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Multi-domain contracting of the non-physician primary care workforce and per-domain service output: a nationwide cross-sectional analysis of Polish National Health Fund data, 2022–2023

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Abstract

Background Combining community nursing, midwifery, and school medicine within a single provider organisation is widely advocated as a route to more comprehensive primary care, yet whether multi-domain provision is accompanied by differences in per-domain service output remains untested at population scale. Economic theories predict opposing effects: economies of scope favour joint provision, while specialisation may yield higher per-unit throughput.

Methods A nationwide cross-sectional analysis was performed using administrative data of the Polish National Health Fund (NFZ) covering all contracts for community nursing (N), midwifery (M), and school medicine (S) in 2022 and 2023. The unit of observation was the unique provider-year ($n = 16{,}574$; 8,302 in 2022 and 8,272 in 2023) from 8,511 providers across all 16 NFZ regional branches. Providers were classified into seven mutually exclusive service-domain combinations. Two primary outcomes were specified ex ante: nurse services per 1,000 nurse declarations and midwife services per 1,000 midwife declarations. Adjusted associations were estimated by negative binomial regression (NB2, dispersion estimated by maximum likelihood) with log(declarations) as offset, fixed effects for regional branch and year, mono-domain providers as reference categories, and standard errors clustered at the provider level.

Results The nursing model included 11,753 provider-years (6,097 providers) and the midwifery model 8,333 provider-years (4,345 providers). Compared with N-only providers, nurse services per declaration were lower in N+M providers (adjusted IRR 0.77; 95% CI 0.71–0.85; $p < 0.001$) and in N+M+S providers (IRR 0.89; 0.82–0.98; $p = 0.016$), whereas N+S providers did not differ (IRR 1.00; 0.90–1.12). The pattern was stronger for midwifery: compared with M-only providers, N+M providers delivered 61% fewer midwife services per declaration (IRR 0.39; 0.30–0.52; $p < 0.001$) and N+M+S providers 59% fewer (IRR 0.41; 0.31–0.54; $p < 0.001$); the small M+S class did not differ significantly (IRR 1.28; 0.56–2.94). Estimates were closely similar in a balanced

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panel of providers observed in both years. In analyses stratified by declaration count, the negative associations were concentrated among small and medium providers and attenuated towards the null in the largest tertile.

Conclusions Multi-domain contracting, particularly the combination of community nursing with midwifery, is associated with substantially lower per-domain service output, a pattern consistent with specialisation effects. The data describe associations between contracted service configuration and domain-specific service rates, not substitution or specialisation as observed processes, and provider scale contributes to the pattern. The trade-off between organisational breadth and per-domain throughput deserves explicit consideration in benchmarking and payment design.

Keywords Primary health care · Multi-domain contracting · Community nursing · Midwifery · School health services · Administrative data · Health services research · Poland

Background

Primary care is associated with better population health, lower socioeconomic inequality in outcomes, and reduced rates of avoidable hospitalisation [1, 2]. Integration of primary care services—the organisational bringing-together of medical, nursing, midwifery, and allied workforce under shared governance—has accordingly become a near-universal policy aim in healthcare systems of high-income countries [3, 4]. Theoretical justifications for integration draw on two literatures. The *fragmentation* literature emphasises that the failure of separate providers to coordinate produces gaps, duplications, and discontinuities of care, particularly for patients with complex needs [5]. The *integrated-care* literature, in turn, proposes a set of organisational mechanisms—shared records, multidisciplinary team working, coordinated care plans—through which fragmentation can be redressed [6]. Both implicitly anticipate that integration will also raise the volume of services delivered per patient: shared infrastructure, peer learning, and reduced duplication should be expected to translate into higher per-domain throughput.

This expectation, however, is not theoretically inevitable. Industrial-economic models of multi-product firms identify two opposing forces. *Economies of scope* arise when joint production lowers average costs; in primary care, these may manifest as shared examination rooms, single front-desk staff, and cross-domain referral within a single team. Working against scope economies are *specialisation effects*: single-domain producers concentrate expertise and routine, generating higher per-unit output. The net effect on per-domain service intensity is an empirical question, not a theoretical one. Empirical work to date has emphasised patient experience and downstream utilisation rather than per-domain output, and where output has been examined, findings are mixed [7, 8]. According to the best of our knowledge, no prior study has tested the integration–output relationship across an entire national primary care system. Because per-domain output metrics capture only one dimension of performance in multi-domain practices, the scope of these measures is itself part of the question, and we return to it when interpreting the findings.

