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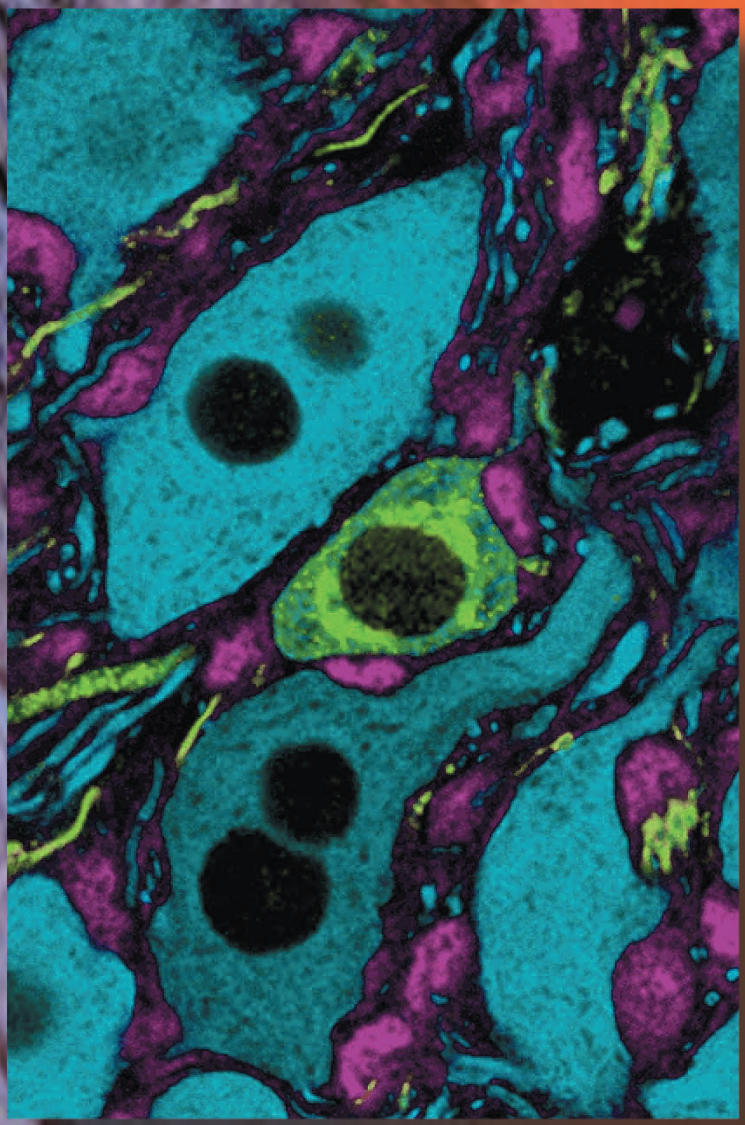

ORIGINAL ARTICLES

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ORIGINAL ARTICLE

The contribution of NSW Health Pathology to medical research: the first 10 years

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Abstract

Medical research is integral to improving diagnosis and treatment of disease. NSW Health Pathology is the largest publicly funded pathology organisation in Australia and also undertakes research related activities, but no formal broad analysis of these activities is available.

A PubMed search of publications was conducted looking for authors who have ascribed their affiliation as NSW Health Pathology (or variations therein).

The final analysis identified a total of 2345 publications citing at least one affiliation as NSW Health Pathology (or variations therein). These publications appeared in a wide range of journals, and from a broad spread of geographical locations and fields of practice.

To the author's knowledge, this provides the most comprehensive analysis of publications arising from researchers citing a NSW Health Pathology affiliation and highlights a broad spread of publications arising from several geographical locations and service streams of NSW Health Pathology.

Key words: ***Medical research, NSW Health Pathology, PubMed.***

Introduction

Medical research is integral to improving diagnosis and treatment of disease. NSW Health Pathology (NSWHP) is the largest publicly funded pathology organisation in Australia. The NSWHP website (https://pathology.health.nsw.gov.au/) indicates that 70% of medical decisions rely on pathology and that the organisation performs 100,000+ clinical and scientific investigations each day, employs 5,000+ staff throughout NSW, has 60+ laboratories, and has 150+ collection services in NSW. Established in 2012, the organisation currently provides comprehensive pathology services; these are organised into several service streams (namely the 'clinical streams' of Anatomical Pathology, Chemical Pathology, Haematology, Immunology, Microbiology, Pre- and post-analytical, and Transfusion), which manage the delivery and performance of these pathology services (https://pathology.health.nsw.gov.au/services/pathology/). In addition to pathology, NSWHP operates several additional state-wide services: Biobanking, Public Health, Point of Care Testing, Genomics, Forensic Medicine, Forensic & Environmental Toxicology, Criminalistics, and Perinatal Postmortem (https://pathology.health.nsw.gov.au/services/).

