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Obstetrics and Gynaecology Supply and Demand Model - Methodology Paper

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List of Acronyms and Abbreviations

ABS	Australian Bureau of Statistics
AECC	Australian Emergency Care Classification
AFHW	Australia's Future Health Workforce
Ahpra	Australian Health Practitioner Regulation Agency
APC	Admitted Patient Care
AR-DRG	Australian Refined – Diagnostic Related Group
DMS	Derived Major Specialty
ED	Emergency Department
EDDG	Emergency Department Diagnosis Groups
ERP	Estimated Resident Population
ESRGs	Enhanced Service-Related Groups
FTE	Full-Time Equivalent
GLM	Generalised Linear Model
GP	General Practitioner
MBS	Medicare Benefits Schedule
MeSHWPoD	Medical Specialist Health Workforce Prediction of Demand
NAP	Non-Admitted Patient
NAPEDC	Non-Admitted Patient Emergency Department Care
NEP	National Efficient Price
NHCDC	National Hospital Cost Data Collection
NHCDC	National Hospital Cost Data Collection
NHWDS	National Health Workforce Datasets
NNAPD	National Non-Admitted Patient Database
NWAU	National Weighted Activity Unit
O&G	Obstetricians and Gynaecology
PHDB	Private Hospital Data Bureau
PLIDA	Personal Level Integrated Data Asset
RANZCOG	Royal Australian and New Zealand College of Obstetricians and Gynaecologists
SA4	Statistical Area 4
SIMG	Specialist International Medical Graduates
URG	Urgency Related Group

1.0 Introduction

This paper provides the methodology used for the supply and demand model for the Obstetrics and Gynaecology (O&G) workforce. It aims to quantify the supply and demand for obstetricians and gynaecologists (O&G specialists) between 2025 and 2048 using data collected from several sources between 2018 and 2023.[1]

2.0 Modelling Overview

2.1 Scope

To practise in Australia, all obstetricians and gynaecologists must be registered with the Australian Health Practitioner Regulation Agency (Ahpra). All O&G specialists must undergo the Royal Australian and New Zealand College of Obstetricians and Gynaecologists (RANZCOG) Fellowship program or international specialist pathway for Specialist International Medical Graduates (SIMG) to become accredited to practise in O&G. SIMGs are defined as medical practitioners whose initial specialist qualification was from overseas.[2]

This study focuses on modelling supply of and demand for O&G specialists who are currently working clinical hours and who are not currently trainees. O&G trainees are modelled as part of the training pipeline analysis (see section 3.3.1 New entries) which focuses on modelling trainees to inform inflows into the O&G workforce over the projection period.

