Australia's health workforce: geographical distribution and the relevance of a vulnerability index

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Introduction

Maldistribution of the health workforce is a pressing issue in Australia. Having the required number of health professionals is essential in being able to provide health services. So too is equitable, needs-based distribution of those professionals (1, p.154). However, the issues of aggregate supply and distribution of the health workforce are entangled. The 2012 publication, *Health Workforce 2025*, recommended a shift towards policy that enables a more sensitive needs and service-based planning approach that complements, but does not replace, the aggregate national planning process (1, p.154, 2).

Geographic distribution of the health workforce is a complex topic. A range of factors influence where doctors and other health professionals choose to practise, including family, social and professional ties, lifestyle preferences and market forces (1, p.154, 3). Literature also suggests service location is complex, and should not simply be based on population catchment. Population catchment can indicate a potential demand for a service, however other dimensions such as the ability to recruit, economic and social considerations, infrastructure availability and support are critical in determining placement of services (1, p.154).

Recent modelling of Australia's existing health workforce found the nursing and midwifery workforces are relatively well-distributed in comparison to the medical workforce, however it should be noted that even distribution of the workforce does not necessarily imply sufficiency (1, p.154). For example, despite a relatively even distribution of the nursing workforce, national projections suggest the demand for nurses will continue to exceed supply in the future (1, p.154, 4).

The importance of a 'whole-of-workforce' approach in health services planning, rather than a profession-by-profession basis, has been highlighted in the literature (1, p.154, 5). Researchers also call for distribution policies to better reflect local need (for example, see 6).

This paper outlines geographical classification systems that are used to inform health workforce and service distribution policy, and begins to explore how those mechanisms might be complemented by a spatially-enabled set of health workforce-related indicators, modelled on a concept similar to a 'vulnerability index' and with policy scenario analysis capability, taking a broad range of factors into account that influence vulnerability to, or assist to build resilience against, a lack of access to primary health care services.

Existing geographical classifications as a basis for targeting workforce programs

Geographical classification systems are often used as the basis for determining locations in which health professionals may be permitted or incentivised to work. In particular, the Australian Department of Health uses the two following classifications as the basis for targeting various health workforce initiatives in Australia:

Modified Monash Model

Introduced by the Australian Department of Health in 2015, the Modified Monash Model was developed by eminent rural academics at Monash University and was modified following consultation with key stakeholders (7). The Modified Monash Model overlays the Australian Statistical Geography Standard – Remoteness Area (ASGS-RA) geography (outlined below) to consider geographical remoteness, but also takes into account town population size. The government-funded General Practice Rural Incentives Program was the first health workforce initiative to transition to the Modified Monash Model in 2015.

District of Workforce Shortage (DWS)

The Australian Department of Health's DWS classification was introduced in 2001 and redesigned 2015, with annual updates. A DWS is an area identified as having a below-average level of access to doctors. This is determined using population data and Medicare billing information to get a doctor-to-population ratio (7). The DWS classification system is relevant to medical specialties, such as general practice.

Other geographical classification systems, which have been (and may still be) used to target health workforce initiatives in Australia include:

Rural, Remote and Metropolitan Areas (RRMA)

Developed in the early 1990s by the Australian Government organisations then known as the Department of Primary Industries and Energy and the Department of Human Services and Health, this classification is based on Statistical Local Areas (SLAs) and allocates each SLA in Australia to a category based primarily on population numbers and an index of remoteness (8).

Australian Standard Geographic Classification—Remoteness Area (ASGC-RA)

This classification was developed by the Australian Bureau of Statistics (ABS) and used by them from 1984 to 2011 for the collection and dissemination of geographically classified statistics. The last edition of the ASGC-RA was released in 2011 and is based on residential population data from the 2006 ABS Census (9).

Australian Statistical Geography Standard—Remoteness Area

The ASGS-RA is the ABS' new geographical framework, which came into effect in July 2011 (10). This framework is based on residential population data from the 2011 ABS Census.

Additionally, most overseas-trained doctors and foreign graduates of accredited medical schools will only be able to obtain limited registration with the Medical Board of Australia initially, and will need to undertake a period of supervised employment in a classified 'Area of Need'. Area of Need applies to both public and private sector positions. Areas of Need are determined by the state and territory governments and methods of defining them vary (11).

Recent developments in current practice

Recent years have seen a number of developments to the Australian Department of Health's geographical classifications, and how they are used in relation to health workforce initiatives. The 2013 independent *Review of Australian Government Health Workforce Programs* (12, pp.227-241) discussed issues relating to the complexity of DWS determinations, reflecting concerns raised in the *Lost in the Labyrinth* report (12, p.229, 13). The independent review (12, pp.227-241) proposed an updated DWS system and examined potential policy implications relating to the proposed new system. In February 2015, an updated DWS system came into effect.

Prior to February 2015, the DWS system relied on what had become out-dated population data, meaning the system was not accurately assessing the medical workforce in towns that had experienced population growth over the previous decade (7). The new system uses the latest ABS geography and population data and the most recent medical workforce statistics (derived from Medicare billing data) (7). The updated system also incorporates an additional measure to recognise areas that are only achieving an above-average level of Medicare services because of a small number of doctors working extremely long hours—a scenario sometimes occurring in small rural towns (7).