The specific characteristics of the Polish healthcare system make it suitable for conducting research in this area. The Polish primary care system (Pol. *podstawowa opieka zdrowotna*, POZ) is organised through separately contracted service domains administered by the National Health Fund (Pol. *Narodowy Fundusz Zdrowia*, NFZ): family medicine, community nursing, midwifery, and school medicine [9]. Each domain is independently contracted, billed under standardised service codes, and supported by a domain-specific population denominator (the patient's written declaration of provider choice, Pol. *deklaracja wyboru*). Providers may hold any combination of contracts; the resulting workforce-integration distribution is determined by historical accident, local labour markets, and the recent national reform agenda [10]. The result is observable, naturally occurring variation in multi-domain contracting of the non-physician workforce under a single national regime, which removes system-wide policy variation and self-report bias as sources of the observed differences, although provider-level confounding by casemix, setting, and organisational characteristics remains possible and is considered in the limitations.

Throughout, we use the term multi-domain contracting for the exposure, because the administrative data identify which service domains a provider entity has contracted rather than the substantive organisational attributes of integrated care.

It should be emphasized that a better understanding of the importance of integrated patient care is crucial for shaping the structure of the national healthcare system, which can impact its efficiency and costs. In a recent umbrella review, the authors noted that the integration of health and social care services leads to cost reductions, enhanced collaboration, and improved staff perceptions [11].

The purpose of this study was to test two pre-specified hypotheses. **H1**: Among community nurse providers, integration with one or more additional service domains is associated with a different rate of nurse services per 1,000 declarations than mono-domain (N-only) provision. **H2**: Among midwife providers, integration with one or more additional service domains is associated with a different rate of midwife services per 1,000 declarations than mono-domain (M-only) provision. The direction of effect is left open in each hypothesis on the grounds that scope economies and specialisation effects predict opposite signs.

Methods

Design and data sources

We conducted a nationwide retrospective cross-sectional study covering the calendar years 2022 and 2023. The study used routinely collected administrative claims data from the Polish National Health Fund (NFZ), accessed through a formal public-information request and provided in anonymised aggregate form at the provider level. Given the nature of the study, which relies on analysis of a nationwide dataset from a public institution, we did not perform an a priori sample-size calculation.

The NFZ administers, contracts, and reimburses essentially all primary care services in Poland through 16 regional branches (Pol. *oddziały wojewódzkie*) corresponding broadly to the country's 16 administrative voivodeships [9]. Reporting follows the Strengthening the Reporting of Observational Studies in Epidemiology (STROBE) and the REporting of studies Conducted using Observational Routinely-collected health Data (RECORD) statements [12, 13].

Study population and unit of analysis

The source population comprised all entities holding at least one community nursing, midwifery, or school-medicine contract with the NFZ during 2022 or 2023. The unit of analysis was the provider × calendar year ("provider-year"). Family doctor (Pol. *lekarz POZ*) contracts were not available in the source extraction; the present analysis is therefore restricted to the non-physician primary care workforce. No clinical or demographic patient-level information was available.

An NFZ provider identifier denotes a single legal entity holding one or more contracts with the National Health Fund; entities contracting several domains share legal registration and management, but the data do not describe internal organisation. All outcomes are aggregated at the provider level and no individual-level workforce data enter the analysis. A declaration is the official registration by which an insured patient chooses, or switches to, a particular primary care provider and, within it, a particular nurse or midwife; it is lodged with the individual provider, so the number of declarations a provider holds equals the number of patients enrolled under its care and serves as that provider's population denominator. School medicine denotes preventive and basic healthcare services delivered to pupils on school premises by nurses contracted for this purpose, including screening tests, prophylaxis, first aid, and health education; the term does not refer to the training of nursing personnel.

The raw contract extract contained 40,194 provider × year × contract-scope records, which reduced to 16,574 unique provider-years (8,302 in 2022 and 8,272 in 2023) from 8,511 unique providers after deduplication of

contract-scope variants. Of the 12,863 nurse-contracted provider-years, 1,090 lacked a matched service and declaration record in the reporting extracts and 20 had zero declarations, leaving 11,753 provider-years (6,097 providers) in the nursing analytic sample; of the 9,607 midwife-contracted provider-years, 1,253 lacked a matched record and 21 had zero declarations, leaving 8,333 provider-years (4,345 providers) in the midwifery analytic sample. Complete-case analysis was applied with no imputation. Figure 1 presents the data flow with counts at each stage.

