=Dataset is available at a cost, 2=Dataset is available at no cost but access requires an application, 3=Dataset is publicly available at no cost and without application)*	
Access to data *(1=Limited data/variables are available,, 2=Most data/variables are available, 3=All data/variables are available)*	
ACCURACY	
Representativeness *(1=Convenience/unrepresentative sample, 2=Random selection of target population, 3=Complete/almost complete cohort of target population)*	
Geographical coverage *(1=Town/region, 2=State, 3=National)*	
Missing data *(1=More than 10% cells/variables have missing data, 2=Less than 10% cells/variables have missing data, 3=There is no evidence of missing data)*	
Total Score	

[a] Minimum data: type of health worker, age, sex and geographical location.
[b] Additional variables may include highest level of education, income, labour force status/hours worked, and country of birth.

BMJ Open

Availability and quality of publicly available health workforce data sources in Australia: A scoping review protocol

Journal:	*BMJ Open*
Manuscript ID	bmjopen-2019-034400.R1
Article Type:	Protocol
Date Submitted by the Author:	09-Dec-2019
Complete List of Authors:	Gillam, Marianne; University of South Australia, Department of Rural Health Leach , Matthew ; University of South Australia, Department of Rural Health Muller, Jessica; University of South Australian - Whyalla Campus Gonzalez-Chica, David; University of Adelaide, Discipline of General Practice, Adelaide Medical School Jones, Martin; University of South Australia, Department of Rural Health Muyambi, Kuda; University of South Australia, Department of Rural Health; Walsh, Sandra; University of South Australian - Whyalla Campus May, Esther; University of South Australia, Division of Health Sciences
Primary Subject Heading:	Health services research
Secondary Subject Heading:	Public health, Health policy, Health informatics
Keywords:	Health workforce, Data sources, Scoping review

I, the Submitting Author has the right to grant and does grant on behalf of all authors of the Work (as defined in the below author licence), an exclusive licence and/or a non-exclusive licence for contributions from authors who are: i) UK Crown employees; ii) where BMJ has agreed a CC-BY licence shall apply, and/or iii) in accordance with the terms applicable for US Federal Government officers or employees acting as part of their official duties; on a worldwide, perpetual, irrevocable, royalty-free basis to BMJ Publishing Group Ltd ("BMJ") its licensees and where the relevant Journal is co-owned by BMJ to the co-owners of the Journal, to publish the Work in this journal and any other BMJ products and to exploit all rights, as set out in our licence.

The Submitting Author accepts and understands that any supply made under these terms is made by BMJ to the Submitting Author unless you are acting as an employee on behalf of your employer or a postgraduate student of an affiliated institution which is paying any applicable article publishing charge ("APC") for Open Access articles. Where the Submitting Author wishes to make the Work available on an Open Access basis (and intends to pay the relevant APC), the terms of reuse of such Open Access shall be governed by a Creative Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Other than as permitted in any relevant BMJ Author's Self Archiving Policies, I confirm this Work has not been accepted for publication elsewhere, is not being considered for publication elsewhere and does not duplicate material already published. I confirm all authors consent to publication of this Work and authorise the granting of this licence.

TITLE PAGE

Title: Availability and quality of publicly available health workforce data sources in Australia: A scoping review protocol.

Authors: Marianne H Gillam[1], Matthew J Leach[1], Jessica Muller[1], David Gonzales-Chica[2], Martin Jones[1], Kuda Muyambi[1], Sandra Walsh[1], Esther May[3]

Author Affiliations: [1]Department of Rural Health, University of South Australia, Adelaide, South Australia, Australia.[2]Adelaide Rural Clinical School/General Practice, Adelaide Medical School, University of Adelaide, Adelaide, South Australia, Australia.[3]Diviscion of Health Sciences, University of South Australia, Adelaide, South Australia, Australia.

Address for correspondence: Marianne H Gillam at the Department of Rural Health, Summit Health, Mt Barker, South Australia, Australia.