Medical research is also one of NSWHP's core activities. The importance of medical research to the operations of NSWHP is noted in several publications from the organisation, which aspires to "lead the way in teaching, training and research in diagnostic and forensic pathology to deliver better outcomes and experiences for the community" (NSW Health Pathology Clinical Services Plan 2019 – 2025). NSWHP also has a research strategy outlined in the document titled "Research Strategy NSW Health Pathology Towards 2025" (https://pathology.health.nsw.gov.au/research/research-strategy/), and has also published several annual 'Research Activity Reports'

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(2017 to 2020 inclusive https://pathology.health.nsw.gov.au/research/our-research/research-activity-reports/.

No recent formal evaluation of medical research performed within NSWHP has been undertaken to the author's knowledge. The current report therefore aims to provide a snapshot of the output of NSWHP researchers, as undertaken and published in the scientific and medical literature, and also noting NSWHP as at least one of the authors' affiliation(s). Since NSWHP was initially established in 2012, the current report essentially assesses data captured within the subsequent 10 or so years.

Materials and methods

As noted above, NSWHP was first established in 2012. The PubMed database is a database managed by the US National Institute of Health (NIH) National Library of Medicine. Available at https://pubmed.ncbi.nlm.nih.gov, the website provides simple and advanced search features. The PubMed database was chosen because it is a freely available database and is well respected and utilised by medical researchers. The database is also the one used by NSWHP to document publications from NSWHP staff on its website (https://pathology.health.nsw.gov.au/research/our-research/research-publications/). Although the database does not cover all journals publishing medical research, it does comprise "more than 37 million citations for biomedical literature from MEDLINE, life science journals, and online books" (https://pubmed.ncbi.nlm.nih.gov). Notably the AJMS is not represented in the PubMed database, and so publications from this journal have been missed in the current data. There are several other well-established databases, but these tend to be available only to subscribers (i.e. exist behind some kind of paywall), and thus are not freely available. This includes some databases in which the AJMS is represented (e.g. Embase).

The recommended affiliation citation for NSWHP researchers according to an internal document is 'NSW Health Pathology'. Researchers may however use variations of this affiliation. An initial scoping review was performed on April 1 2024, using a search of 'NSW Health Pathology' as well as the abbreviation 'NSWHP' in the affiliation field of the advanced search site of PubMed. This uncovered several additional affiliation formats used by NSWHP researchers, primarily 'New South Wales Health Pathology', so a second search was performed using 'New South Wales Health Pathology' in the affiliation field of the advanced search site also on the same day. An initial evaluation of search results was then undertaken to assess for any other unexpected patterns for the affiliation. Finally, a subsequent search was performed using the search string "((New South Wales (NSW) Health Pathology[Affiliation]) OR (NSW Health Pathology[Affiliation]) OR (New South Wales Health Pathology[Affiliation]) OR (NSWHP[Affiliation]))" on May 11 2024. The search data was downloaded to a personal computer and formal data analysis then undertaken.

Ethics

As this is a retrospective review of publication citations available from a freely accessible database, not otherwise involving patients or non-freely available information, specific ethics approval for the study was deemed to not be required.

Definitions and assignments

As indicated in the introduction, NSWHP provides both pathology services and additional services including state-wide services. Pathology services are organised into both service streams (also called 'clinical streams') and separate pathology networks according to geographic locality and use of specific laboratory information systems (i.e. separated as 'West', 'Rural and Regional', 'South', 'North' and 'East') (Favaloro *et al* 2023). Other service streams have also been outlined in the introduction. Research activity within NSWHP may occur within any of these services, fields or geographic locations. The 'locations' often cited by authors using an NSWHP affiliation will not specify a given network or service steam, but the affiliation location and department will usually provide this information indirectly. For example, the author to this report works within the Haematology Department at the Institute of Clinical Pathology and Medical Research (ICPMR) located at Westmead Hospital. His affiliation can therefore be linked both to the Haematology clinical stream (or service stream) as well as to the 'West' network of laboratories (Favaloro *et al* 2023). Similarly, an author citing a department of 'Anatomical Pathology' or else 'Tissue Pathology' can be ascribed to the 'Anatomical Pathology' clinical (service) stream; if they cite Royal North Shore Hospital as their location, they will also be ascribed to the 'North' network, but if they cite Royal Prince Alfred Hospital as their location they will be ascribed to the 'South' network, and so on.