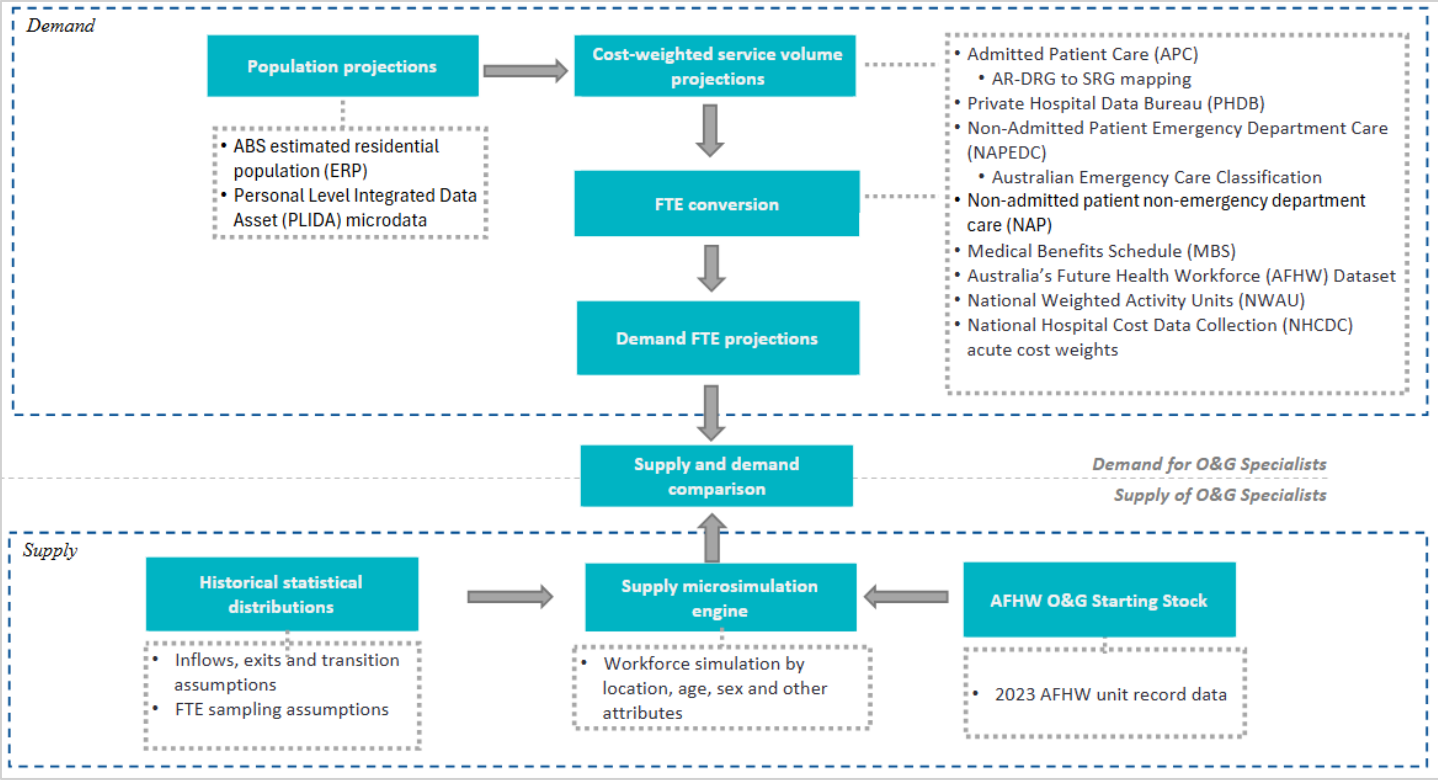
Modelling has been undertaken at the Statistical Area 4 (SA4) geography (where data availability permitted). However, results will be published at state and territory level, with their aggregation forming the national results.

Figure 1 provides an overview of the modelling process. The following sections will explain the steps in further detail.

[1] The workforce projections have been estimated over a longer period, as compared to the 15-year period for all allied health practitioner supply and demand studies, due to the relatively longer training pipeline for medical practitioners.

[2] Please note that this definition differs from the standard way International Medical Graduates (IMGs) are typically described in the literature. In most cases, the definition is based on a practitioner's initial medical qualification rather than their specialist qualification.

Figure 1: Overview of the O&G modelling process



3.0 Obstetrics and Gynaecology (O&G) Supply

The O&G supply model uses the AFHW data on O&G specialists from 2018 to 2023.

The supply model uses the microsimulation approach where attributes such as entries and exits to the workforce and practitioner Full-Time Equivalent (FTE) are modelled distinctly. The supply methodology begins by identifying the current stock of O&G specialists, analysing their demographic profile and historically observed work patterns. Statistically significant predictors of future O&G workforce supply (such as age, sex, etc.) are selected, and their historical distributions are measured to allow the development of a microsimulation model.

The microsimulation works at a yearly time-step, tracking the progressing O&G specialists throughout their career. Each year, it accounts for new fellows, removes O&G specialists who take temporary or permanent leave, and simulates transitions of O&G specialists between geographic locations. The following sections describe how each component is defined and modelled in the supply model.

The baseline projections assume an initial equilibrium between supply and demand in the base year, **2023**.