Phone: +61 8 8302 2584 Fax: +61 8 8302 1209

E-mail: marianne.gillam@unisa.edu.au.

Keyword: health workforce, data sources, scoping review

Total word count: 2363

ABSTRACT

Introduction

The health workforce is an integral component of the health care system. Comprehensive, high-quality data on the health workforce are essential to identifying gaps in health service provision, as well as informing future health workforce and health services planning, and health policy. While many data sources are used in Australia for these purposes, the quality of the data sources with respect to relevance, accessibility and accuracy is not clear.

Methods and analysis

This scoping review aims to identify and appraise publicly available data sources describing the Australian health workforce. The review will include any data source (e.g. registry, administrative database, survey) or document reporting a data source (e.g. journal article, report) on the Australian health workforce, which is publicly available and describes the characteristics of the workforce. The search will be conducted in ten bibliographic databases and the grey literature using an iterative process. Screening of titles and abstracts will be undertaken by two investigators, independently, using Covidence® software. Any disagreement between investigators will be resolved by a third investigator. Documents/data sources identified as potentially eligible will be retrieved in full-text and reviewed following the same process. Data will be extracted using a customised data extraction tool. A customised appraisal tool will be used to assess the relevance, accessibility and accuracy of included data sources.

Ethics and dissemination

The scoping review is a secondary analysis of existing, publicly available data sources and does not require ethics approval. The findings of this scoping review will further our understanding of the quality and availability of data sources used for health workforce and health services planning in Australia. The results will be submitted for publication in peer reviewed journals and presented at conferences targeted at health workforce and public health topics.

Strengths and limitations

- This is the first scoping review to map publicly available health workforce data sources in Australia.
- Data will be extracted using a customised data extraction tool.

- The customised appraisal tool is novel and will help facilitate the application of the findings, though validation of the tool is needed.
- Only data sources that are publicly available will be included.
- The results will provide an important resource for health planners, policy makers and researchers both nationally and internationally.

INTRODUCTION

The health workforce is a core element of any health care system. Large differences in the distribution of the health workforce currently exist within many countries, including Australia. This workforce maldistribution is evident in terms of both geographical location and skill-mix (1). For instance, in rural areas, there are major challenges regarding the accessibility, availability and appropriateness of health services (2). These restrictions on the accessibility of health services (i.e. services staffed by appropriately qualified health practitioners) have been shown to be associated with poorer health outcomes, including lower cancer survival rates and increased prevalence of diabetes complications (3).

Health workforce data can assist in addressing the health care needs of a population by informing health services and health workforce planning. These data can be used to (a) diagnose gaps in workforce supply, (b) ascertain workforce recruitment and retention issues, (c) uncover areas of workforce maldistribution, and (d) identify priority areas for research, and workforce education and training.

Government and non-government agencies collect workforce data for various purposes. However, the quality of these data sources with respect to relevance, accessibility and accuracy is not entirely clear, partly because a comprehensive review of Australian health workforce data sources has not been performed to date. Mapping available data sources by way of a scoping review may help further our understanding of the quality of these data sources, and their potential utility for health workforce and health services planning in Australia. This may in turn facilitate better data utilisation, highlight areas where there is unnecessary duplication of effort, and identify areas where data are lacking (4).

Information on the health workforce can be gathered from primary and secondary data sources. For the purpose of this review, primary data sources are those that have been collected specifically for health workforce use. They can include professional registries, administrative databases and workforce surveys. Secondary data sources, on the other hand, provide second-hand information on the health workforce, often drawing data from multiple sources; reviews and discussion papers are examples of this category. Both primary and secondary data sources can be helpful in informing health workforce and health services planning. Accordingly, the objective of this scoping review will be to identify and appraise publicly available primary and secondary data sources describing the Australian health workforce.

METHODS AND ANALYSIS

Design

This scoping review will use an adaption of the approach proposed by Peters et al. (5), which extends the Arksey and O'Malley framework (6). The approach will be modified to map data sources rather than map literature. The database search will cover the period from January 1 2000 to December 31 2019. The approach will consist of the following stages: identifying review questions, determining the selection criteria and search strategy, undertaking extraction, charting, appraisal and reporting of the results. Each stage is further described below.

