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Research

Priorities for building Australian workforce capacity to leverage population-based, routinely collected data: views from pharmacoepidemiology

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Key points

- Building workforce capacity in the Australian routinely collected arena will increase the ability to provide valid and credible findings to inform practice and policy
- Essential knowledge required for the workforce includes understanding the Australian healthcare system; how data are generated from real-world health service use; ethics and governance processes and data confidentiality. Developing educational opportunities to fill the gaps in this knowledge base is a priority

Abstract

Aim: To explore perspectives of leaders in pharmacoepidemiology on building workforce capacity in the routinely collected data arena to enable researchers to generate evidence to support clinical and policy decision-making.

Methods: Semi-structured interviews were conducted between May and August 2018 with 13 leaders in pharmacoepidemiology in Australia. Discussion topics included training needs, workforce enablers, barriers and priorities for building capacity. The data was analysed using a content analysis approach.

Results: Leaders identified a range of knowledge and skills that are needed to work with routinely collected data and generate evidence to support clinical and policy decision making. Enablers identified included collaborations and promoting awareness to attract new people to work with this data type. Barriers included difficulty accessing data, lack of critical mass of human capital to build skill levels and funding issues.

Conclusions: Building workforce capacity involves addressing identified enablers and barriers. Central to building workforce capacity is the harmonisation of Australia's data infrastructure, which can improve the way people work, learn, collaborate, share ideas and expand their professional network.

Key points (cont.)

- Harmonising Australia's data infrastructure and re-organising the way people work together is central to building workforce capacity
- Australia needs to address issues that hinder the progress of research using routinely collected data or risk lagging behind countries with more highly functioning systems

Introduction

Investments in Australian routinely collected data infrastructure (e.g. data from electronic medical records, administrative payment data, disease registries and a broad range of digital apps) and the development of policy frameworks to support such research have increased scientific productivity. This output informs and drives health system effectiveness and population health improvement across a wide range of health disciplines.[1, 2] Current opinion suggests broadening the skill base of the existing research workforce to form new, larger, interdisciplinary teams. These teams must incorporate capabilities ranging from computer science and partnership research to research translation.[2] However, these needs are not necessarily based on empirical evidence or prioritised based on stakeholder needs. Research is needed to understand the current state of Australian research workforce that uses routinely collected data and to prioritise needs to inform evidence-based capacity building.

We interviewed leaders who ran studies with routinely collected data, using pharmacoepidemiology as an example. Pharmacoepidemiology has grown significantly in recent decades in Australia and internationally. Widespread recognition of shortcomings of pre-market clinical trials and increased access to routinely collected health data to undertake studies of drug use and risks in real-world clinical care have been the driving force for growth.[3,4] Pharmacoepidemiology in Australia provides a valuable lens through which to examine the challenges associated with using different types of routinely collected data (e.g. claims, clinical registry and service contact data). In addition, changes in medicine availability and use over time, combined with the many historical changes to the Pharmaceutical Benefits Scheme (PBS), the Australian Government program that provides residents with access to subsidised prescription medicines, require a workforce with a range of backgrounds, including clinical, population health and data sciences, together with a good understanding of the limitations and intricacies of these data.[5]

We aimed to explore the views, needs and perspectives of leaders in pharmacoepidemiology on issues relevant to building capacity in the workforce, working with routinely collected data collections to enable researchers to generate evidence to support clinical and policy decision making.

Methods

This study comprised data from semi-structured interviews with leaders in pharmacoepidemiology in Australia. We used goal-directed sampling to identify leaders from four Australian jurisdictions who employed or supervised people working with routinely collected data in pharmacoepidemiology. Of 14 leaders who were approached, 13 agreed to participate. An experienced and trained interviewer (CS) conducted semi-structured telephone interviews between May and August 2018. Interviews were audio-recorded and later transcribed and de-identified. Discussion topics included current and future training needs, workforce enablers, barriers and priorities for building capacity (Box 1).