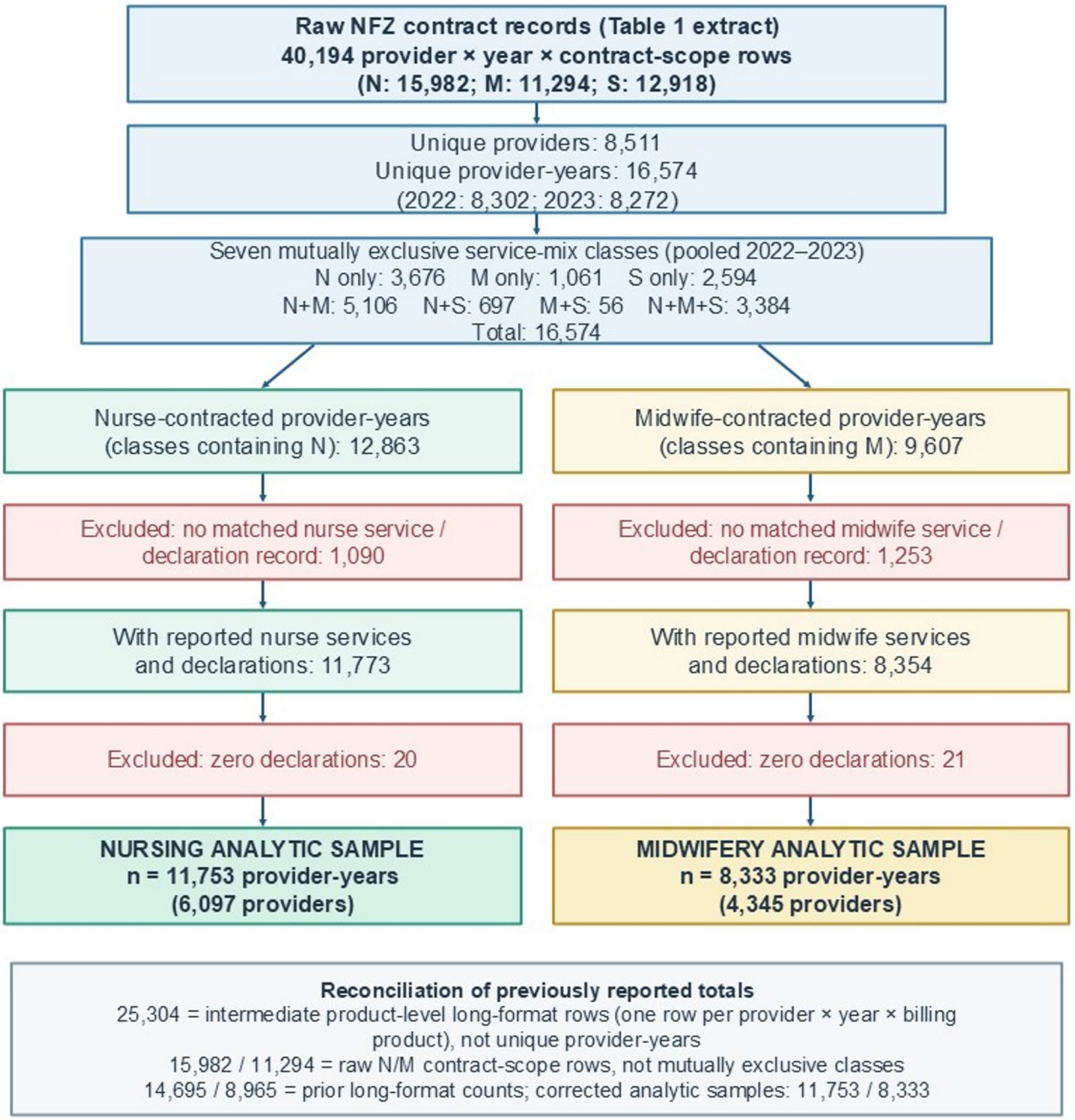

Fig. 1 Data flow of the study. Counts of raw contract records, unique providers and provider-years, mutually exclusive service-domain combinations, exclusions, and the nursing and midwifery analytic samples, with reconciliation of the totals reported in the originally submitted version

Exposure

The exposure of interest was the provider's *service-mix class*, defined as the combination of contracted service domains in a given year. Three binary indicators were constructed: $N=1$ if a community nursing contract (Pol. *świadczenia pielęgniarki POZ*) was held; $M=1$ if a midwifery contract (Pol. *świadczenia położnej POZ*); $S=1$ if a school-medicine contract (Pol. *świadczenia pielęgniarki szkolnej*). The seven non-empty combinations of N, M, and S define the categorical exposure with the following levels: N only, M only, S only, N + M, N + S, M + S, N + M+S. The seven classes are mutually exclusive and are referred to throughout as service-domain combinations (multi-domain contracting).

Outcomes

Two pre-specified primary outcomes were operationalised in the spirit of routine NFZ statistical service reporting:

(1) *Nurse services per 1,000 nurse declarations*: the sum of community-nursing statistical service codes (NFZ category 1002xx, comprising patronage visits, home visits, prophylactic services, diagnostic procedures, nursing care, therapeutic procedures, rehabilitative services, injections, and screening tests) for the provider-year, divided by that provider-year's reported nurse declarations and scaled to 1,000. Analyses of this outcome were restricted to provider-years with $N=1$ and declarations >0.