Identifying review questions

Primary research question: Which health workforce data sources are publicly available and can be used to inform health workforce and health services planning in Australia?

Secondary research questions:

1. Which primary data sources are available to inform the health workforce and health services planning in Australia?
2. Which secondary data sources are available to inform the health workforce and health services planning in Australia, and which data sources do they draw from?
3. To what extent are primary data sources used to inform the health workforce and health services planning in Australia?
4. What is the quality of health workforce data sources in terms of relevance, accessibility and accuracy?

Determining selection criteria

Data source: This review will include any data source (e.g. registry, administrative database, survey) or document reporting a data source (e.g. journal article, report), published or unpublished, which meets the following inclusion criteria:

- Data source is publicly available, meaning the data source is available for general public consumption or by request, subscription or purchase,
- Data can be extracted on the Australian health workforce (at the national, state and/or regional level), and
- Data source describes the characteristics of the health workforce (e.g. type of health worker, demographic profile [e.g. age, sex, geographical location]).

Data sources will be limited to those containing data collected from the year 2000 onwards. This will ensure the source is likely to be accessible, and is still pertinent for health service planning purposes (e.g. while recent data may be used to calculate current workforce estimates, older data may be used to calculate trends over time).

Concept: The key concept of this review is the health workforce. This refers to any discipline that provides health services (e.g. nursing, medicine, physiotherapy, chiropractic), in any setting (e.g. private practice, community centre, hospital, residential facility), and in any industry (e.g. health care, social assistance, education, public health).

Context: The context of this review is Australia. This may include data reported at the national, state and/or regional level.

Search strategy

The search which was developed with the assistance of a librarian, will be conducted using an iterative process. This will include the following steps (5):

1. Conduct an initial search of at least one bibliographic database and one grey literature source to identify key words used in the title, abstract, description and/or index terms of identified sources/documents (note: this step has been completed).
2. Perform a search of selected database, detailed below, and grey literature sources using the keywords and index terms defined in step 1.
3. Remove duplicates from the identified sources/documents
4. Screen title / abstract / description of identified sources / documents for eligibility.
5. Access data sources / obtain full-text versions of documents considered eligible in step 4, and screen for eligibility.
6. Search for other relevant sources / documents in the reference lists of all identified sources / documents, and screen for eligibility by following steps 4 and 5.

The first two steps will be conducted by a single investigator. Steps 3-6 will be undertaken by two investigators, independently, using Covidence® software (www.covidence.org). Any disagreement between investigators will be resolved by a third investigator.

Information resources

Bibliographic databases: Studies reporting Australian workforce data will be sourced through: MEDLINE, EMBASE, OvidEMCare, Scopus, Web of Science, InfoRMIT, Joanna Briggs Institute, PsycInfo, EconLit, and The Cochrane Library.

Grey literature: Unpublished documents, or those published in non-commercial form, will be identified using: Google, Google Scholar, and the World Health Organisation website. The following websites also will be interrogated for eligible data sources: professional associations (e.g. Australian Association of Social Work), universities/institutes (e.g. Flinders University National Institute of Labour Studies), government agencies (e.g. Medicare Benefits Schedule, Australian Bureau of Statistics, Health Workforce Australia/Australian Department of Health, Australian Institute of Health and Welfare), workforce/registration agencies (e.g. Australian Health Practitioner Regulation Agency [AHPRA]), registries (e.g. metadata online registry) and pertinent survey/project sites (e.g. MABEL survey).

Preliminary search terms

See Appendix 1 for detailed secondary source search strategy.