3.1 Key data inputs

The key datasets used for the O&G supply modelling are extracted from the following sources:

#	Source	Description and use in model
1	Australia's Future Health Workforce (AFHW) dataset	The AFHW datasets are created from the National Health Workforce Datasets (NHWDS) for modelling purposes. A sequence of rules (supply criteria) is applied to each NHWDS to determine which practitioners meet the definition of supply for each profession (and sub-groups where applicable). The headcount and workload of these practitioners, along with other variables required for modelling, are included, derived or imputed in the AFHW datasets. The AFHW dataset contains unit record data on O&G specialists, including demographic variables and information on their career (such as hours worked which is converted to FTE).
2	Yearly snapshot of trainees in the RANZCOG Fellowship Program and substantial/partial comparability pathways (provided by RANZCOG)	Contains unit record data on O&G trainees, including SIMG indicator, training status, training stage, training type, state, extract date, sex, program, date of birth, etc.

3.2 Historic and starting stock

The AFHW data is a unit record longitudinal dataset, where each respondent is assigned a unique identifier that can be linked across multiple years. To be in scope, O&G specialists must be:

1. registered as a medical practitioner and have O&G as one of their 6 specialties registered with Ahpra
2. working in medicine in Australia including those on extended leave; and
3. working clinical hours, and indicate O&G as a specialty they worked the most or second most hours in.

3.2.1 Total Hours (Full-Time Equivalent)

Total specialist hours (clinical and non-clinical) of O&G specialists are used in modelling supply. If an O&G specialist is employed but on extended leave (defined as a period of over 3 months), their hours are halved for simplicity, assuming they worked an average of 6 months during the year.

One FTE is defined as 40 self-reported weekly average hours in the AFHW dataset (across 46 weeks in the year).

3.3 Measuring entries, exits and transitions

The AFHW dataset enables tracking of individuals as they age, relocate, progress in their careers and transition in and out of the workforce. Historical data relating to entries, exits and transitions is used to determine future trends based on the analysis of historical demographic probabilities and distributions.

The demographic probabilities and distributions are sampled to understand the effects of age, sex, state of primary workplace and place of specialist qualification on workforce patterns.

3.3.1 New entries

New entries into the O&G workforce include individuals entering through both the domestic RANZCOG Fellowship Program and the RANZCOG international pathways.

New entries are modelled through a training pipeline module that considers assumptions about inflows to the Fellowship Program and international pathways. This module estimates the number of new fellows each year based on transition probabilities between stages in the training program. The number of new fellows is then converted into the number of new O&G specialists that meet the criteria in section 3.2. This is done by estimating transition rates from the AFHW dataset which gives the number of new O&G specialists as an inflow to the supply microsimulation model.

The main data source informing this modelling is the trainee and new fellow data provided by the RANZCOG that covers reporting periods 2020 to 2024.

Inflows to RANZCOG Domestic Fellowship Program and international pathways

A medical practitioner joining the RANZCOG Fellowship Program is classified as a trainee in the domestic program, whereas those joining the partially/substantially comparable pathways are classified as trainees in the SIMG program.

It is assumed that the number of new entries to the domestic and SIMG training pathways stay constant over the projection period. For domestic trainees, the number of new entries is held constant at 2024 level, whereas an average of the last 3 years (2022–2024) of new entries is used for international trainees.[3]

[3] During consultations, RANZCOG confirmed that they do not plan to alter the number of trainees from the current level. Therefore, the number of new domestic trainees for 2024 are held constant throughout

The rate of transition between each stage of the training program (and becoming a new fellow) remains constant using the average transition rates observed between 2020 and 2024.

3.3.2 Exits and re-entries

Exits from the O&G workforce are determined using historical AFHW data by tracking individual specialist's participation over time. O&G specialists who appear in the AFHW data in one year but not the next are classified as having exited the workforce. Exits are modelled by age, sex, place of initial specialist qualification and state of primary workplace as covariates.

These one-period exits are further classified as temporary or permanent exits:

- **Temporary exits or re-entries**: refer to O&G specialists who leave the workforce after working for at least one reporting period (i.e. one year) but returns to the medical profession within a 4-year period.[4] The point of re-entry is estimated based on the rate at which O&G specialists who leave the workforce, return in subsequent years. The modelling of re-entry probabilities includes the same covariates as exits i.e., age, sex, place of initial specialist qualification and state of primary workplace.
- **Permanent exits**: refer to O&G specialists who, after working for at least one reporting period (i.e. one year), leaves the workforce and does not return within a 4-year period.