Results

The search strategy and summary data are shown in Figure 1. The initial search identified 1796 publications, with highest usage of the organisation's recommended affiliation citation as "NSW Health Pathology", but also identifying secondary usage of "New South Wales Health Pathology", "NSWHP" and "New South Wales (NSW) Health Pathology". The secondary search using "New South Wales Health Pathology" identified 536

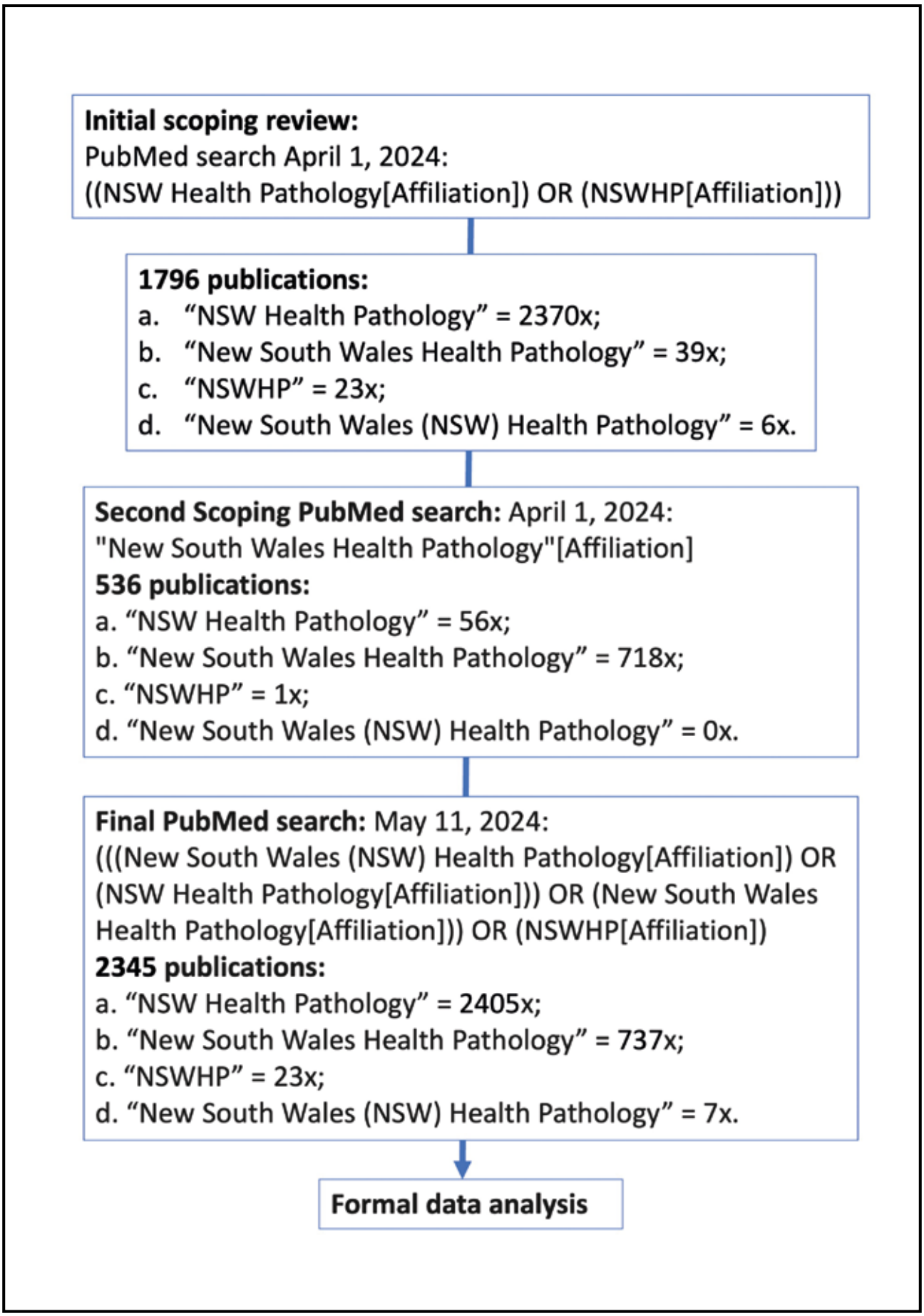

Figure 1. *Study design.*

publications, many of which were missed in the first search. After checking the output for any other possible affiliation citation variations, a final search was performed using the four identified affiliation citation variations and no further affiliation citation variations were identified. This final search identified a total of 2345 publications citing at least one of these affiliation variations.

