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Retention patterns of the public sector nursing and midwifery workforce in regional and rural settings of southern Queensland, Australia: a 12-year retrospective analysis

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Abstract

Background The aims of this study were to investigate: (a) Specific time points of exit and time spent working in location of the public sector nursing and midwifery workforce in regional, rural, and remote southern Queensland; and (b) the influence of selected demographic, geographic, and employment variables on the risk of leaving a location.

Methods A retrospective cohort design was employed using the employment records of 3234 public sector nurses and midwives between January 2010 and December 2021. Employment records were analysed using survival analysis and Coxs proportional hazards regression, using the Andersen-Gill method to account for the inclusion of multiple records for some employees.

Results Study results revealed an overall median survival time of 1.83 years for public sector nursing and midwifery professionals. Registered Nurses were the predominant group employed, yet they also exhibited high turnover rates. Nurses and midwives in permanent full-time positions were more likely to leave location than those in part-time roles.

Conclusions Retention of nursing and midwifery professionals in rural Queensland is notably low, with high turnover rates among younger nurses and midwives and those in full-time positions. This study underscores the need for targeted retention strategies, such as flexible work arrangements, improved workplace conditions, and comprehensive professional development programs. Results indicate the need to focus nursing and midwifery workforce retention strategies within 12–18 months post recruitment to retain staff to avoid the current pattern of staff turnover.

Clinical trial number Not applicable.

Keywords Nurse, Midwife, Rural, Remote, Retention, Workforce

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Background

Retention of nurses and midwives in the health workforce of rural and remote areas is a growing area of concern internationally [1–4]. It is no less of a concern in Australia, where nurses are considered the “backbone of rural healthcare” as they account for 68% of the workforce in remote and very remote locations [5–9]. With a shortage of general practitioners, rural nurses have advanced/broad scope of services as they provide most healthcare services in these areas [10, 11]. Similarly, rural midwives also play a crucial role in delivering comprehensive maternity care and supporting overall healthcare services in these communities [12]. Midwives are employed in various roles outside the regional centre, including community midwifery, antenatal and postnatal care, birthing centres, public health and education, and telehealth services [13, 14].

Recruitment, retention and survivability of rural nurses and midwives are growing concerns in Australia, as identified in healthcare workforce data where there is expected to be a nursing workforce shortage of 85,000 nurses by 2025 [15]. Shortage of this workforce is further exacerbated by an ageing workforce, higher staff turnover rates and limited professional development opportunities for nurses [16, 17].

The economic costs associated with annual turnover of staff (recruitment, replacement, relocations costs) are high and are an increasing burden on health budgets [3]. Costs of replacing a nursing or midwifery position was estimated at AU\$22,000 per position in a rural location, with this amount increasing for a position in remote and outer remote areas [18].

Studies examining retention of the rural and remote nursing and midwifery workforce are limited and relate to small geographical areas. Cosgrave et al. [19] found that rural nurses make the decision to stay or leave within 12–18 months of commencing employment. They did not, however, collect information about actual retention of these rural nurses. Recent studies by Wakerman et al. [20] and Veginadu et al. [21] have highlighted workforce retention problems for remote nurses, with approximately 20% of remote area nurses remaining in their positions 12 months after being recruited and half leaving their work location after just 4 months. This work, however, focused on remote Indigenous communities in the Northern Territory and Western Australia and thus may not relate to nursing and midwifery retention in other parts of rural and remote Australia. Queensland Health is the public health system in Queensland, comprising sixteen statutory Hospital and Health Services (HHS), the Department of Health, and the Queensland Ambulance Service [22]. Each HHS provides health services to its local area [23]. One key difference between Queensland and other rural and remote areas of Australia

is its unique geographic and demographic characteristics. Queensland's population is relatively decentralised, with a significant portion living outside major urban centres [19]. This decentralisation means that healthcare services are spread across vast and diverse regions, from regional cities to very remote areas [24].

Russell and colleagues [25] conducted a study on nursing workforce retention in 20 primary health care services in rural and remote Australia. They collected 1285 employment records, 69% of which were records for nurses. Approximately 20% of nurses in the sample had left their position within 6 months of starting. Nurses in remote areas had a median employment duration of four years, while over 50% of those in rural areas remained employed for seven years. Nurses in rural towns stayed 53% longer than those in remote locations. Based on these findings, the suggested benchmarks for primary care are five years of service for rural nurses and 3.5 years for remote nurses.

In the context of midwifery, workforce shortages are a significant concern in the rural and remote areas. Donnelly et al. [13], has highlighted the crisis in rural maternity services, noting that inadequate investment and shortages of local health professionals have led to the closure of many rural maternity units. This shortage exacerbated the challenges of retaining midwives in these areas, as they often face increased workloads and professional isolation [13].