3.3.3 Interstate transitions

Interstate movement of O&G specialists is estimated based on the probability of O&G specialists changing their primary place of work from one state/territory to another. Covariates used to determine transition rates and destinations are the current state of the O&G specialist's primary workplace, sex, age and place of initial specialist qualification.

3.3.4 Estimating full-time equivalent (FTE) of entries, re-entries and transitions

The number of FTE each O&G specialist works is a central component of the model. FTE is a measure which can vary significantly between individuals and years. One FTE is defined as 40 self-reported weekly average hours worked.

To account for the variations in FTE by various demographics of O&G specialists, the simulated O&G workforce FTE distribution is estimated by age, sex, place of initial specialist qualification, state of primary workplace and whether they work in the private or public sector (or both). This is done by:

1. Re-sampling an existing O&G specialist's FTE annually to reflect their demographic attributes, as it may change from year to year. Additionally, their FTE is adjusted by a time-dependent modifier based on changes to the average FTE observed over the past 5 years.

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the projection period. For SIMG pathway, the international trainee numbers were affected by COVID-19, so the average of last three years (2022–24) is used to determine new entries.

[4] The 4-year period is used because practice considerations become less relevant beyond that timeframe. This approach is used for both historical and future workforce exits.

2. Additional FTE adjustments, in the form of a series of multipliers, is then applied to an O&G specialist's FTE, following one of the workforce status changes below:
    - a workforce exit or entry, or
    - a change in state of workplace

These adjustments are applied after the new FTE re-sampling has been applied. This is because the adjustments effectively adjust for breaks in regular employment.

3.4 Supply Modelling

A microsimulation process is used to project supply for O&G specialists. An overview of this process is shown in Figure 2 below. The supply model uses the following attributes:

1. Full-time Equivalent (FTE) based on 40 hours per week
2. sex
3. age
4. specialty graduation country (domestic RANZCOG Fellowship Program versus international pathways)
5. primary work location (state, SA4).

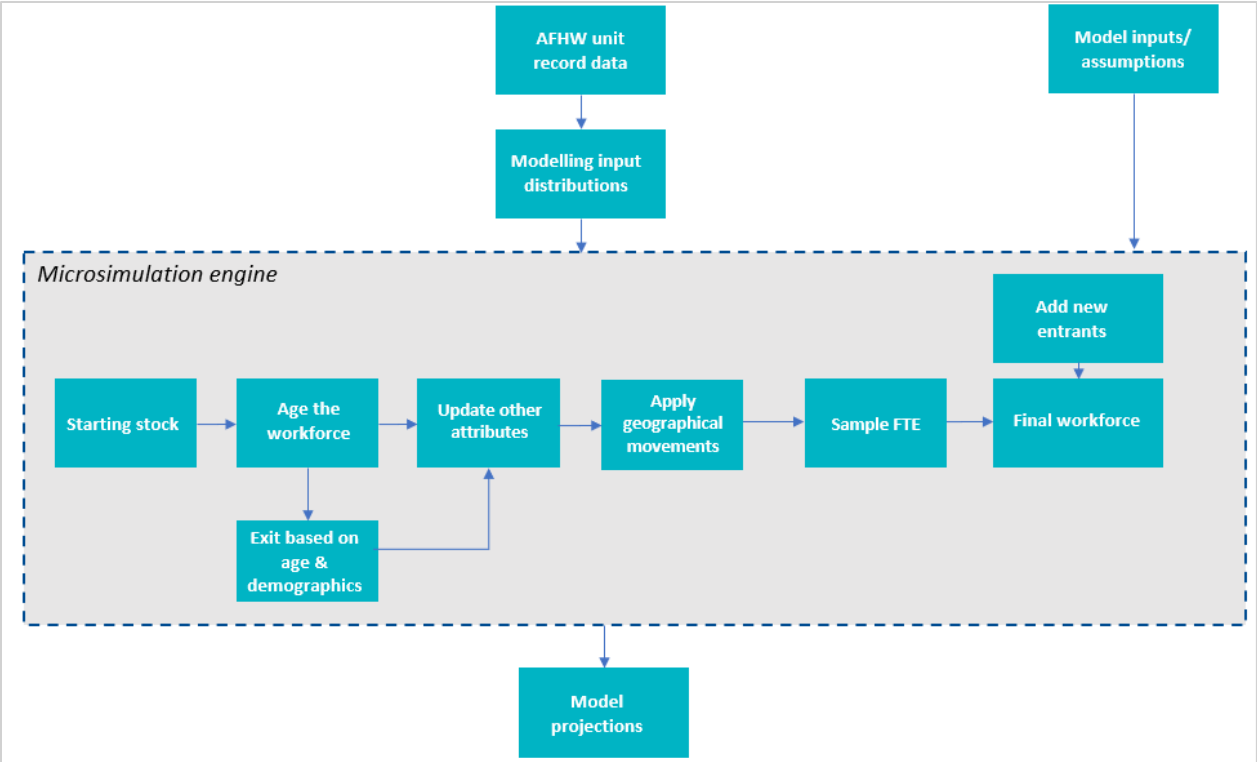
In each iteration of the microsimulation:

1. The workforce is aged, and some practitioners exit the workforce based on their age, sex, specialty graduation country and state of primary workplace.
    a) Exits are sampled to determine if the exit is permanent or temporary.
    b) O&G specialists that temporarily exit will re-enter the workforce during a subsequent period of up to 4 years, in accordance with the historical distribution of re-entries following up to 4 periods of absence.
2. Geographical movements are applied to O&G specialists based on historic state/territory migration patterns broken down by sex, age, place of initial specialist qualification and state/territory of primary workplace.
3. FTE is updated based on smoothed historical FTE year-on-year changes by age, unless an O&G specialist:
    a. geographically transitions to a different state/territory or
    b. returns from a temporary exit.
4. O&G specialists that are flagged for re-entry are brought back into the workforce when their pre-assigned leave duration has elapsed. Leave duration is determined by factors such as age and place of initial specialist qualification, with a maximum of 4 years for temporary exits. The FTE for re-entering specialists is sampled from a distribution modelled on historical AFHW data.

5. New O&G specialists are added to the workforce either as:
    a. new fellows that completed the RANZCOG Fellowship Program or
    b. new fellows that completed one of the RANZCOG partially/substantially comparable pathways.
6. The modelling process iterates annually, where the number of O&G specialists in the following year is calculated as the number of O&G specialists in the current year, minus the number of O&G specialists exiting and transitioning-out, plus those entering the workforce and transitioning-in in the new year. In other words:

$$\text{Supply}_{(t+1)} = \text{Supply}_{(t)} - \text{Exits}_{(t+1)} + \text{Entries}_{(t+1)} + \text{Net transitions while staying employed}_{(t+1)}$$

Figure 2: The supply microsimulation process



3.5 Assumptions

#	Caveat/Limitation	Description and implications
1	Static sampling assumptions	The microsimulation module applies static sampling distributions based on historical data from 2019 to 2023 to simulate projected behaviour, except for average FTE distribution which is adjusted based on historical trends.
2	COVID-19 impact	The effects of COVID-19 on affected years (2020-2021) are unclear and will be confirmed with further analysis of updated data. It is likely that some trainees were unable to progress due to the pandemic. If so, stage transition disruptions could affect subsequent years as well.
3	Technological change	Technological improvements during the projection period that may affect workforce FTE in providing care are not considered.

4.0 Obstetrics and Gynaecology (O&G) Demand

Demand is measured in terms of observed utilisation of medical services which captures expressed (observed) service demand for O&G services across a variety of care settings. Historical patterns of usage are examined and used to estimate the future demand for O&G Specialists, accounting for differences in service demand across various age groups and geographies. Estimation of future demand for O&G services also considers the Australian Bureau of Statistics (ABS) Population Projections.