Box 1. Key discussion topics for interviews

- The interviewees' role in pharmacoepidemiology
- What professional skills or knowledge are currently needed to work with routinely collected health data?
  - Needed in this field in the next five years?
  - Needed for the increasing availability and use of linked data and big data?
- What are the current training opportunities, strategies and programs?
  - Formal and informal ways to train
  - Existing resources
  - Future recommendations
- What are the barriers to building workforce capacity?
- What are the enablers to building workforce capacity?
- What do you feel are the three priority areas for building workforce capacity in pharmacoepidemiology?

DL and CS completed a content analysis[6] of the transcripts discussed and reviewed by the other authors. The content analysis involved immersion in the transcripts and coding of the data. All data were grouped into topic categories and subcategories.

Ethical considerations

This study was approved by the Human Research Ethics Committee of The University of Western Australia (RA/4/20/4304). Participants provided signed informed consent before the interview.

Results

Profiles of leaders

Leaders were nine women and four men aged 40–59 years who had been involved in studies using routinely collected data in pharmacoepidemiology for an average of 15 years (range 3–30 years). Eight were from academia, with five from non-academic settings (government and nongovernment organisations).

The results that follow are reported in the key topic categories.

Knowledge and skills needed to work with routinely collected data

Leaders stated the routinely collected data workforce (hereafter 'the workforce') required a wide range of knowledge and skills, citing biostatistics, epidemiology, clinical understanding, and working with large datasets or linked data to be critical workforce competencies. They were cognisant that one person would not possess all the required skills. Therefore, interdisciplinary teams must undertake quality research using routinely collected data, for example:

> *"… it's not about an individual, it's about the teams … people with the different skills coming together." (Leader 9, non-academia)*

All leaders expressed the importance of understanding the Australian healthcare system and how these data relate to service contacts and how they are generated or collected. Furthermore, understanding the intricacies of health data, and understanding the context in which medicines are used in Australia are essential knowledge in pharmacoepidemiology teams. For example, one participant commented:

> *"… a key understanding of the (healthcare) system in Australia in terms of the way medicines are subsidised, the way medicines are collected in the PBS [Pharmaceutical Benefits Scheme] and how you might use that data to look at exposure to medicines and some of the approaches that are inherent in using that data …" (Leader 8, academia)*

As in all health research, broader skills cited included good communication skills, writing and translating study findings for a range of audiences, and consulting with end-users and policymakers, especially as data, methodologies, and technologies become more complex.

Skills that the workforce will require in the next 5 years

There was no consensus among leaders on the specific skills that the workforce would require in the next 5 years. Still, the prevailing perception was that they reflect the ability to embrace the burgeoning availability of complex datasets. In summary, leaders suggested that the workforce will need the skills to work with an expanding variety of data sources in different formats. These include unstructured data that require natural language processing and novel and sophisticated analytic techniques (e.g. data mining, data analytics, deep learnng, machine learning and econometrics).

Current and future training for the workforce

Leaders employed a variety of approaches to upskill their staff, including in-house training, seminars, presentations, master classes, team meetings, journal clubs and methodology forums. Leaders sent staff to external courses, conferences or symposia, analytical techniques and other related topics. Those working in academia often had relevant classes within their institution that staff could attend, and non-academics reported reliance on engaging external trainers to upskill their workforce. Regardless of the training strategies, workforce upskilling was fundamental to ensuring the skill set within a team met the needs of the constantly changing and upgrading skills needed in using these data.