1. Health workers / health occupations
2. Workforce
3. Data Planning
4. Australia
5. 1 AND 2 AND 3 AND 4 AND 5
6. Limit: year 2000 onwards

Primary source search strategy will contain key terminology modified from the secondary search strategy to capture the most pertinent concepts:

1. 'health workforce' OR ‘health personnel’ OR ‘health occupations’ OR 'workforce planning' OR ‘health planning’ AND Australia
2. Limit: year 2000 onwards

Data extraction and charting

A customised data extraction tool was developed for this review (Table 1). The tool will be used to extract information from eligible data sources/documents, including name of agency, data type, aim, years, and workforce type (Table 1). Data extraction will be performed by two investigators, independently. The extracted data will be compared and any disagreements will be resolved by discussion. In the event that the two investigators cannot reach consensus, a third investigator will be consulted to resolve the dispute. Table 2 presents an example of how the data will be charted, using the AHPRA data source as an exemplar.

Critical appraisal

The quality of included data sources will be assessed using a customised critical appraisal tool informed by the Data Quality Assessment Tool for Administrative Data framework (7). The tool comprises ten items, captured under three themes: relevance (including discipline [type of health worker] coverage, variables of interest, recency, frequency of data collection, and reference time period), accessibility (including access to the dataset, and access to data) and accuracy (including representativeness, geographical coverage, and missing data). Each item will receive a score ranging between 1 and 3, with lower scores indicating lower quality or scope (Table 3). Two investigators will appraise each included data source, independently. If any disagreement cannot be resolved by discussion, a third investigator will be consulted to arbitrate the decision.

Reporting of results

The reporting of the scoping review will be informed by the Preferred Reporting Items for Systematic reviews and Meta-Analyses extension for Scoping Reviews (PRISMA-ScR) Checklist (8). The results of the search, and each screening step, will be presented in a PRISMA flowchart. The findings from the charting and appraisal tools will be summarized and presented in tabular form using the categories from the respective tools. The relationships between the primary and secondary data sources will be illustrated in a network diagram expressing the relationship in terms of data sources, i.e. which primary data source contributed to the secondary data sources.

Patient and Public Involvement (PPI) statement

This research was done without patient and public involvement. Patients and public were not invited to comment on the study design and were not consulted to develop patient relevant outcomes or interpret the results. Patients and public were not invited to contribute to the writing or editing of this document for readability or accuracy.

DISCUSSION

The health workforce plays a pivotal role in the provision of health care, and is therefore a fundamental component of the health care system. However, these human resources are costly, contributing between 9% and 80% (mean 42%) of total health care expenditure, globally (9). In an era of health care rationalisation, the quantity and composition of the heath workforce needs to be adequately justified and prioritised.

Comprehensive, high-quality data on the health workforce can assist in informing health policy, as well as health workforce and health services planning. This is critical to ensuring that the health care needs of the population are adequately met. Such data may also assist in improving healthcare efficiency by ensuring that services are delivered in a timely and appropriate manner to the people who need them.

While many workforce data sources are used in Australia, to our knowledge, there has not been a comprehensive review or appraisal of these health workforce data sources. To address this knowledge gap, we will conduct a scoping review to identify, and assess the quality of, publicly available data sources describing the Australian health workforce. Results from this review can be used to inform health workforce and health services planning, as well as policy development, to help overcome barriers to the provision of accessible, available and appropriate health services for all Australians.

The scoping review will provide a comprehensive mapping of available health workforce data sources in Australia identifying and describing health workforce data sources in terms of breath and depth. The insights gained from this review will help identify areas where data sources could be improved, so they can better inform policy. The results will be relevant for international comparison and further research in this field.

Ethics and dissemination

The data sources are publicly available so the study will not require ethics approval. The results will be published in peer reviewed journals relevant to health workforce and public health and presented at conferences.

Author contributions: EM and MG conceptualised the project. MG and ML drafted the manuscript. MG, ML, MJ, DG, SW, KM, JM and EM contributed to the development of the research questions, study design, and reviewed and edited the manuscript for important intellectual content. All authors approved the final manuscript.

Funding: This study was supported by infrastructure provided by the Department of Rural Health, University of South Australia.

Conflict of interest: The authors have no conflict of interest to declare.