Following implementation of the updated DWS system, the Australian Department of Health also introduced the Modified Monash Model in May 2015. The model is a modified version of a new geographical classification scheme that was proposed by Humphreys et al (14) as an alternative to the ASGC-RA system as a basis for determining the locations in which health professionals would be eligible for rural workforce incentives. The Modified Monash Model was designed to better categorise metropolitan, regional, rural and remote areas according to both geographical remoteness and town size, recognising the challenges in attracting health workers to more remote and smaller communities.(7)

Developing a set of health workforce-related indicators: what can we learn from the concept of a 'vulnerability index'?

Indices, such as 'vulnerability indices', have been applied internationally to a range of public health challenges, including extreme heat, climate change, and mental and physical health outcomes (for example, see 15, 16-18).

Vulnerability indices are constructed in many ways (for example, see 19, 20), but they are typically developed from a range of variables (sometimes referred to as factors or indicators) representing dimensions or domains of vulnerability including exposure to a threat, sensitivity of a population, and adaptive capacity of a population to cope. In this case, vulnerability is the combined effects of exposure and sensitivity mediated by adaptive capacity. Indices can vary in complexity from simple rankings of variables to data reduction techniques, such as principal components analysis (PCA). Thus, the indices are composites of many variables and represent constructs not easily measured by single variables (for example, the 'SEIFA IRSAD' (Socio-economic Indexes for Areas—Index of Relative Socio-economic Advantage and Disadvantage) is an example of a composite socioeconomic disadvantage index (21)). The rankings produced from this analysis can be used in subsequent analysis and modelling, and it is common for vulnerability indices to be mapped to show patterns of spatial variability, and in some cases, to inform spatially targeted interventions, at various geographical levels (19). Of note, 'social vulnerability indices' measure the burden or vulnerability of a population in relation to hazards (20, 22). Exposure and sensitivity measures commonly used in social vulnerability indices could be applicable in a health workforce context.

It is useful to consider further how indicators and the concept of vulnerability have been applied to health workforce planning specifically, as a way of analysing communities' vulnerability to, or capacity to overcome, a lack of access to health workforce and health services.

In 2011, Health Workforce New Zealand proposed a revised process to support better targeting of funding of resident medical officers (RMOs). The proposed process was to be based on consideration of the criticality of each medical discipline and of the general service load of trainees at different stages of their training (23). Determination of the criticality of each of the medical disciplines was to be

based on two broad categories; firstly, vulnerability, and, secondly, contribution to the government's health targets (23). Medical disciplines received a vulnerability rating based on factors, such as: the mean age and trainee-to-practitioner ratio; the level of dependence of the workforce on general registrants; the level of dependence of the workforce on international medical graduates; and the level of District Health Board vacancies (23).

In Australia, the Health Workforce Australia (24) report, *Health Workforce 2025, Volume 3, Medical Specialties*, detailed a set of four indicators—collectively called the workforce dynamics indicator. The workforce dynamics indicator was introduced to highlight aspects of the current workforce that may be of concern into the future. The indicator was adapted from Health Workforce New Zealand's medical discipline vulnerability ranking method (24). In developing an assessment of existing workforce position, Health Workforce Australia consulted with stakeholders and used vacancy rate and waiting time data (where available) to make an assessment of the existing workforce position for each medical specialty—that is, an assessment of whether the workforce is perceived to be in balance (24, pp.21-23).

Further, combining the concepts of a workforce index and spatial analysis, the Australian Institute of Health and Welfare recently introduced a new measure known as the Geographically-adjusted Index of Relative Supply (GIRS). This index focuses on workforce supply and distribution in relation to distribution of the Indigenous population. The GIRS takes data relating to seven professions from the 2014 National Health Workforce Data Set, then makes an adjustment for three other factors (land size, population dispersion, and drive time to services) to create a score for each profession, by Statistical Area Level 2 (SA2) (25).

The previously mentioned geographical classifications each serve a purpose and take into account useful factors, such as remoteness, population size, and access to doctors in comparison to the national average. However, there is an opportunity to further strengthen the tools available to support and inform health workforce policy and planning. For example, existing geographical classifications could be complemented by a tool, which:

- provides a set of health workforce-related indicators;

- is spatially-enabled, and allows local health workforce and service needs to be considered at a more granular level (for example, from low levels such as Statistical Area Level 1 (SA1));

- takes a more extensive range of factors into account; for example, workforce data across the health professions (a 'whole-of-workforce' approach), including nursing, midwifery, dentistry, and allied health, in addition to medical practice, and other factors that influence and affect access to health services, such as community demographics and geography;

- is interactive, so that policymakers and planners can switch individual indicators on and off, to examine those of most interest;

- allows the results to be visualised spatially, to support agile analysis and interpretation of the results; and

- enables a level of policy scenario analysis, supporting policymakers and planners to consider and test 'what if' scenarios in relation to health workforce and service distribution.