Leaders had a wide range of suggestions for future training modes ranging from developing online modules like Massive Open Online Courses (MOOC) to graduate diplomas or streams in Masters degree programs. They also spoke of the value of current formal short courses offered in different Australian jurisdictions and suggested sharing resources, for example:

> *"We need to be sharing all these resources to make sure that we're not reinventing the wheel … it'd be really good if we have a national training and we brought it all together." (Leader 7, academia).*

Barriers and enablers for building capacity in the workforce

Most leaders felt the main barrier to building workforce capacity was difficulty accessing data. This included blockages to accessing more 'sensitive' data (e.g. patient-level data) even when de-identified, and long delays in receiving data even once approved. Delays were attributed to lengthy and complex application proceses and the oversight by numerous ethics committees and data custodians. One suggestion was for a unified ethics committee to approve projects instead of multiple committees. A consistent view was that having 'more readily' available and timely access to data would enable more research to be undertaken, and would result in greater demand from various partners to undertake and fund research.

Another barrier to workforce capacity was not being able to form a critical workforce to build a team that could learn from each other and support each other. This lack of cooperation was primarily due to limited funding opportunities in a highly competitive environment, and the situation where when obtained, funds were typically limited to a specific project. However, if sustained core funding was available, leaders believed it would be easier to maintain processes to support the workforce and infrastructure, for example:

> *"… you need money to create the dataset, to maintain the dataset, to make really good data managers, and then you also need the early- to mid-career people ... you need the whole team … so to enable the next step, it would be funding the kind of teams and infrastructure rather than sort of picking out isolated parts of it." (Leader 5, academia*)

Collaboration with a range of interstate and overseas partners allowed the expansion of the breadth of the work beyond the current boundaries. Another enabler was raising awareness among students, future partners and the potential workforce about the possible uses and impact of these data in each research field, for example:

> *"… it's also about generating awareness of pharmacoepidemiology … we've been approached by a lot of people who have seen presentations that we've done … and they've said, 'Could you work with us on this particular research question?'" (Leader 6, academia)*

Priority areas

Priority areas suggested by leaders included increased collaborative work within Australia and internationally, including engaging with clinicians and industry partners; developing new and novel methods in the field; developing training such as offering field placements and online modules; and improving funding for projects and fellowships. However, one leader expressed caution with use of online resources, as they required dedicated ongoing support to provide continual updating in an ever-changing field. Another priority area was around data access issues, for example:

> *"A priority is around the sort of data access and governance and a fairly coordinated approach to working with government and those who are drafting new legislation …" (Leader 12, academia)*

Discussion

There has been a considerable improvement in accessing linked data over the last 5 years, as evident from the steady increase in the scientific output involving the use of routinely collected data.[1] There have also been many lessons learned in this field, including the requirement for good communication, engagement and governance[7], and understanding of linkage challenges[8], data limitations[9] and complexities of the datasets.[5] This paper identified knowledge and skills, barriers and enablers, and priority areas for building workforce capacity to leverage the burgeoning availability and complexity of routinely collected data. We identified factors to make system improvements that will progress outcomes across all health and human services research sectors. Our findings are likely to be transferable beyond the field of pharmacoepidemiology with relevance to other areas of epidemiology and data science in both health and non-health sectors.

Given the highly complex nature of work using routinely collected data, the required range of knowledge and skills are unlikely to be found in a single person but rather within an interdisciplinary team. Team members would include those from 'more traditional' backgrounds (e.g. statistics, epidemiology, health economics, clinical) and those with expertise in data science and other emerging areas of data analytics. This has been highlighted in other research workforces (e.g. health services, allied health) that are made up of a broad team of professionals who self-identify as researchers rather than by their graduate degree or professional body.[10,11] It is perhaps appropriate that a specific qualification or formal training is not mandated. This may be overly restrictive and exclude people who could bring creative or novel approaches to problem-solving or expand the types of analysis performed using these data, leading to higher research impact.