REFERENCES

1. Crettenden IF, McCarty MV, Fenech BJ, Heywood T, Taitz MC, Tudman S. How evidence-based workforce planning in Australia is informing policy development in the retention and distribution of the health workforce. Human resources for health. 2014;12:7.
2. Thomas SL, Wakerman J, Humphreys JS. Ensuring equity of access to primary health care in rural and remote Australia - what core services should be locally available? International journal for equity in health. 2015;14:111.
3. Smith KB, Humphreys JS, Wilson MG. Addressing the health disadvantage of rural populations: how does epidemiological evidence inform rural health policies and research? The Australian journal of rural health. 2008;16(2):56-66.
4. Hurst K, Patterson DK. Health and social care workforce planning and development--an overview. Int J Health Care Qual Assur. 2014;27(7):562-72.
5. Peters MD, Godfrey CM, Khalil H, McInerney P, Parker D, Soares CB. Guidance for conducting systematic scoping reviews. International journal of evidence-based healthcare. 2015;13(3):141-6.
6. Arksey H, O'Malley L. Scoping studies: towards a methodological framework. Int J Soc Res Methodol. 2005;8(1):19-32.
7. Iwig W, Berning M, Marck P, Prell M. Data quality assessment tool for administrative data. Federal Committee on Statistical Methodology, Washington, DC, Federal Committee on Statistical Methodology W, DC; 2013.
8. Tricco AC, Lillie E, Zarin W, O'Brien KK, Colquhoun H, Levac D, et al. PRISMA Extension for Scoping Reviews (PRISMA-ScR): Checklist and Explanation. Annals of internal medicine. 2018;169(7):467-73.
9. Hernandez P, Drager S, Evans DB, Tan-Torres Edejer T, Dal Poz MR. Measuring expenditure for the health workforce: evidence and challenges. Geneva: World Health Organization, Evidence and Information for Policy; 2006.

Commons licence – details of these licences and which Creative Commons licence will apply to this Work are set out in our licence referred to above.

Table 1 Data collection tool

Data Source	Details
Agency	Name of agency
Abbreviation	Abbreviation of agency name
Data type	Census/administrative/sample/longitudinal
Associated micro data	
Aim of data collection	
Primary or secondary data source	
Population coverage	Sample/whole population
Individual level/aggregated data	
How data were collected	Online/paper/face-to-face/telephone
Years data were collected	
Geographic coverage	National/state/regional
Geographic level of reporting	Statistical level (e.g. Remoteness Area)
Sample size	Number of participants
Data capture	% participation / response rate
Workforce type/profession	
Age	Mean & SD / median & interquartile range / range
Sex	Sex ratio / % male / % female
Level of education	% with specified qualification
Hours of work	Full-time equivalent
Activity level	Number of patient interactions
Work setting	Hospital/community
Employment sector	Public/Private
Principal role	Clinician/administrative/educator/researcher
Other information	
Accessibility of information	
References/websites	E.g author(s) and year of paper/review/report

Table 2 Charting tool, comprising AHPRA data as an exemplar

Data Source	Details
Agency	Australian Health Practitioner Regulation Agency
Abbreviation	AHPRA
Data type	Administrative (registration of health professionals) + voluntary survey in conjunction with registration
Associated micro data	Not known
Aim of data collection	Registration of health professionals Collection of data required for workforce planning
Primary or secondary data source	Primary
Population coverage	Licensure registry
Individual level/aggregated data	Individual level
How data were collected	Online/paper (1.5%)
Years data collected	Annually from 2010
Geographic coverage	National
Geographic level of reporting	Statistical level (e.g. Remoteness Area)
Sample size	678,938 health practitioners in 14 professions registered in Australia in 2016/17
Data capture	97% of registrants completed an online workforce survey at renewal
Workforce type/profession	Aboriginal and Torres Strait Islander Health Practitioners; Chinese Medicine Practitioners; Chiropractors; Dental Practitioners; Medical Practitioners; Medical Radiation Practitioners; Nurses; Midwives; Occupational therapists; Optometrists; Osteopaths; Paramedics; Pharmacists; Physiotherapists; Podiatrists; Psychologists
Age	Yes
Sex	Yes