Russell et al. [26, 27] highlighted potential of using employment records for benchmarking health service retention. Their findings, however, were based on data from 12 services located in small rural towns and eight services operating in remote locations. Poor response rates from sampled primary care services affected power of statistical analyses, the ability to generalise findings and have sufficient sensitivity to separate nursing records from midwifery records. Moreover, they did not include a regional city with which to compare retention rates to those observed in rural and remote settings and use length of time employed with a health service rather than time employed in location, which might be considered a better correlate to continuity of care and development of connection with community and its residents and over the long term better health outcomes for those using these services. For this study, a regional city comparator was included to determine the relative extent of workforce retention issues in rural and remote areas.

The study reported here aimed to add to current knowledge by: (a) using employee records from public sector rather than primary health care, since this sector comprises a high percentage of the rural and remote nursing and midwifery workforce; (b) gathering a large sample of records from a specific geographic region; (c) having sufficient sensitivity to separate nursing records

into enrolled nurses (ENs), registered nurses (RNs) and midwives (MWs); (d) including records from a regional city within the same geographic footprint; and (e) using time employed in location as the dependent variable of interest. The aim of this study was to investigate the retention patterns of the public sector nursing and midwifery workforce in regional, rural and remote southern Queensland, Australia. Specifically, we aimed to identify specific time points of exit from location within the service, median retention timeframes and determine areas of retention vulnerability. Additionally, we sought to understand how selected demographic, geographic and employment-related variables influenced the retention of nurses and midwives in this region. By analysing employment records, we aimed to provide insights to inform targeted retention strategies and improve workforce stability in these areas.

Methods

Design

This review was a retrospective quantitative study of de-identified employee record data for the public sector nursing and midwifery workforce.

Setting

The setting encompassed areas west of the Great Dividing Range in southern Queensland, Australia. Two public health providers service a geographic footprint within area of 400,000 km² encompassing regional, rural and remote regions [28, 29]. Health Service A is smaller in area but has a larger number of employees to service with greater population density. It is comprised of a regional city and smaller rural and remote communities. Health Service B is much larger in area, but with fewer employees that service an area with a smaller population density. Nursing and midwifery services are provided to a rural hub and remote and very remote communities throughout the service footprint through district hospitals, healthcare centres, and multi-purpose health services.

Regions within the service footprint were classified using the Modified Monash Model (MMM), which classifies locations based on population size, level of geographical isolation, and availability of healthcare services. Modified Monash Model classifications are metropolitan (MMM1), regional (MMM2-3), rural (MMM4-5), remote (MMM6) and very remote (MMM7) [30]. The two health services from which data were collected encompassed areas classified from MMM2 (the regional city) to MMM7 (very remote locations), however there is not a MMM3 in this area due to the mentioned factors.

Sample selection

The population sampled in this study were ENs, RNs and MWs employed in the two participating health services,

where most of their time of employment occurred within the geographic region of the health service. Appropriate ethical approval was gained from participating universities and health services; for further details, please refer to the Ethics Approval section of the manuscript under Declaration. All ENs, RNs and MWs records from the Health Service B were retrieved. All MW records and 40% of EN and RN records from the Health Service A were retrieved. This sampling method was used to ensure patterns evident in Health Service B, with its smaller employee base, were not swamped by those observed in Health Service A, and to maximise the size of the midwife sample.

Data collection and data sources

Data were collected from health service employee records across a 12-year observation window between January 2010 and December 2021. All data were de-identified prior to analysis. Only employees who began work with the health service after the start of the observation period were included in the analysis. Time-in-location (i.e. a particular city or town) that the employee worked served as the main dependent variable in the survival analysis. Multiple records could potentially exist for each employee. A new record was created if an employee moved to a new location within the health service footprint or if an employee had a period of longer than six months before returning to work with the health service. When an employee worked many locations simultaneously, their employment location was tracked according to the location in the earliest chronological employee record and continued until they left that location. To account for the dependence between records from the same employee, we used the Andersen-Gill method for Cox proportional hazards regression. A record was right-censored if the employee was still working in location with the health service on December 31, 2021.

Dual registered nurse/midwives were classified based on the role they were predominantly working in during the study period, regardless of their registration. This classification was determined by the role in which they spent the greatest percentage of their time. The term 'clinical nurse' refers to a senior nurse who typically has advanced clinical skills and responsibilities, often serving as a resource or leader within their clinical area.

Covariates available in employee records included *geographic location, starting age, gender, role, employment type, employment facility and starting paygrade*. Employment location was categorised according to the MMM classification [5]. The participant's age when they started working in a location was categorised into three distinct categories: (a) under 30 years old; (b) between 30 and 45 years old; and (c) above 45 years old. Participant roles were classified as either clinical or non-clinical

(e.g. Nurse Unit Managers or above as being non-clinical) in nature. A predominance rule was applied in this and other covariates, that is, if an employee held both clinical and non-clinical roles at a specific site, their record was categorised according to the role in which they spent the greatest percentage of their time. Employment type was classified according to whether the employee was predominately employed on a casual, permanent full-time, permanent part-time, or temporary basis. Employment facility, again based on predominance, included classifications of the service being (a) public hospital; (b) community health; or (c) aged care. Multipurpose health services were categorised as public hospitals within these classifications; community clinics were categorised under community health. Starting paygrade was collapsed into EN (Grades 3 and 4), RN (Grade 5) and Clinical Nurse (CN) and higher (Grade 6 and above).