The yearly publication rate of NSW Health Pathology researchers captured by the search and according to year, up to the final complete year of 2023, is shown in Figure 2A. Surprisingly, there were two publications cited in 2012 (the year the organisation was created) followed by four and nine publications respectively in the next two years. It is unclear if the low initial publication counts reflected "uncertainty" around using a NSWHP affiliation, or a lack of author knowledge around the 'correct' affiliation citation to use, but publications ascribed to NSWHP grew over subsequent years. NSWHP researchers published in excess of 400 PubMed listed papers/year in the last four full years of data capture (2020-2023 inclusive). The most "popular" PubMed listed journals utilised by NSWHP researchers is shown in Figure 2B. The most popular journal was perhaps unsurprisingly the Journal 'Pathology'. Forty-six NSWHP affiliated researchers published in excess of 20 papers each over the data capture period (Figure 2C), with the lead author publishing nearly 250 publications over this time. An analysis was also performed for NSWHP affiliated researchers contributing to these publications as first, second or last author. In general, first and second listed authors are either the major contributors of the study (for original studies) or take the lead for writing duties, inclusive of reviews, or might also act as the 'corresponding' author. In contrast last authors are often the 'senior' authors, who may take overall responsibility for the study or for a research group or who might otherwise act as the 'corresponding' author. In summary, nine authors published ≥10 papers each over the data capture period as a first author (Figure 2D), 11 authors published ≥10 papers each over the data capture period as a second author (Figure 2E), and 18 authors published ≥10 papers each over the data capture period as a last author (Figure 2F).

The geographic work site location of authors with a NSWHP affiliation was also assessed and summary data shown in Figure 3. It should be noted that this data captures all authorships ascribed to a NSWHP affiliation publication and a given geographic location (e.g. Westmead Hospital, Royal North Shore Hospital, Royal Prince Alfred Hospital and so on). Since multiple authors appear in most publications, the counts in these figures will exceed the total publication counts shown in Figure 2A. Figure 3A shows the authorship counts in the capture period by geographic work site location. Sixteen work site locations contributed authorships in excess of 20 each over the data capture period. Figure 3B shows the authorship counts in the capture period according to the NSWHP 'service stream'. Ten 'service streams' contributed authorships in excess of 60 each over the data capture period. Figure 3C shows the authorship counts in the capture period by 'service network'. Seven 'service networks' contributed authorships in excess of 25 each over the data capture period. Finally, Figure 3D shows the authorship counts in the capture period by both work site location and 'service fields', to provide better context around authorships.

Discussion

To the author's knowledge, this is the first detailed analysis of medical research output from researchers citing a NSWHP affiliation. The analysis has focussed on journals listed within the PubMed database, a freely available database and therefore the veracity of the data can be easily checked. It will additionally permit future comparative analyses of other publicly funded pathology organisations or research facilities.

The author was involved in a separate similar analysis published in 1998, which comprised an analysis of medical research in New South Wales (NSW) from 1993-96, as also assessed by Medline publication capture (Favaloro 1998). In that publication, it was found that NSW hospitals were very much involved in medical research and indeed accounted for the majority of publications identified - generally in excess of those arising from medical research institutions.

No comparative analysis of publication output from NSWHP vs established medical research institutions has occurred on this occasion, since the intention here is to provide a summary of NSWHP affiliated publications in the first 10 years (or so) of existence. As NSWHP associated research is also expected to have a different focus to that of established medical research institutions, the utility of such a comparison may be limited. Further comparative exercises may be performed in the future. The author is not aware of any similar comparative analysis of medical research undertaken by any other organisation where that research is freely available in the literature. There are however likely to be annual research reports from a wide variety of organisations that list publications from their researchers in that yearly data capture period. NSWHP has indeed released several such research reports in the past (NSW Health Pathology Research Activity Reports; 2017 to 2020 inclusive (https://pathology.health.nsw.gov.au/research/our-research/research-activity-reports/).

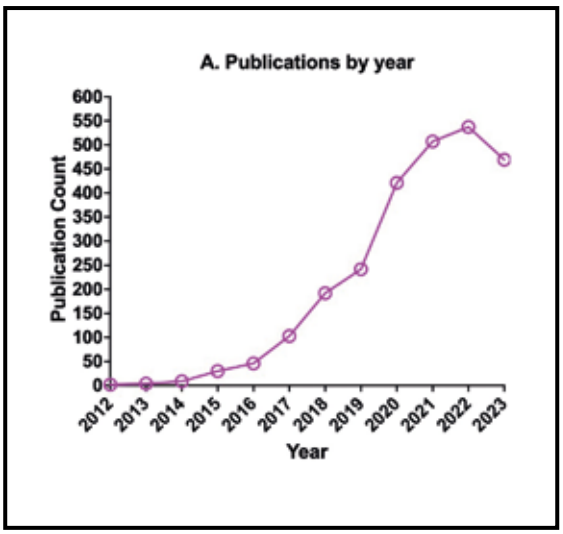

Figure 2A. *Publications ascribed to authors citing a NSW Health Pathology affiliation and extracted from the PubMed database as published over the years 2012 to 2023 inclusive, comprising the full years available at study completion date.*