The development of education and training opportunities to increase competencies in the current workforce and keep pace with the recent advancements and emerging methodologies is a priority. Essential knowledge required for each person, regardless of their academic background or discipline, includes understanding the Australian healthcare system, how data are generated from real-world health service use and the intricacies of these data, and understanding the context in which services are being used in real-world practice. Failure to incorporate such knowledge can lead to erroneous conclusions, which in extreme cases can result in detrimental shifts in clinical practice or large-scale policy changes. We recommend developing study material to fill the gaps in understanding in the Australian healthcare system. Information about how data are generated and how to access these data by addressing issues (e.g., ethics, governance) specific to each jurisdiction (or multiple jurisdictions) and those at the national level; could be incorporated into current courses provided throughout Australia. Equally important is the appreciation of the complexities of the data linkage environment in Australia and the nuances that exist in different jurisdictions. This also includes understanding ethics application processes and data confidentiality and privacy issues. Well-prepared data requests and ethics applications are essential in ensuring a sound project and could expedite the application process. Appropriate training in these areas may also increase trust between data custodians and data users.

There are many challenges in providing these continuing professional development (CPD) opportunities. The breadth of this field and emerging methodologies, adequate resourcing and accessibility issues in a country that is 31 times the size of the United Kingdom (UK) geographically but with a smaller population (25 million vs 65 million) are just a few of these challenges. Providing a one-stop training program for gaining experience in working with these data is near impossible given the broad range of areas to be covered. We propose exploring a decentralised distance learning model, such as that used by Biostatistics Collaboration Australia (BCA)[12] to train biostatisticians for teaching and training users of routinely collected data. The BCA model involves multiple universities collaborating to develop and deliver a range of courses for a single specialist program. The same could be applied to training for routinely collected data. For example, universities could form a consortium with each delivering different course units that would cover the broad areas of knowledge required, with each university contributing in their areas of expertise. Most of the leaders we interviewed were enthusiastic about sharing their resources.

Furthermore, various postgraduate and intensive short courses are delivered at selected centres throughout Australia. The cost (e.g., registration, flight, accommodation) to send staff to these training events is expensive. This could be a barrier to providing CPD opportunities for groups with a limited budget. Additionally, travel restrictions such as those due to pandemics may limit attendance. The experience of delivering distance learning ('learning without boundaries') during the coronavirus 2019 (COVID-19) pandemic could be used during standard travel times. This should not be difficult as most Australian universities are equipped with hardware and software for online/distance education. It is also possible that the COVID-19 pandemic will lead to the development of new distance-learning technologies in the coming years.

We must consider CPD opportunities for the current and future workforce. To provide a pipeline into this field, universities must be more proactive in promoting this type of work across all their degree programs. For example, offering students the opportunity to work directly with simulation datasets that reflect real-world data, with projects designed to be completed by students within their allotted study time. Given the increasing emergence of data-driven employment opportunities, it would be beneficial to expose students to this type of work at an undergraduate level rather than just at the postgraduate level, which is currently the norm in most Australian universities. There is competition for students across the university sector and the COVID-19 pandemic has disrupted international student numbers. Providing such exposure could add a competitive advantage in recruiting the best minds to work with these data, particularly in institutions willing to adopt this approach.

Central to working with routinely collected data is timely access to such datasets, with most leaders interviewed expressing frustrations with the slow and complex processes required to access these data. This is made more difficult by the fragmentation of publicly owned data collections in Australia, where they are held by many custodians across state and federal agencies. The approval process can be slow due to the large number of applications received, the complexity of some applications, and the custodian and ethics committee not feeling confident about the decision making in a complicated legislative environment.[13] There is an urgent need to reduce the burden on all parties through streamlining the application process while mitigating risk and ensuring that the public interest is served by approving research that will benefit the community. There has been some progress in streamlining ethics processes by implementing a national system for mutual acceptance of scientific and ethical review (i.e., National Mutual Acceptance Scheme), now covering all Australian jurisdictions.[14] There have also been calls for the establishment specialist Human Research Ethics Committee with specific expertise in data linkage and the ethical issues that arise from using linked data, particularly without patient consent.[13]

Australia has historically lagged behind other countries by not establishing comprehensive enduring linkage of, and access to, routinely collected data for research. This is despite having universal healthcare arrangements and the potential to undertake whole-of-healthcare and whole-of-population research of national interest.[15-17] However, Australia has the capacity to turn this situation to its advantage by learning from mature, highly functioning systems to scale up its current capability. For example, Australia can learn from the UK and Canada, which have similar healthcare delivery organisation and political structures. While both countries, like Australia, have issues bringing together a complete national data resource, the UK and Canada have more contemporary models for routinely collected data studies. These include dedicated entities such as data centres that focus specifically on providing data to researchers for research. The entities would assume responsibility as the data custodian of their linked data holdings and convene an independent scientific and ethical review of projects using the data collections.[18] However, data sharing agreements with the original data custodians would still be necessary to support arrangements for secondary use of the data.