(2) *Midwife services per 1,000 midwife declarations*: the sum of midwifery statistical service codes (NFZ category 1003xx, comprising home visits, gynaecological-oncological screening, and routine midwifery visits) per 1,000 midwife declarations, restricted to provider-years with $M=1$ and declarations >0.

School-medicine output (category 1004xx/1005xx) has a different natural denominator (number of students), and is therefore the subject of a separate companion analysis.

Covariates

We adjusted for two pre-specified covariates: NFZ regional branch (16 levels, treated as a categorical fixed effect to control for region-specific contracting practices, casemix, and infrastructure) and calendar year (2022 vs. 2023). No additional individual-level or area-level adjustment was performed in the primary model.

Statistical analysis

Continuous outcomes are described by median and interquartile range (IQR). Unadjusted comparisons of rate distributions across service-mix classes used the Kruskal-Wallis omnibus test. Adjusted associations were modelled using negative binomial generalised linear models with log(declarations) included as an offset, treating service-mix class as a categorical predictor with the mono-domain category as the reference. The negative binomial family was selected on the basis of overdispersion of the count outcomes; the dispersion parameter was estimated from the data by maximum likelihood under the NB2 parameterisation, yielding $\alpha=1.26$ (SE 0.04) for the nursing model and $\alpha=3.89$ (SE 0.10) for the midwifery model [14]. Effect estimates are expressed as adjusted incidence rate ratios (IRR) with 95% confidence intervals. Because 94.7% of providers contributed observations in both calendar years, standard errors were clustered at the provider level; [15] reported p-values derive from Wald tests of the regression coefficients, and values below 0.001 are reported as $p<0.001$. Two sensitivity analyses were performed: a balanced-panel analysis restricted to providers contributing observations in both 2022 and 2023, and re-estimation of the primary models within tertiles of declaration count.

All analyses were performed in Python 3.12 [16] using pandas, NumPy, SciPy, and statsmodels. Two-sided p-values <0.05 were considered statistically significant.

Data quality and curation

Two data-curation steps were applied before analysis. First, three non-standard regional branch codes in the school-medicine source Tables (1400, 1401, 1402, identifiable from cross-walks as belonging to the Warmińsko-Mazurski region) were recoded to the standard code 14. Second, provider identifiers in regional branches 06 (Małopolski), 08 (Opolski), 09 (Podkarpacki), and 12 (Śląski) were formatted as alphanumeric strings (e.g. "060/100260") rather than integers, in contrast to the numeric convention used in the other 12 regions. Numeric coercion would have silently excluded 2,379 providers across these four regions; identifiers were therefore retained as strings throughout. No further exclusions were applied at the dataset construction stage.

Ethical considerations

The analysis used fully aggregated, anonymised administrative data and is exempt from ethical review under Polish law governing research with anonymised health-services data. No individual patient-level information was processed.

Results

Study population

The study covered 16,574 unique provider-years (8,302 in 2022 and 8,272 in 2023) from 8,511 unique non-physician primary care providers across all 16 NFZ regional branches; 8,063 providers (94.7%) appeared in both calendar years. The distribution of the seven mutually exclusive service-domain combinations was strongly non-uniform: the nurse plus midwife pairing (N + M) accounted for 30.8% of provider-years, mono-domain community nursing (N only) for 22.2%, three-domain provision (N + M+S) for 20.4%, and school medicine alone (S only) for 15.7%. The distribution was essentially stable between 2022 and 2023 (Table 1). The nursing analytic

Table 1 Characteristics of the analytic dataset

Characteristic	2022	2023	Pooled
Provider-year observations	8,302	8,272	16,574
Unique providers	8,302	8,272	8,511
Service-mix class, n (%)			
N only	1,836 (22.1)	1,840 (22.2)	3,676 (22.2)
M only	532 (6.4)	529 (6.4)	1,061 (6.4)
S only	1,291 (15.6)	1,303 (15.8)	2,594 (15.7)
N + M	2,551 (30.7)	2,555 (30.9)	5,106 (30.8)
N + S	352 (4.2)	345 (4.2)	697 (4.2)
M + S	31 (0.4)	25 (0.3)	56 (0.3)
N + M+S	1,709 (20.6)	1,675 (20.2)	3,384 (20.4)
Nursing analytic sample, provider-years	**5,929**	**5,824**	**11,753**
Nurse declarations, median [IQR]	3,613 [2,142–6,193]	3,642 [2,165–6,219]	3,629 [2,153–6,206]
Nurse services per 1,000 decl., median [IQR]	1,294 [600–2,483]	1,365 [608–2,621]	1,329 [606–2,558]
Midwifery analytic sample, provider-years	**4,204**	**4,129**	**8,333**
Midwife declarations, median [IQR]	2,365 [1,415–3,992]	2,505 [1,481–4,292]	2,427 [1,447–4,143]
Midwife services per 1,000 decl., median [IQR]	39 [0–103]	36 [0–99]	38 [0–100]