Level of education	Yes
Hours of work	Yes
Activity level	No
Work setting	No
Employment sector	No
Principal role	No
Other information	Reports demographics, employment status, indigenous status, country of qualification, principal role of main job, principal area of main job, registration category, endorsement/specialisation, working hours & work setting
Accessibility of information	Publicly available reports. Fees and charges applied on a cost recovery basis for data requests.
References/websites	https://www.ahpra.gov.au/About-AHPRA/What-We-Do/Data-access-and-research.aspx

Table 3 Critical appraisal tool

Item	Score
RELEVANCE	
Discipline (type of health worker) coverage *(1=1 discipline, 2=2-3 disciplines, 3=4 or more disciplines)*	
Variables of interest *(1=Minimum data[a] only, 2=Minimum data plus 2-3 additional variables[b], 3=Minimum data plus 4 or more additional variables[b])*	
Recency (as of 2019) *(1=Data are 10 or more years old, 2= Data are 5-9 years old, 3=Data are less than 5 years old)*	
Frequency of data collection *(1=Data collected every 4 or more years, 2=Data collected every 2-3 years, 3=Data collected at least annually)*	
Reference time period *(1=fixed, 2=user defined)*	
ACCESSIBILITY	
Access to dataset *(1=Dataset is available at a cost, 2=Dataset is available at no cost but access requires an application, 3=Dataset is publicly available at no cost and without application)*	
Access to data *(1=Limited data/variables are available,, 2=Most data/variables are available, 3=All data/variables are available)*	
ACCURACY	
Representativeness *(1=Convenience/unrepresentative sample, 2=Random selection of target population, 3=Complete/almost complete cohort of target population)*	
Geographical coverage *(1=Town/region, 2=State, 3=National)*	
Missing data *(1=More than 10% cells/variables have missing data, 2=Less than 10% cells/variables have missing data, 3=There is no evidence of missing data)*	

[a] Minimum data: type of health worker, age, sex and geographical location.
[b] Additional variables may include highest level of education, income, labour force status/hours worked, and country of birth.

Appendix 1

PCC	Term	Keywords	MeSH
Participants	NA	-	-
Concept	Health workers / health occupations	((Health*) adj1 (Practitioner* or Profession* or Worker* or Occupations or Staff or Employee or Carer)) or ((Allied Health) adj1 (personnel or profession*)) or Medic* Practitioner* or Chiropract* or Dental Practitioner* or Dentist* or Medical Radiation Practitioner* or Nurs* or Midwi* or Occupational Therap* or Optometr* or Osteopath* or Paramedic* or Pharmac* or Physiotherap* or Podiatr* or Psycholog* or Audiolog* or Counsel?or* or counsel?ing or Dietician* or Dietetic* or Orthot* or Prostheti* or Massage Therap* or Speech Patholog* or Speech Therap* or Sonograph* or Social Work* or Care?giver* or Dental Assistant* or Dental Technician* or Doctor* or General Practitioner* or Surgeon* or Physician*	exp health occupations/ exp health personnel/ exp complementary therapies/ exp social workers/
	Workforce	staff* ratio? or provider?-population? ratio? or population?-provider? ratio? or patient?-provider? ratio? or provider?-patient ratio? or workforce or manpower or man power or womanpower or woman power or staffing or labo?r supply* or labo?r supplies or human resourc*	exp workforce/
	Data planning	plan or planning or plans or planned	Data Collection/ Datasets as topic/ Statistics as topic/

			Dataset/ "Information storage and retrieval"/ sn.fs. (Statistics and Numerical Data) exp health planning/ Health Information Systems/
Context	Australia	Austral* or Australian Capital Territory or New South Wales or Northern Territory or Queensland or South Australia or Tasmania or Victoria or Western Australia or Sydney or Melbourne or Canberra or Perth or Brisbane or Hobart or Darwin	exp Australia/
Limits	Year	2000 – Current	