Next steps

The Australian Department of Health is exploring the feasibility of developing a set of indicators, as part of a scenario analysis tool, to internally support health workforce and service policymaking and planning.

Taking into consideration which datasets are available to the department, from internal or external sources, and available at a low level of geography, such as the SA1 level, a set of health workforce-related indicators could potentially comprise domains and indicators, such as those suggested in Table 1 below. Ensuring data incorporated into the set of indicators are available at a low level of geography means the layers of data could be built up to a wider range of geographical boundaries, such as Primary Health Network (PHN) boundaries.

The domains and indicators presented in Table 1 are examples only of aspects that could potentially be incorporated in a set of health workforce-related indicators to better inform policymaking and planning within the department. This is not intended to be an exhaustive or final list of indicators; the proposed indicators and domains are expected to evolve based on ongoing research and consultation. A set of indicators could potentially lead to the development of a 'health workforce index', however the ways in which each indicator is measured or weighted would require further consideration and advice from subject matter experts.

Table 1   Proposed domains and example indicators

Domain	Indicators
Health workforce	Workforce supply
	Age of existing workforce
Health services and infrastructure	Hospitals
	Practices
	Schools
Demography	Estimated Residential Population
	Age of population
	Socioeconomic disadvantage
Geography	Remoteness
	Population dispersion

The rationale for inclusion of the suggested domains as the basis for a set of health workforce-related indicators is discussed further below.

Domain 1: health workforce
The availability of Medicare Benefits Schedule data within the Department of Health presents the opportunity to build medical workforce data into a spatially-enabled analysis tool and set of indicators. While such data are already used in the DWS classification, the way these data are used to inform policy and planning could be broadened if incorporated in a set of indicators. For example, these data could support workforce succession planning, by providing information on workforce demographics, such as age and workforce programs that doctors are enrolled on. Ideally, a set of indicators would take a 'whole-of-workforce' approach, and have the capability to build additional datasets into the tool for other professions eventually.

Domain 2: health services and infrastructure

The availability of datasets, which enable health facilities to be mapped, would strengthen a set of indicators. This would enable users of the set of indicators to visualise where health facilities, such as hospitals and practices are located. Schools data, if incorporated, could act as a proxy for general infrastructure in a community. The existence of schools in a community might suggest a community's capacity to support the establishment of new health services. Schools data also provide an indicator of existing education facilities in a location—a key factor influencing a health professional's decision to commence practice in, and remain practising in, a particular area (14, 26).

Domain 3: demography

Estimated residential population data are available from the ABS. Recent research has made it increasingly clear that population data should be taken into account during health workforce planning (14). Ensuring a set of indicators includes additional demographic variables, such as a measure of socioeconomic disadvantage, would enable users of the indicators to better assess community needs.

Domain 4: geography

The geographic context of the health workforce is another important consideration, particularly when units of analysis (for example, Modified Monash Model and DWS areas) can be relatively large. Geographic factors such as land area and population dispersion influence access to services, and cases where community members must travel great distances to access health services may require novel solutions to providing services. The most up-to-date geographical classifications could be overlayed as indicators of remoteness, for example, by incorporating the Modified Monash Model and ASGS-RA into a set of indicators.

Conclusion and consultation

A set of health workforce-related indicators could complement existing geographical classifications, which are used to inform health workforce and service distribution policy and planning. A set of indicators would ideally factor in a broad range of professional and non-professional variables, across multiple domains. This will allow policymakers to consider current and projected workforce characteristics and to test 'what if' policy scenarios, but also to build community profiles and better assess the types and levels of need in those communities.

In exploring the possibility of developing a set of indicators, the department should ensure the tool is robust enough to cope with changes and updates affecting underlying datasets, to support agile analysis that reflects the changing landscapes and needs of the community and the health workforce.

Following presentation on this topic at the 14th National Rural Health Conference, Cairns, 27 April 2017, interested stakeholders are invited to provide feedback in relation to the development of a set of health workforce-related indicators. Feedback is invited via email to the corresponding author by 31 May 2017.

Authors' contributions

AL Morell, M McCarty, S Thain, RM Beaty, and A Catchpole are employed by the Australian Department of Health, the organisation conducting research into the potential development of a set of health workforce-related indicators.

AL Morell is a final year candidate in the UNSW professional Doctorate in Public Health (DrPH).

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AL Morell drafted the manuscript. M McCarty, S Thain, RM Beaty, A Catchpole, G Lawrence and R Menzies critically reviewed the draft manuscript and provided input to the final manuscript.

All authors read and approved the final manuscript.

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Presenters

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Maureen McCarty has over 25 years' experience in health service delivery and workforce planning in both the public and private sectors. She is currently the Director of the Workforce Data Analysis Section, Health Workforce Division, at the Australian Government Department of Health. The section is responsible for management of the National Health Workforce Dataset, an online data tool and production of the department's health workforce supply and demand studies, including the Australia's Future Health Workforce reports. Previously, Maureen managed the workforce planning program at Health Workforce Australia, which produced Australia's first major, long-term national projections for the health workforce out to 2025.