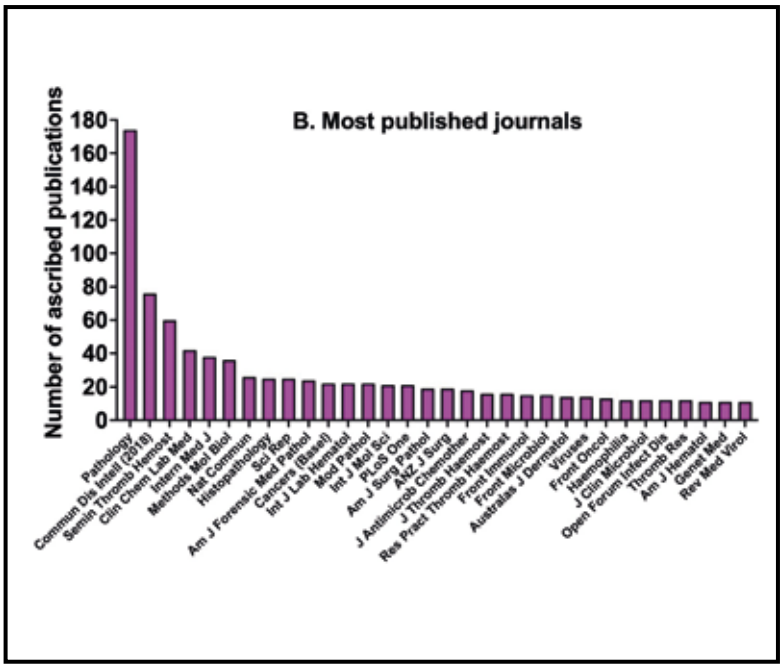

Figure 2B. *Most published journals as pertaining to data shown in Figure 2A (>10 publications).*