Statistical analysis

Microsoft Excel was used to compile the descriptive data, which were presented as proportions, 95% confidence intervals (CIs), and medians. The “survival” library in RStudio (v4.3.0) was used to analyse data. Survival analysis helps us understand how long nurses and midwives stay in a particular location before leaving. Survival analysis, employing right censoring, assessed whether specific events occurred and evaluated time-to-event outcomes [31]. In this review, the event was defined as leaving a particular location, with duration measured in years as the dependent variable. Kaplan-Meier survival curves were generated for each of the covariates. Cox proportional hazards regression identifies factors that affect the likelihood of leaving a location. Because of the presence of more than one record from each employee, a robust version of the log-rank test was used to identify significant variations in median survival durations among covariate strata. Crude hazard ratios and 95% CIs for each covariate and profession were obtained via Cox proportional hazards regression. Covariates showing significant univariate associations with median survival time were included in a multivariate Cox regression model to identify factors affecting the likelihood of leaving a location, using the Andersen-Gill method to account multiple records per employee [32]. Estimated adjusted hazard ratios with corresponding 95% CIs described the direction and intensity of the link between covariate strata and the risk of leaving employment in location. The Cox-Snell test was used to assess the fit of the Cox regression model. Robust statistical tests, like the Cox-Snell test, confirmed the accuracy and stability of our models. At least 20 events per variable (EPV) is regarded as being an appropriate number to achieve regression model stability when there are potential recurrent records from the same individual in the dataset [33]. With a number of

covariates considered in the design and a 70% occurrence rate, a minimum sample size of 171 records was required to establish stable regression models.

The baseline categories for the crude hazard ratio analysis were chosen based on their relevance and prevalence within the dataset. MMM2 (regional city) was selected as the baseline for geographic location because it represents a centre reference point with a relatively stable workforce. Male was chosen as the baseline for gender due to its smaller proportion in the sample, allowing for a clearer comparison with the larger female group. EN (Enrolled Nurse) was selected as the baseline for profession because it is the entry-level nursing position, providing a foundational reference for comparing higher-level nursing roles.

Results

Sample characteristics

Sample characteristics are provided in Table 1 for ENs, RNs and MWs, according to the *geographic classification, gender, employment location, position type, starting age, role, sector, position start date, starting pay grade, number of records per employee* and *event status*. Employees contributing more than one record to the analysis totalled 560 (20.9%), with the maximum number of records being contributed by any employee being six. Events (i.e., the participant left a geographic location of employment) occurred in 66.5% of records.

Overall, sample records were predominately from employees who identified as female (89.6%), were permanently employed (74.8%), were employed in a clinical role (97.2%), were working in a public hospital setting (87.1%) and were aged 30 years or older (57.8%). Patterns in sampled records were also reflective of those observed in the health workforce, with: (a) a higher percentage of males employed as ENs and RNs compared to those employed as MWs (b) and higher percentages of MWs employed in the regional centre, in the hospital sector and in permanent part-time roles. Of the 1083 employees who started with the health services on or after January 2010 and were still employed by the health services, 95 (8.8%) were aged 60 years or more and 26 (2.4%) were aged 65 and above.

The large sample size of 3234 records significantly enhances the statistical power of our analysis, allowing for more precise estimates and greater confidence in the robustness of our findings. This substantial dataset enables us to detect even small effects and provides a comprehensive understanding of the factors influencing retention in the nursing and midwifery workforce.

The overall adjusted median survival time employed in location was 1.83 years [95% CI, 1.71–1.97]. This median survival time represents the overall median for all participants included in the study, regardless of location.

Table 1 Summary of covariates and their strata, records per employee and event status collected from employee records for nursing and midwives