N = community nurse contract; M = midwife contract; S = school-medicine contract. Service-mix classes are mutually exclusive; percentages within year sum to 100. Analytic-sample statistics are restricted to provider-years with the corresponding contract, a matched service and declaration record, and declarations > 0 (see Fig. 1)

sample comprised 11,753 provider-years (6,097 providers) and the midwifery analytic sample 8,333 provider-years (4,345 providers); Fig. 1 presents the data flow.

Unadjusted rate distributions

Unadjusted service rates per 1,000 declarations were highly variable both within and between service-domain combinations (Fig. 2). Within the four nurse-contracted classes, median rates ranged from 1,117 (N+M) to 1,610 (N+S) services per 1,000 declarations, with interquartile ranges spanning approximately four-fold within each class. The corresponding distributions for midwife-contracted classes ranged from 29 (N+M) to 66 (M+S) services per 1,000 declarations. Distributions differed significantly across classes for both outcomes (Kruskal-Wallis H=231.8 and 105.7, respectively; both $p<0.001$). The Kruskal-Wallis tests reflect both a systematic downward shift for classes containing both community nursing and midwifery (N+M and N+M+S for each outcome) and substantial within-class heterogeneity that the violin plots in Fig. 2 make explicit.

Adjusted associations

Negative binomial regression with estimated dispersion and provider-clustered standard errors confirmed the unadjusted gradient and quantified its magnitude (Table 2; Fig. 3). For the community nursing outcome, the combination with midwifery (N+M) was associated with a 23% reduction in services per declaration relative to N-only providers (adjusted IRR 0.77, 95% CI 0.71–0.85; $p<0.001$), and three-domain provision (N+M+S) with an 11% reduction (IRR 0.89, 0.82–0.98; $p=0.016$). The combination of nursing with school medicine alone (N+S) was statistically indistinguishable from N-only provision (IRR 1.00, 0.90–1.12; $p=1.00$). For the midwifery outcome, the effect was substantially larger: N+M providers delivered 61% fewer midwife services per 1,000 declarations than M-only providers (IRR 0.39, 0.30–0.52; $p<0.001$), and N+M+S 59% fewer (IRR 0.41, 0.31–0.54; $p<0.001$). The M+S estimate was above unity but imprecise and non-significant (IRR 1.28, 0.56–2.94; $p=0.55$); with 56 provider-years, this class is too small to support inference.