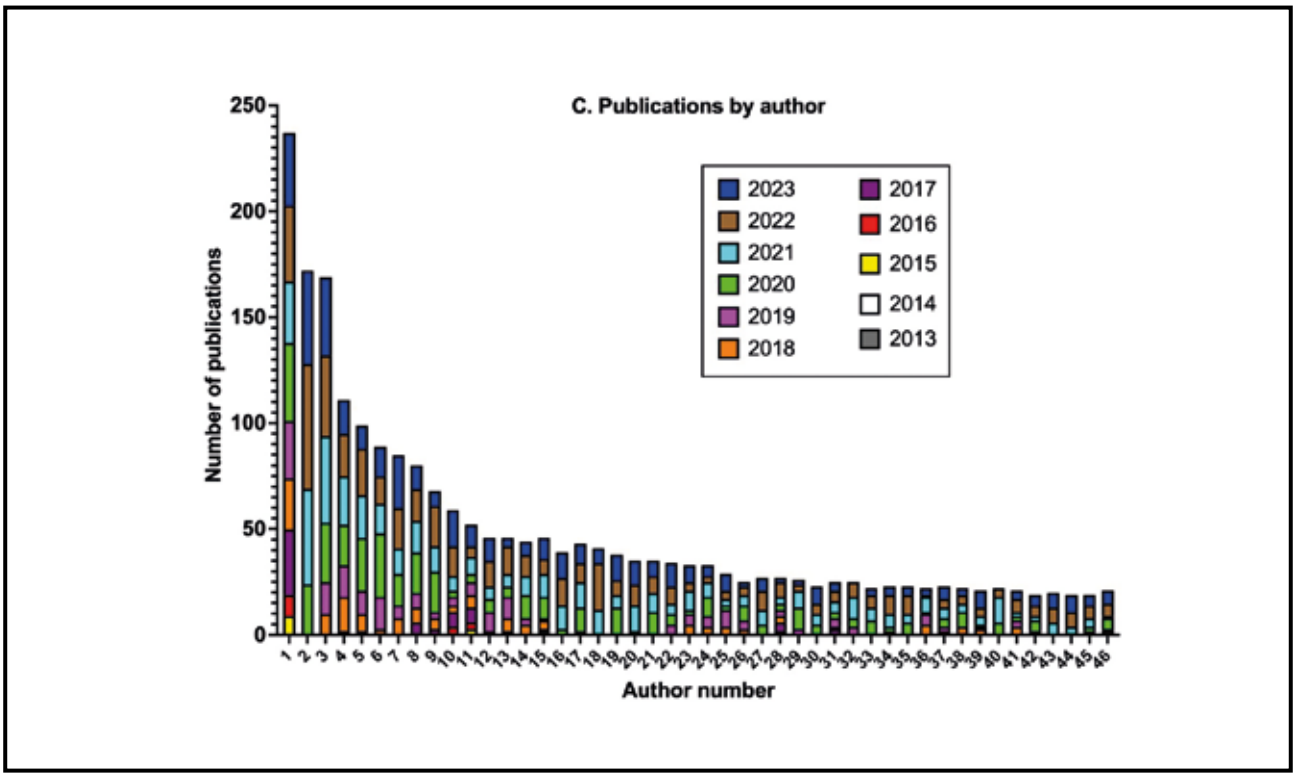

Figure 2C. *Publications ascribed to authors citing a NSW Health Pathology affiliation, as related to data in Figure 2A, and where a NSW Health Pathology affiliated author can be identified. Author identity has been kept anonymous.*

Figure 2. *Study metrics - Outcomes Part 1.*

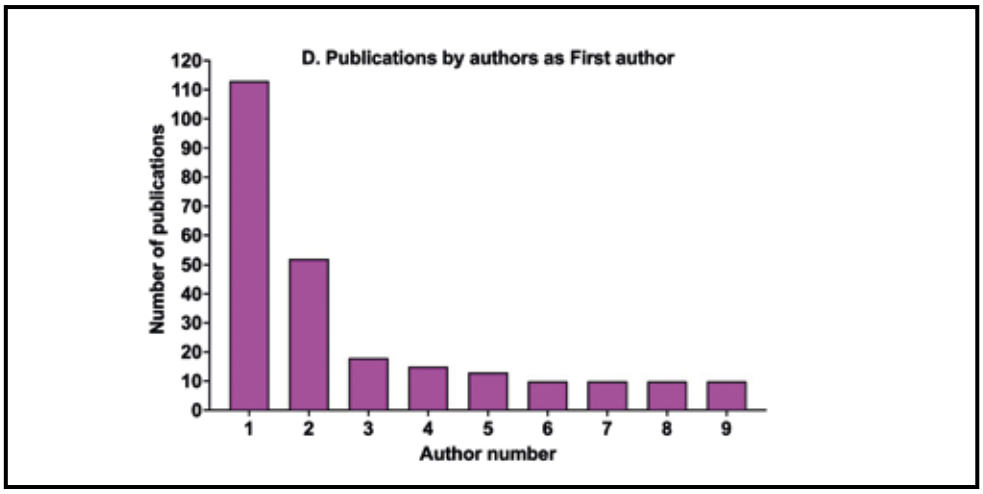

Figure 2D. *Publications ascribed to authors citing a NSW Health Pathology affiliation, as related to data in Figure 2A, and where a NSW Health Pathology affiliated author is listed as the first (or lead) author (≥10 publications). Author identity has been kept anonymous.*

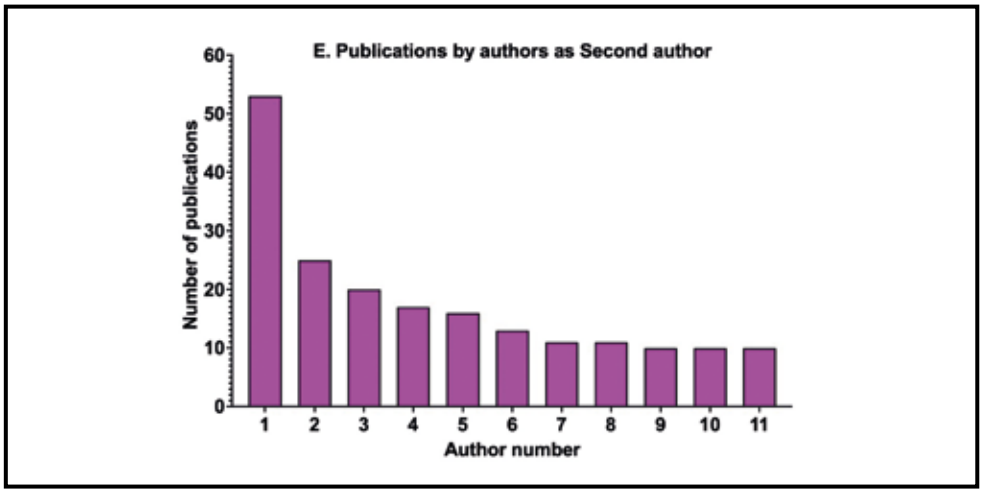

Figure 2E. *Publications ascribed to authors citing a NSW Health Pathology affiliation, as related to data in Figure 2A, and where a NSW Health Pathology affiliated author is listed as the second author (≥10 publications). Author identity has been kept anonymous.*