Covariate	Category	Overall <i>N</i> <i>n</i> (%)	Profession		
			Enrolled Nursing (<i>N</i> =430) <i>n</i> (%)	RN or Higher (<i>N</i> =2502) <i>n</i> (%)	Midwifery (<i>N</i> =302) <i>n</i> (%)
Gender	Male	348 (10.8%)	46 (10.7%)	299 (12.0%)	3 (1.0%)
	Female	2885 (89.2%)	384 (89.3%)	2202 (88.0%)	299 (99.0%)
	Other	1 (0.0%)	0 (0.0%)	1 (0.0%)	0 (0.0%)
Geographic Status	MM2	1024 (31.7%)	135 (31.4%)	746 (29.8%)	143 (47.4%)
	MM4-MM5	1300 (40.2%)	185 (43.0%)	974 (38.9%)	141 (46.7%)
	MM6-MM7	910 (28.1%)	110 (25.6%)	782 (31.2%)	18 (6.0%)
Position Type	Casual	744 (23.0%)	177 (41.2%)	533 (21.3%)	34 (11.3%)
	Permanent Full-Time	1445 (44.7%)	108 (25.1%)	1233 (49.3%)	104 (34.4%)
	Permanent Part-Time	989 (30.6%)	142 (33.0%)	687 (27.4%)	160 (53.0%)
	Temporary	56 (1.7%)	3 (0.7%)	49 (2.0%)	4 (1.3%)
Starting Age	< 30 years	1339 (41.4%)	132 (30.7%)	1082 (43.2%)	125 (41.4%)
	30 - < 45 years	910 (28.1%)	131 (30.5%)	692 (27.7%)	87 (28.9%)
	45 years and >	985 (30.5%)	167 (38.8%)	728 (29.1%)	90 (29.8%)
Role	Clinical	3125 (96.6%)	430 (100.0%)	2395 (95.7%)	300 (99.3%)
	Non-clinical	109 (3.4%)	0 (0.0%)	107 (4.3%)	2 (0.7%)
Sector	Hospital	2797 (86.5%)	372 (86.5%)	2146 (85.8%)	280 (99.3%)
	Community	168 (5.2%)	1 (0.2%)	165 (6.6%)	2 (0.7%)
	Aged Care	248 (7.7%)	57 (13.3%)	191 (7.6%)	0 (0.0%)
Position Start Date	Pre-2016	1451 (44.9%)	207 (48.1%)	1128 (45.1%)	116 (38.4%)
	2016–2017		71 (16.5%)	416 (16.6%)	56 (18.5%)
	2018–2019		76 (17.7%)	463 (18.5%)	60 (19.9%)
	2020–2021		76 (17.7%)	495 (19.8%)	70 (23.2%)
Starting paygrade	Level 3–4 (EN)	543 (16.8%)	429 (99.8%)	116 (4.6%)	3 (1.0%)
	Level 5 (RN)	599 (18.5%)	1 (0.2%)	1831 (73.2%)	235 (77.8%)
	Level 6 (CN and higher)	641 (19.8%)	0 (0.0%)	555 (22.2%)	64 (21.2%)
No. of records per employee	1	548 (16.9%)	385 (89.5%)	2003 (80.1%)	286 (94.7%)
	2	2067 (63.9%)	41 (9.5%)	380 (15.2%)	13 (4.3%)
	3	619 (19.1%)	3 (0.7%)	96 (3.8%)	3 (1.0%)
	4 or >	2674 (82.7%)	1 (0.2%)	24 (1.0%)	0 (0.0%)
Event Status	Completed	434 (13.4%)	281 (65.3%)	1693 (67.7%)	177 (58.6%)
	Continuing	102 (3.2%)	149 (34.7%)	809 (32.3%)	125 (41.4%)

However, the survival time varied by geographic location, with specific median survival times provided for key covariates. Median survival rates and corresponding 95% CIs for geographic location and study covariates are presented in Table 2, along with corresponding robust log-rank statistics.

The Kaplan–Meier survival function for employee survival in a location is provided for each MMM category in Fig. 1, after adjusting for covariates with significant crude relationships with the time variable. There were insufficient employees in the “Other” category of the gender covariate. These records had to be omitted from the initial overall Cox regression, thus leaving 3233 records for the initial analysis and, since gender was a significant crude predictor of exiting a location, the final multivariate Cox regression. Adjusted survival curves clearly indicate a time-in-location survival advantage for nurses

employed in the regional centre compared to rural and remote areas.

Crude and adjusted hazard ratios from Cox regressions are presented in Table 3. The final Cox regression demonstrated significant concordance (64.6%, Robust χ^2 (15) = 667.9, $p < 0.001$). After adjusting for other covariates, those employed in MMM 4–5 and MMM 6–7 locations were 84% [95% CI 65%–107%] and 239% [95% CI 210%–270%] more likely to leave a location than those employed in the MMM2 regional centre, respectively. Those employed as RNs and MWs were 44% [95% CI 26%–58%] and 46% [95% CI 25%–61%] less likely to leave a location than those employed as ENs, respectively. Those employed in permanent part-time roles were 46% [95% CI 39%–53%] less likely to leave a location than those employed in casual positions, and those employed in permanent full-time roles were equally likely to leave a location as those employed casually. Compared to those

Table 2 – Crude median survival times (in years), 95% cis, and robust log-rank statistics for geographic classification and study covariates