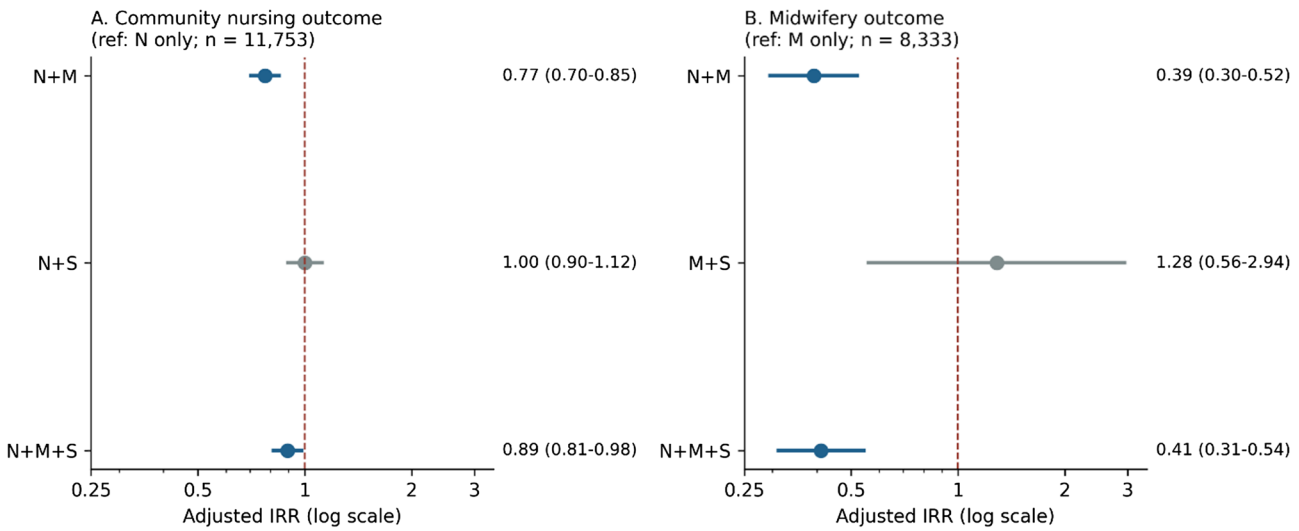

Fig. 2 Adjusted associations between service-domain combination and per-domain output. Forest plot of adjusted IRRs and 95% CIs from NB2 negative binomial regression models with estimated dispersion, log(declarations) as offset, fixed effects for NFZ regional branch and year, and provider-clustered standard errors. Panel **A**: community nursing outcome (n=11,753). Panel **B**: midwifery outcome (n=8,333). Dashed vertical line indicates the null (IRR=1)

Table 2 Adjusted incidence rate ratios for non-physician primary care services

Outcome	Comparison	Adjusted IRR (95% CI)	*p* value
Nurse services	N+M vs. N only	0.77 (0.71–0.85)	<0.001
Nurse services	N+S vs. N only	1.00 (0.90–1.12)	1.00
Nurse services	N+M+S vs. N only	0.89 (0.82–0.98)	0.016
Midwife services	N+M vs. M only	0.39 (0.30–0.52)	<0.001
Midwife services	M+S vs. M only	1.28 (0.56–2.94)	0.55
Midwife services	N+M+S vs. M only	0.41 (0.31–0.54)	<0.001

Negative binomial regression models with offset = log(declarations), adjusted for NFZ regional branch and year fixed effects. Reference categories: N only for nursing outcome; M only for midwifery outcome. Dispersion estimated by maximum likelihood (α = 1.26, nursing; α = 3.89, midwifery); standard errors clustered at the provider level; Wald tests

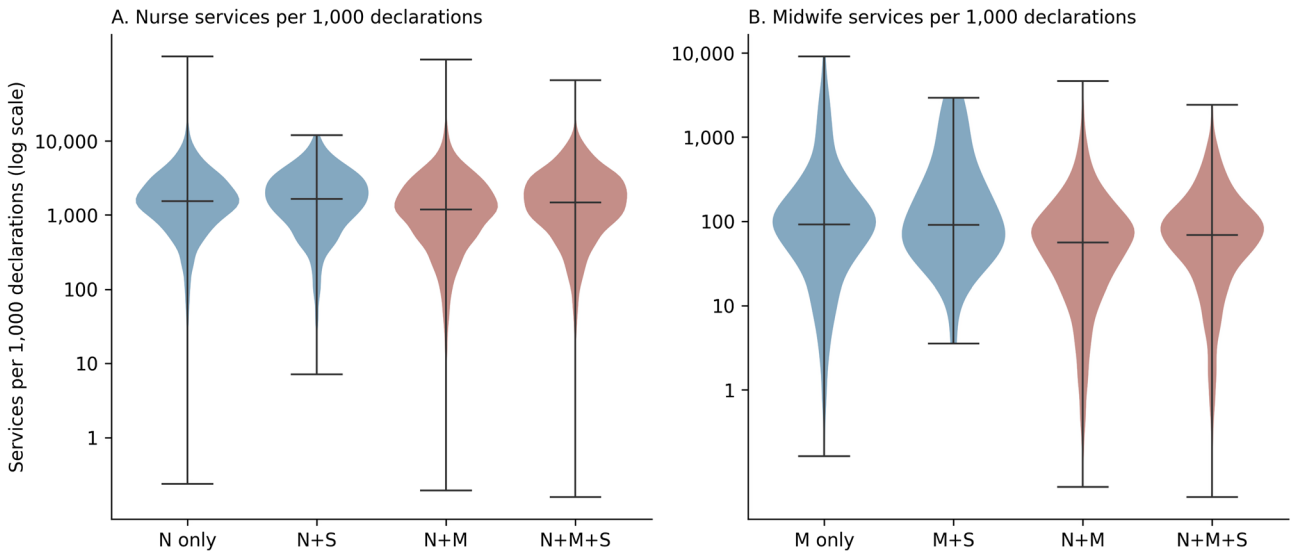

Fig. 3 Distribution of per-domain service rates by service-domain combination. Violin plots on a log-scaled rate axis; horizontal lines mark medians. Panel **A**: nurse services per 1,000 nurse declarations across four nurse-contracted classes. Panel **B**: midwife services per 1,000 midwife declarations across four midwife-contracted classes. The downward shift of the central tendency in N+M and N+M+S relative to the mono-domain reference categories, visible in both panels, is the unadjusted manifestation of the association quantified by the regression models reported in Table 2 and Fig. 3