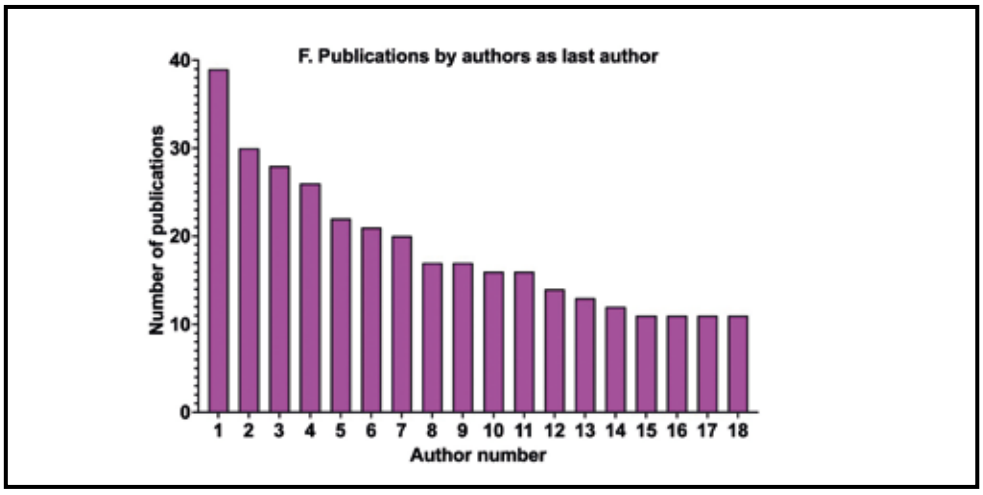

Figure 2F. *Publications ascribed to authors citing a NSW Health Pathology affiliation, as related to data in Figure 2A, and where a NSW Health Pathology affiliated author is listed as the last (or senior) author (≥10 publications). Author identity has been kept anonymous.*

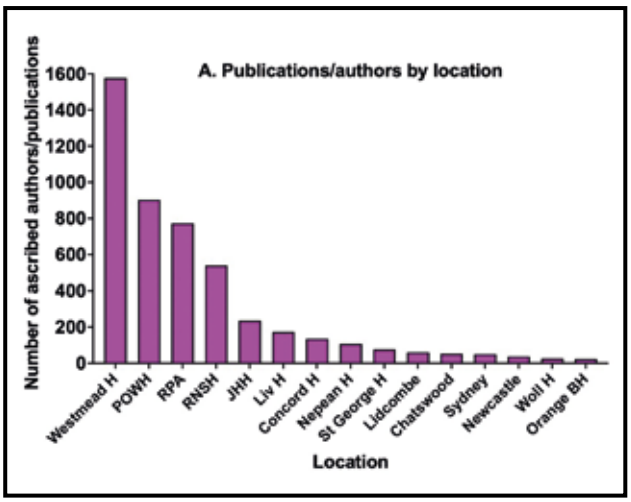

Figure 3A. *Publications/authors as ascribed to data in Figure 2A listed according to affiliation cited location (where >20 publications/authors listed).*

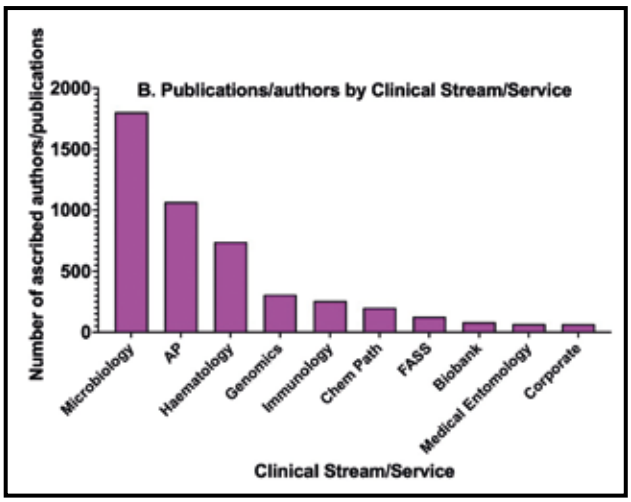

Figure 3B. *Publications/authors as ascribed to data in Figure 2A listed according to Clinical Stream or other NSW Health Pathology Service (where >60 publications/authors listed).*