Factor	Variable	Median Survival and range [95% CI]	Robust Log-rank Test
Geographic Region	MM 2	4.72 [4.00–5.73]	$\chi^2 (2) = 321.10^{***}$
	MM 4–5	1.66 [1.52–1.84]	
	MM 6–7	1.08 [1.00–1.19]	
Profession	EN	2.32 [1.89–2.67]	$\chi^2 (2) = 16.25^{***}$
	RN	1.71 [1.62–1.85]	
	MW	2.66 [1.85–3.74]	
Gender	Female	1.86 [1.75–2.01]	$\chi^2 (1) = 4.48^*$
	Male	1.47 [1.29–1.88]	
Position Type	Casual	1.82 [1.63–2.05]	$\chi^2 (3) = 211.80^{***}$
	Permanent Full-Time	1.33 [1.17–1.43]	
	Permanent Part-Time	4.19 [3.50–4.93]	
	Temporary	0.89 [0.68–1.19]	
Starting Age	< 30 years	1.78 [1.67–2.00]	$\chi^2 (2) = 37.64^{***}$
	30 - < 45 years	2.43 [2.12–2.94]	
	45 years and >	1.51 [1.31–1.68]	
Role	Clinical	1.85 [1.73–2.00]	$\chi^2 (1) = 10.69^{**}$
	Non-Clinical	1.36 [1.13–1.79]	
Sector	Hospital	1.88 [1.76–2.03]	$\chi^2 (2) = 14.47^{***}$
	Community	1.96 [1.39–3.20]	
	Aged Care	1.20 [1.00–1.69]	
Pay Start Grade	Level 3–4 (EN)	2.81 [2.48–3.43]	$\chi^2 (2) = 44.27^{***}$
	Level 5 (RN)	1.73 [1.65–1.88]	
	Level 6 (CN and higher)	1.48 [1.29–1.71]	

* $p < 0.05$, ** $p < 0.01$, *** $p < 0.001$. CI, confidence interval. MM, Modified Monash geographic classification. EN, Enrolled Nurse; RN, Registered Nurse; MW, Midwife. CN, Clinical Nurse; For Gender = "Other", there were insufficient numbers to determine CIs

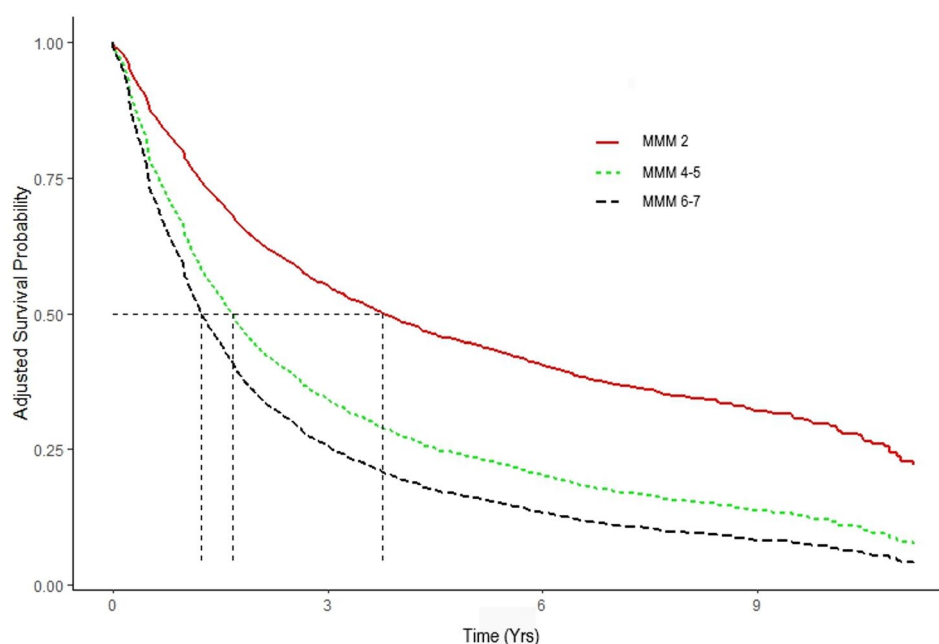
**Fig. 1** Survival functions of time-in-location for each geographic region, after adjusting for covariates

Table 3 – Crude and adjusted hazard ratios for Cox regressions

Variables	Categories	Crude Hazard Ratio [95% CI]	Adjusted Hazard Ratio [95% CI]
Geographic region	MM 2	1.00	1.00
	MM 4–5	2.07 [1.86–2.31]***	1.84 [1.65–2.07]***
	MM 6–7	2.86 [2.55–3.21]***	2.39 [2.10–2.70]***
Gender	Male	1.00	1.00
	Female	0.86 [0.75–0.99]*	0.94 [0.82–1.07]
Profession	EN	1.00	1.00
	RN and above	1.16 [1.02–1.32]*	0.56 [0.42–0.74]***
	Midwife	0.88 [0.73–1.06]	0.54 [0.39–0.75]***
Position Type	Casual	1.00	1.00
	Permanent Full-Time	1.13 [1.02–1.25]*	0.92 [0.82–1.03]
	Permanent Part-Time	0.53 [0.47–0.60]***	0.54 [0.47–0.61]***
	Temporary	1.94 [1.46–2.58]***	1.70 [1.26–2.30]***
Starting Age	< 30 years	1.00	
	30 - < 45 years	0.85 [0.76–0.94]**	0.90 [0.81–1.01]
	45 years and >	1.20 [1.08–1.33]***	1.09 [0.98–1.22]
Role	Clinical	1.00	1.00
	Non-Clinical	1.38 [1.14–1.68]**	0.91 [0.73–1.13]
Starting Pay	Level 3–4 (EN)	1.00	1.00
	Level 5 (RN)	1.41 [1.24–1.59]***	2.23 [1.72–2.90]***
	Level 6 (CN) and higher	1.61 [1.40–1.86]***	2.19 [1.65–2.92]***
Sector	Hospital	1.00	1.00
	Community	0.94 [0.79–1.16]	0.78 [0.64–0.96]*
	Aged Care	1.35 [1.16–1.57]***	1.19 [1.00–1.42]*