Sensitivity analyses

In the balanced panel of providers contributing observations in both years (nursing: 11,312 provider-years from 5,656 providers; midwifery: 7,976 from 3,988), estimates were closely similar to the main results (nurse outcome: N+M IRR 0.77, N+M+S 0.89; midwife outcome: N+M 0.44, N+M+S 0.46; Supplementary Table S3). Declaration denominators differed by class (Supplementary Table S1): median nurse declarations were 4,175 in N+M and 4,726 in N+M+S versus 2,304 in N only, whereas median midwife declarations were lower in N+M (2,282) than in M only (3,277). In models re-estimated within declaration tertiles (Supplementary Table S2), the negative associations were concentrated in the small and medium tertiles for both outcomes and attenuated towards the null in the largest tertile.

Discussion

Principal findings

In the analysis of the integration–output relationship in non-physician primary care, organisational integration was systematically associated with *lower* per-domain service output, not higher. According to the best of our knowledge, the current study presents one of the largest published to date analysis related to integration of non-physician primary care domains. The combination of community nursing with midwifery was associated with a 23% reduction in nurse services per declaration; the reciprocal effect of nursing integration on midwifery output was a 61% reduction. The pattern was robust to adjustment for regional branch and year, and was driven specifically by the presence of the partner domain: combination with school medicine alone produced no detectable change in per-domain output. These results contradict the implicit expectation that scope economies in shared primary care infrastructure raise per-domain throughput.

Mechanisms

Three non-mutually exclusive mechanisms can plausibly account for the observed gradient. First, *substitution within the care team*: in an integrated practice, a patient who would generate a nursing-coded service in a mono-domain organisation may, by virtue of being seen by an integrated team, receive a midwifery-coded service instead. Because the Polish reimbursement system maintains separate denominators for each domain, this substitution registers as a reduction in domain-specific rates without necessarily implying lower total care volume. Cochrane evidence on nurse-physician substitution in primary care documents precisely this phenomenon at a different boundary [17]. Second, *denominator inflation*: integrated practices attract patients who file declarations across multiple domains, increasing each domain's denominator without a proportional increase in domain-specific service counts. Third, *specialisation advantage*: mono-domain practices concentrate expertise, infrastructure, and throughput norms on a narrower scope of activity. Industrial-organisation theory predicts higher per-unit output in specialised producers; the present results are consistent with this prediction.

The asymmetry of effects is consistent with mechanisms 1 and 3 rather than with mechanism 2 alone. If denominator inflation were the dominant cause, we would expect comparable reductions for all integrating combinations, including N+S and M+S. We did not. The effect is concentrated in combinations containing the partner domain, suggesting that substitutability between activities matters: nursing and midwifery in Polish primary care share overlapping clinical territories (women's preventive care, family education, perinatal patronage), whereas school medicine occupies an essentially separate clinical and physical space. The absence of any per-domain penalty in the school-medicine combinations (N+S indistinguishable from N only; M+S imprecise but not reduced) is itself a substantive finding: extending activity into the school-health domain was not accompanied by lower community nursing or midwifery service intensity. We emphasise that the data capture associations between contracted service configuration and domain-specific service rates; they do not observe substitution or specialisation as processes, and the asymmetry should be read as consistent with these mechanisms rather than demonstrating them.

Provider scale contributes to the observed pattern. Multi-domain providers hold substantially larger nursing denominators, and the negative associations for both outcomes are concentrated among small and medium providers, attenuating towards the null in the largest declaration tertile (Supplementary Tables S1–S2). A larger enrolled population mechanically lowers per-capita service rates where service capacity does not grow proportionally, and the stratified results indicate that part of the multi-domain differential operates through this route. The specialisation reading and the scale reading are not mutually exclusive, and the present data cannot apportion the differential between them.

Comparison with existing literature

The international literature on integrated primary care has examined patient experience, hospitalisation, and patient-reported outcomes far more thoroughly than per-domain output [7, 18]. Systematic reviews of integrated-care effects find evidence for improved patient satisfaction and access but generally inconclusive evidence for service-volume or cost outcomes [7]. Studies of the Patient-Centered Medical Home in North America have similarly reported improvements in process measures and access without consistent effects on service throughput [19]. Our results add a distinct dimension: at population scale, integration of the non-physician primary care workforce in a country with separate domain denominators is associated with measurable downward shifts in per-domain output, with effect sizes (20–60% reductions) that would be detectable in any reasonable benchmarking exercise. Whether this pattern reflects reallocation of activity within multi-domain teams or genuinely lower output cannot be determined from per-domain counts alone and requires further research.