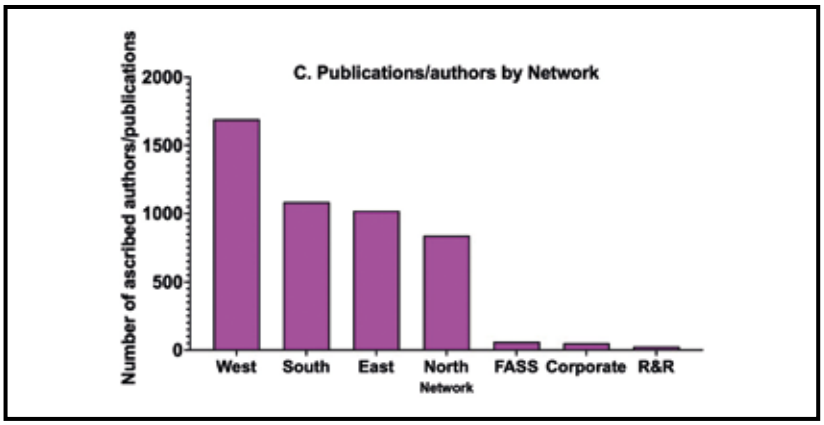

Figure 3C. *Publications/authors as ascribed to data in Figure 2A listed according to NSW Health Pathology Network Location (where >25 publications/authors listed).*

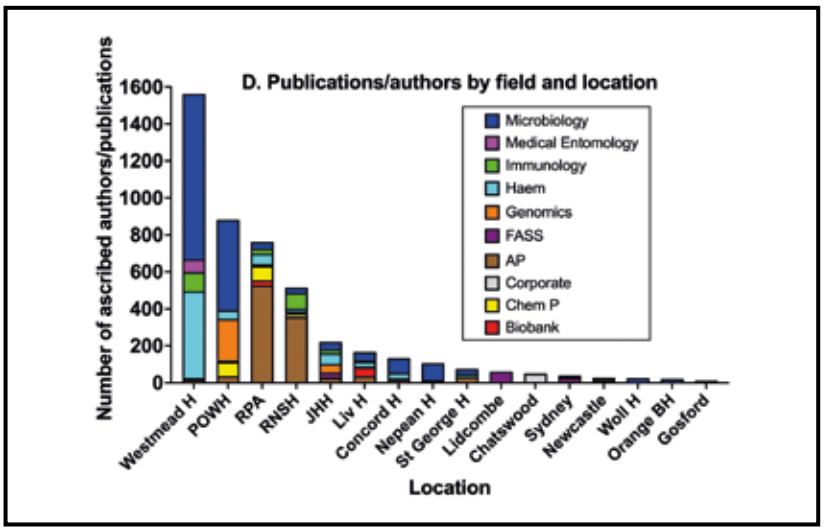

Figure 3D. *Publications/authors as ascribed to data in Figure 2A, and according to location and Clinical Stream or NSW Health Pathology Service ('field').*

Figure 3. *Study metrics - Outcomes Part 2.*

Study limitations and strengths

There are various study strengths and limitations that could be highlighted and are summarised in Table 1. The main limitation is that data available from only a single database has been assessed. Additional data bases are available and could also be assessed, assuming there is availability. On the other hand, the PubMed database is freely available, well respected, and contains in excess of 37 million citations for biomedical literature from MEDLINE, life science journals, and online books (PubMed database - US National Institute of Health (NIH) National Library of Medicine). Future assessments are planned using other databases and additional approaches when time permits.

Conclusion

To the author's knowledge, this is the most comprehensive analysis of publications arising from researchers citing a NSWHP affiliation. It highlights a broad spread of publications arising from several locations and service streams of NSWHP.

Conflict of interest statement

The author was, and remains, an employee of NSW Health Pathology during the data capture period. He has attempted to remain otherwise impartial during the analysis. The views expressed in this paper are those of the author, and not necessarily those of NSW Health Pathology or other institutions to which the author is affiliated.

Table 1. *Strengths and limitations of current study*

Study Limitation	Study Strength	Additional Comments
Assesses output from single database	PubMed database freely available, well respected, and has extensive listing. Ability to search author 'affiliations' using free text. Use of free database permits check of data veracity.	Addition databases that could be assessed in the future, but with caveats are: (a) Embase – but requires access (paywall), which author does not have (b) Google Scholar – freely available, but does not permit easy retrieval of captured data; also, difficult to filter captured data to publications associated with a particular organisation (c) Web of Science – author has access via University affiliation, but database does not list NSW Health Pathology as an Affiliation for search purposes (d) Scopus - author has access via University affiliation; although database does not list NSW Health Pathology as an organisation for 'organisation' search purposes, a free-text search of "NSW Health Pathology" is possible within an affiliation field.
Assesses publication number, but does not assess publication type or quality	Publication number is a major used metric.	Future analyses can be undertaken assessing publication type, journal impact factors, and other available metrics.
No comparison made with other 'comparable' organisations	Use of free database permits check of data veracity.	Direct comparison of publication metrics is limited given limitation of analysis to publication number without further assessment of publication type and quality metrics. Different organisations may target different journals, with different capture within any given database. Different organisations have different research focus.

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