employed casually, those employed in temporary roles were 70% [95% CI 26%–130%] more likely to leave a location. Those whose starting paygrade was Level 5 (RN/Registered MW) and Level 6 (Clinical Nurse) or higher were 223% [95% CI 172%–290%] and 219% [95% CI 165%–292%] more likely to leave a location, than whose starting paygrade was Level 3–4 (EN). Those employed in the community sector and the aged care sector were 22% [95% CI 4%–26%] less likely and 19% [95% CI > 0–42%] more likely to leave a location, respectively, than those employed in the hospital sector. Gender, starting age and type of role were not found to predict risk of leaving a location after adjusting for other covariates in the analysis.

Predicted Cox-Snell residuals from the final model demonstrated appropriate goodness-of-fit with the model's observed residuals (see Supplementary Material).

Discussion

This retrospective study identified time spent in location employed in the public sector, and the effects of available factors in the employee dataset collected. After adjusting for these other factors, time spent in location in rural and remote areas of the geographic footprint of the selected health services was considerably less than for those working in the regional city comparator. Moreover, time spent in location was less for those working in remote communities (i.e., MMM 6–7) compared to those working in rural communities (i.e., MMM 4–5). The profession

in which the EN, RN or MW spent the majority of their time, position type and paygrade at which the employee commenced work in a location all contributed to the risk of leaving a location. Gender, the age of the employee when they began working in a location, and the role employed in, the majority of time in a location, did not influence the risk of leaving a location.

Overall, the data points to a much lower overall median retention than that observed in previous studies [19, 25, 27]. The observed median retention in location less than 2 years corresponds with past health workforce studies in Australia, where rural nurses and midwives decide to stay or leave within 12–18 months of starting their employment [19, 27, 34]. However, when examining data relative to geographic location, the median retentions of less than 2 years for rural locations and slightly greater than 12 months for remote locations is concerning. Retention for this study sample sits lower than that observed previously for nurses in the primary health care setting [25], but higher than that observed for remote area nurses working in Aboriginal controlled health services [20]. They also fall well short of the suggested primary health care benchmark median retention of 3 years [25]. It is worth noting that primary healthcare benchmarks used leaving the service as the time-dependent variable, which is distinct from leaving employment in a location. Despite different definitions being used in the two studies, the data is suggestive of lower retention rates in the public sector.

Moreover, adjusted survival curves for retention in location for employees working in rural and remote communities begin to diverge from those observed in the regional comparator almost immediately; corresponding divergence of remote communities from rural communities does not occur until at least 12 months after starting work in location.

The retention rates found in this study are reflective of repeated concerns documented in the nursing and midwifery literature of high turnover rates and poor retention of the nursing and midwifery workforce globally [1, 3]. Factors contributing may vary, however with consideration of remote areas of the Australian outback, this setting can often be isolated, lacking in resource availability and access to supervision [35]. Previous literature suggests nurses and midwives in rural and remote areas leave for reasons such as burnout, professional development opportunities or career advancement in metropolitan areas [10, 11]. Newly graduated nurses and midwives are increasingly recruited to rural positions, which has resulted in a workforce that is less skilled, less qualified, and less able to perform the broad scope of diverse skills required as a generalist rural nurse or midwife [36–39]. Difficulties have been reported with retaining rural nurses and midwives, with reports of feeling overwhelmed by increased roles and responsibility and limited professional support from mentors, senior staff, and management [2, 19, 34]. By including a regional city comparator in the study, the findings provided here suggest that retention issues in rural and remote areas go beyond the regularly utilised metropolitan vs. rural and remote comparison.

The adjusted contributions of profession (EN, RN, MW) and the paygrade at which employees began their employment in location were examined. The data reveals those who commenced employment at a Level 5 or higher (an RN or CN) were more than twice as likely to leave a location compared to those who started employment in location at Level 3–4, (an EN). After adjusting for this relationship and other variables, though, those who were employed as either RN/Registered MWs or CN/Clinical MWs for much of their time in a location were less likely to leave a location than those employed as ENs for most of their time in a location. While these two findings at first appear incongruous, consider that the predominance rule explained earlier in this paper was used to determine profession, while the paygrade variable was defined according to what grade employees were employed at when they commenced working in that location. This may lead to these factors having opposing effects once influences of all variables in the design are adjusted for. It is of concern, though, that regardless of the paygrade RNs and MWs are initially employed at in a location, they are less likely than those initially employed

at an EN level to stay in location. Furthermore, the data suggests that those initially employed at the EN level are less mobile, possibly due to their limited scope of practice when compared to an RN. This limitation restricts their ability to develop advanced clinical skills or engage in autonomous practice, which is often required in rural and remote areas.