Generalisability

The estimates are conditioned on the Polish arrangement, in which the three non-physician domains are separately contracted, denominated, and reported, so the absolute magnitudes should not be carried over to systems with blended capitation or bundled payment. The underlying question, whether multi-domain provision is accompanied by lower per-domain service intensity, is relevant to any system that keeps per-domain accounts, and the possible transfer of the observed pattern to such settings is a hypothesis for comparative research rather than a conclusion of this study.

Policy and methodological implications

Two implications follow from the results. First, identical per-domain benchmarks applied to mono-domain and multi-domain providers will systematically disadvantage the latter, because providers combining community nursing with midwifery deliver fewer services per declaration in each domain; payers and regulators comparing providers on per-domain volumes should account for service-mix configuration when setting or interpreting such benchmarks [20]. Second, the trade-off between organisational breadth and per-domain throughput deserves explicit attention wherever multi-domain provision is promoted or incentivised, so that workforce and skill-mix policies encouraging broader service portfolios are designed and evaluated with realistic expectations about per-domain output [21, 22]. Comparative evidence on primary care organisation across Europe likewise supports attention to service configuration when interpreting cross-provider differences [23, 24].

Strengths and limitations

Strengths include national census coverage (all 8,511 contracted providers and all 16 regional branches), use of administrative service-count data unaffected by recall bias, standardised national service-code reporting that allows clean per-domain comparisons, and adherence to STROBE and RECORD reporting standards [12, 13]. Limitations are several. First, the analysis excluded family doctors (Pol. *lekarz POZ*) integration because complete physician-domain declaration counts were not available; physician–nurse, physician–midwife, and four-domain integration combinations are accordingly unexplored. Second, the design is cross-sectional and observational; unmeasured confounding by practice casemix, urban–rural setting, and patient socioeconomic composition cannot be excluded. Casemix differences in particular may differ systematically between mono-domain and integrated providers and could partly account for the observed differences [25–27]. Third, observations are clustered within providers (each provider contributes up to two observations across years); this is addressed in the primary models through provider-level cluster-robust standard errors, and a balanced-panel sensitivity analysis restricted to providers present in both years is reported alongside the main results (Supplementary Table S3) [15]. Fourth, the

outcome is recorded service volume—a process measure—not patient health outcomes. The analysis addresses per-domain service volumes and does not evaluate the quality, comprehensiveness, or clinical effectiveness of care. Moreover, the nurse outcome aggregates heterogeneous activities such as patronage visits, home visits, diagnostic procedures, injections, screening. It should be taken into account that a reduction in the aggregate count may reflect a shift in service composition rather than simply lower throughput. Further studies are needed to explain the influence of clinical overlap between different domains. Fifth, the dataset contains no information on staffing levels, nurse full-time equivalents, or working hours, so workforce input could not be adjusted for and declarations remain the only available proxy for practice scale. Sixth, multi-domain contracting is an administrative proxy that may misclassify substantive integration in both directions: entities holding several contracts share legal registration and management but need not share records, team working, or coordinated care plans, while genuine integration may exist across separately registered entities. Finally, per-domain output metrics may fail to capture some dimensions of productivity in multi-domain practices, such as cross-domain coordination, and this consideration tempers, without overturning, the interpretation offered above.

Conclusions

In a complete national census of non-physician primary care providers in Poland, 2022–2023, covering 16,574 provider-years, multi-domain contracting of service domains was associated with substantially lower per-domain output, with the largest effects observed for combinations of community nursing with midwifery; the pattern is consistent with specialisation effects and is partly linked to provider scale. Per-domain benchmarks should account for service-mix configuration, and the trade-off between organisational breadth and per-domain throughput warrants explicit consideration in payment design, performance measurement, and the evaluation of primary care policies.

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Data availability The data are available from Polish National Health Fund, but restrictions apply to the availability of these data, which were used under licence for the current study and so are not publicly available. The data are, however, available upon request and with the permission of Polish National Health Fund.

Declarations

Ethics approval and consent to participate An inquiry was submitted to the Bioethics Committee and the response was that the presented study did not require the committee's consent because it was based solely on aggregated and anonymized administrative data obtained from the National Health Fund (Decision of the Bioethics Committee of the Medical University of Silesia in Katowice, No. BNW/NWN/0052/KB/200/26, 14th July 2026). The study is based solely on the analysis of anonymized data obtained from a public institution. Therefore, informed consent for participation in the study is not required. Research was conducted in compliance with the Helsinki Declaration.

Declaration of AI use During the preparation of this work, the authors used ChatGPT, a service provided by OpenAI, to assist with corrections and improvements to the readability of the text. After using this tool, the authors carefully reviewed and edited the content as needed and take full responsibility for the final version of the publication.

Consent for publication Not applicable.

Competing interests The authors declare no competing interests.

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