In recent times Australia has made some significant progress in breaking down many of the legislative and cultural barriers to liberating Australia's data assets for public benefit. This includes the establishment of an Office of the National Data Commissioner (ONDC) in August 2018.[19] Importantly, the recent passing of the *Data Availability and Transparency Act 2022,* developed by the ONDC, provides legislation to modernise and streamline the sharing of government data between agencies and the private and research sectors.[20] Furthermore, groups such as the Population Health Research Network[21] and the Australian and New Zealand Real-World Data Network[22] continue to consult with stakeholders across all sectors of health and human services research in drafting their responses to the Australian government's legislative reforms on data sharing and release. These strategies should include recommendations for change and incorporate a robust implementation plan supported by the highest levels of government and appropriate resourcing.

While waiting for improved access to Australian data, there are many suitable datasets available internationally that could be used to provide the Australian workforce with the skills and experience of working with large datasets. These include the Secure Anonymised Information Linkage Databank (Wales)[23], ICES data (Canada)[24], and Clinical Practice Research Datalink (UK).[25] Access to these data will also allow researchers to perform comparative studies between different health systems, however staff may be required to travel overseas as many countries restrict access beyond international boundaries. This may be a barrier for Australian groups, given our geographical isolation, and for groups with smaller budgets to cover staff relocation costs. However, there are a number of initiatives for remote-access cloud computing virtual laboratories that are being explored in Australia and internationally that may overcome these issues. On the positive side, by leveraging the international collaboration, Australian groups may be in a good position to access foreign funding schemes.

Like most scientific fields, there must be sustainable long-term funds for workforce salaries, projects, infrastructure (including data infrastructure), postgraduate scholarships, fellowships and CPD opportunities. This is difficult in a highly competitive funding environment where funding is limited and spread across research areas. The Centre of Research Excellence (CRE) in Medicines Intelligence[26] was established in November 2020 through a $2.5 million 5-year grant from the Australian Government National Health and Medical Research Council (NHMRC). By using population-based routinely collected linked data and sophisticated study designs, the CRE plans to develop and deliver new knowledge of medicines in Australia that can be used by regulators and payers, and can be translated directly into policy and practice, improving responsiveness to current and emerging policy imperatives. This CRE, through its four portfolios (i.e. methods; data; capacity building and training; translation and communication), will provide opportunities for researchers in institutions across Australia to collaborate more closely on key research priorities and accelerate the development and translation of evidence about real-world medicine use and outcomes. Although the CRE is in the early stages of its initiatives, sustained funding is needed for the long-term success of work using these data.

Conclusions

Building workforce capacity to enable greater use of routinely collected health data involves providing education and training opportunities, collaborations and partnerships. Notably, there must be access to data and sustained funding. Central to building workforce capacity is the harmonisation of Australia's data infrastructure, which can improve the way people work, learn, collaborate, share ideas and expand their professional networks. However, Australia must not develop more data infrastructure without investing in the workforce who will analyse these data and provide valid and credible findings so clinicians and policy makers can use them to inform practice and policy.

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Competing interests

None declared.

Author contributions

DL conceived the study and, together with FMS, BD, SP, and DBP, developed the interview questions. CS conducted all interviews. DL and CS completed a content analysis of the transcripts, which was discussed and reviewed by the other authors. DL and CS wrote the first draft of the manuscript and all other authors provided critical feedback.

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