A similar influence may be at play when one examines the effect of type of position in which nurses and midwives are employed in a location. Those employed in a part-time role, are at the least risk of leaving a location. Those employed in full-time roles have about the same risk of leaving a location than those employed in casual roles. It is important to note that an employee classified as being employed part-time may have had more than one simultaneous role. While we can only speculate on why those employed in a location part-time stay in location for longer than those employed in full-time roles, one potential reason may be that part time roles reduce the risk of workplace fatigue and burnout as mentioned earlier. However, we recognize that work-life balance and childcare are important factors that could also influence this trend. Unfortunately, our current data is quantitative and does not include interviews to explore these aspects in depth. A follow-up study incorporating qualitative methods could provide valuable insights into these factors.

The public sector in which the employee worked also had a minor, but nevertheless significant role in risk of leaving a location, with those employed in the aged care sector being at greatest risk and those employed in the community sector being at least risk of leaving location. Overall, the aged care sector has historically had low rates of pay and poorer conditions compared to other sectors [40, 41]. Therefore this finding is not surprising, however it provides further evidence for issues in aged care nursing to be addressed to reduce risk of leaving positions in location and increase retention in this public service sector.

Age at beginning of employment in location did not influence the risk of leaving employment in a location after adjusting for other factors in the regression model. This finding is counter to previous studies where age, or at least stage of life, are related to health worker retention. For example, the rural health workforce literature suggests that nurses and midwives aged in their late 40s are most employed and more likely to be retained for longer periods than their younger counterparts [16]. 1234 [35], We are not certain of why starting age was no longer a significant predictor of hazard of leaving a location after adjusting for other factors in the Cox regression model, though it may have been influenced by the way the time-dependent variable was defined. Further investigation of

the role of age and its influence of risk of leaving location should be undertaken.

The study suggests two primary messages for readers. RNs and MWs working in rural and remote locations are at a greater risk of leaving employment in a location than those employed in the regional city. The findings provide good evidence for earlier retention initiatives, particularly targeting towards those employed in MMM 4–7 areas, where risk of leaving location and its concomitant effect on continuity of care is much higher. Interventions should be designed specifically for retention issues of those working in full-time roles and public sector nurses working in aged care.

Several approaches to improve on the accessibility to education have been implemented through the introduction of technology and for online education. Another solution to overcome this includes the hub and spoke model, where university institutions (hubs) support peripheral “spokes” in rural and remote areas, facilitating resource sharing and professional development [4, 42, 43]. Larger health services can also act as hubs, providing support and education for smaller health services [44]. This approach has been effective in other contexts and can enhance the support network for rural healthcare professionals [44]. The model has been particularly effective in providing support and ensuring consistent quality of education and healthcare services in rural settings [4, 16, 42, 45]. Such models ensure that rural professionals can access higher education and training without the necessity of relocation, thereby maintaining their community ties and support networks [45]. Russell et al. [26] supports this, stating staff involved with a hub and spoke model were more likely stay in their rural locations than those who were not involved. These supports, often identified as lacking in rural nursing literature, are crucial in mitigating nursing attrition in these locations. This approach is one the authors suggest could potentially increase connection to professional colleagues, as well as building community status and reputation. The data from this study indicates a significant proportion of RNs under 30 years of age ($n = 1339$). The authors hypothesize that the hub and spoke model may enhance professional development and resources support for this younger nursing workforce in rural and remote areas.

Strengths and limitations

A strength of this study is the focus on time-in-location as the dependent time variable. Time spent working in a location, rather than, for example, overall time employed by the health service, provides the best relationship to costs associated with position vacancies and filling vacant positions. Moreover, time-in-location more closely aligns continuity of care in a location and concomitant outcomes for clients/patients accessing public health

services in a community. Size of the sample used in this study enabled a closer examination of variables not previously able to be examined because of low sample size.

The study identifies areas of workforce retention vulnerabilities, helping public sector human resource managers target interventions that encourages nurses to remain in rural and remote locations for longer periods. Moreover, rather than gathering new data from rural and remote nurses and midwives, the study leverages existing employee records to (a) derive usable measurements of retention that stakeholders can use to pinpoint the most effective intervention points along the retention timeline for different groupings (e.g., regional, rural, remote) and (b) identify covariates that influence the retention of nurses and midwives.

A corresponding limitation to our study is the dependence on these administrative records. The sole use of these records may overlook other important factors affecting retention in the rural and remote nursing and midwifery workforce, such as job satisfaction, individual experiences, and workplace culture, all of which may play a significant role in nurse retention [24].

Furthermore, the study's validity could be compromised by the higher likelihood of changing positions within regional centres without relocating, compared to rural and remote areas. This positional movement can affect continuity of care and potentially inflate median retention in location in regional centres. However, we believe this inflation is minimal compared to the overall geographic effects on nurse retention. Additionally, retention in remote areas is generally lower than in rural ones, which may be due to fewer opportunities available for changing positions within the same rural location compared to regional centres.

A limitation of this study is its geographic scope and the generalisability of its findings to other regions. However, we believe the results are applicable to public health services in areas with similar geographic characteristics, such as parts of New South Wales, Central Queensland, and southwestern Western Australia, as well as regions like Canada.

We acknowledge that some factors in the analysis are correlated, such as profession and starting paygrade. For instance, ENs can only be employed at levels 3 or 4, so those who started and worked primarily as ENs are classified as such. However, some employees started as ENs but later worked as RNs; thus, classified as RNs in the professional variable. Despite these correlations, both starting paygrade and profession provided unique contributions predicting retention after adjusting for other covariates, ensuring the models robustness.

The inclusion of employees with multiple records is another potential confounding variable. Over 20% of employees contributed to 2 or more records, which might

differ from those with only one record in ways that influence frequent location changes. Despite this, we included all available data, recognising retention as an issue for all employees. The analyses accounted for relationships between records from the same individual using robust statistical methods, such as the Anderson Gill method for Cox proportional hazards regression, which considers clustering in its calculations. This approach provided a comprehensive picture of retention and the risk of leaving a location.

Conclusions

This study analysed retention rates and the impact of employment and demographic variables on retentions of the nursing and midwifery workforce in public health services in regional, rural, and remote southwestern Queensland, Australia. The study highlights significant retention challenges for public sector nurses and midwives in rural and remote southern Queensland. The findings reveal rural and remote RNs employed in permanent full-time positions are more likely to retain their positions in comparison to Enrolled Nurses. In contrast, nurses employed in a regional centre, those employed in permanent part-time positions, and those employed in the public community sector were more likely to be retained in location longer. Nurses and midwives employed in rural and remote geographic locations were more vulnerable to leaving position and location earlier, with nurses and midwives in remote areas being the most vulnerable to leaving early.

With an adjusted overall median employment duration of just 1.83 years, the study highlights the need for targeted strategies, particularly for those in remote areas and full-time roles, to enhance retention of rural and remote nurses and midwives to aid in preventing further rural nursing workforce losses. The reduction in nurse and midwifery retention impacts their ability to form connections with the community, which is essential for effective healthcare delivery. This disruption not only affects healthcare outcomes but also imposes an economic burden due to the costs associated with high turnover and recruitment. Implementation of such strategies may slow down the continued nursing and midwifery workforce losses in rural and remote locations and avoid further impacting on the already reported poorer healthcare outcomes experienced in rural and remote communities.

Suggestions for future research

Findings from this study indicate a need for further research into strategies that address rural workforce concerns particularly those related to the retention rates of rural and remote nurses. It is essential to prioritise the implementation of co-designed strategies such as flexible

work arrangements, improved workplace conditions, and robust professional development opportunities at the organisational level, health district and state government level. Addressing these factors may help mitigate further losses in the rural nursing workforce.

Additionally, research that evaluates the outcomes of these strategies is recommended to assess their impact on the sustainability of rural and remote nursing practices and to potentially prevent future workforce attrition. This research is crucial for ensuring the delivery of quality and equitable healthcare delivery in rural and remote communities thereby improving health outcomes for communities that are already at risk of diminished access to healthcare services.

Moreover, further research to explore the underlying reasons behind the retention rates observed in this study would be beneficial. While our data highlighted which nurses and midwives have lower survival rates, qualitative research methods, such as exit interviews, could provide deeper insights into the factors influencing these trends. Understanding the 'why' behind these patterns is essential for developing effective retention strategies. Additionally, given the significant impact of the COVID-19 pandemic on the healthcare workforce, future studies should also focus on understanding the long-term effects of the pandemic on job satisfaction, retention, and the overall well-being of nursing and midwifery professionals.

Supplementary Information

The online version contains supplementary material available at <https://doi.org/10.1186/s12912-025-03324-1>.

Supplementary Material 1

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Author contributions

JE and L O'M substantially contributed to the conceptualisation, investigation, data curation, formal analysis, methodology, results, discussion and writing of the original draft. TF contributed to conceptualisation, methodology, formal analysis, and results. PM, CW, A V E, HSC, and BS all contributed to conceptualisation of the manuscript. All co-authors reviewed the manuscript and approved the final manuscript for publication.

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Data availability

The datasets generated and/or analysed during the current study are not publicly available because they contain information that could compromise the privacy of the research participants but are available from the corresponding author on reasonable request.

Declarations

Ethical approval

Ethics approval was provided by the Darling Downs Health (DDH) Human Research Ethics Committee (Ref: EX/2022/QTDD/81938; dated 27/01/2022) and was ratified by the University of Queensland (Ref:2022/HE000313) and University of Southern Queensland (Ref: H22REA044) Human Research Ethics Committees. Additionally, site-specific approval for the review was also obtained from both health services. The need for informed consent to participate was waived by the Darling Downs Health (DDH) Human Research, University of Queensland and University of Southern Queensland Ethics committees. This study adhered to the ethical principles outlined in the Declaration of Helsinki.

Consent for publication

Not applicable.

Competing interests

The authors declare no competing interests.

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