The model, known as the Medical Specialist Health Workforce Prediction of Demand (MeSHWPoD) is used by the Department of Health, Disability and Ageing (the Department) to provide demand projections for the specialist workforce. For further details on the MeSHWPoD methodology with worked examples, please refer to ***Attachment A***.

4.1 Key data inputs

The key datasets used for the O&G demand modelling are extracted from the following sources:

#	Source	Description and use in model
1	Medical Benefits Schedule (MBS) data	Contains data on patients billed through the MBS, including patient demographics such as age, sex, location, service provider location, the specific MBS item and benefit paid. A hospital flag indicator is used to exclude any MBS services delivered in hospitals to avoid

#	Source	Description and use in model
		overlap with Admitted Patient Care (APC) data/Private Hospital Data Bureau (PHDB) data.
2	Admitted Patient Care (APC) data	Contains data on episodes of care for admitted patients in all public and private acute, and maternity/women's hospitals, free standing day hospital facilities, and hospitals specialising in other specialised acute medical or surgical care. The data includes patient demographics such as age, sex, location of residence, service provider location and type of facility (used to derive sector). It also includes detailed data on procedures and diagnoses based on Australian Refined – Diagnostic Related Group (AR-DRG) classification.
3	Private Hospital Data Bureau (PHDB)	Contains data on episodes of care for admitted patients in private hospitals (although three of these hospitals are treated as public for reporting purposes). The structure and variables collected is similar to those in the APC data.
4	Non-Admitted Patient Emergency Department Care (NAPEDC) data	Contains data on episodes of care for patients who physically present to emergency departments. The data includes patient demographics such as age, sex, location of residence, service provider location, the length of stay measured in minutes, and various classifications relating to the principal diagnosis of each presentation.
5	National Non-Admitted Patient Database (NNAPD)	Contains data on services provided to non-admitted patients in Australian public hospitals, including the types of services provided, service delivery settings and selected patient characteristics. This data collections exclude non-admitted patient services provided during emergency department care and to admitted patients.
6	Population and household projections based off ABS data	Population and household projections developed by the Department based on ABS Series B population projections and the ABS Census household distribution type. Population projections by age group, sex, geography and year.

#	Source	Description and use in model
7	National Weighted Activity Unit (NWAU)	NWAU is used as part of the National Funding Model and is a measure of health service activity expressed as a common unit, against which the National Efficient Price (NEP) is paid. It provides a way of comparing and valuing each public hospital service, including emergency care, subacute care, admitted care and non-admitted care, weighted for clinical complexity.
8	National Hospital Cost Data Collection (NHCDC)	NHCDC public sector, collected through the states and territories, is an annual and voluntary collection of public hospital data. The NHCDC is used to develop the national efficient price, which determines the level of funding public hospitals receive annually.

4.2 How services for O&G specialists are defined

Defining services within the scope of practice for O&G specialists is done using dataset-specific methods, explained below.

4.2.1 MBS data and Derived Major Specialty

A provider may have more than one registered specialty with Medicare. The Derived Major Specialty (DMS) classification provides a single specialty, derived to represent the major/highest qualification and/or major activity of a provider during the observed period according to the type of services delivered. O&G services from MBS data are derived using the DMS group(s) for O&G specialists.

More specifically, DMS codes have 3 progressive levels. The first level is determined solely by the provider's highest registered specialty. The second and third levels are determined by the provider's qualifications and major services provided.

Providers who are classified as DMS level 2: Obstetrics and Gynaecology or Maternal-foetal Medicine and Specialist GP – Obstetrics and Gynaecology, are identified as in-scope for the O&G demand model.

4.2.2 APC and PHDB data

Every separation within the APC and PHDB data has a Diagnostic Related Group (DRG) and Australian-Refined Diagnostic Related Group (AR-DRG) attached to group patients with similar diagnoses and/or interventions, reflecting similar resource use. These two classifications (i.e. DRG and AR-DRG) can be mapped to Enhanced Service-Related Groups (ESRGs), which group patients by specific diagnoses and/or procedures, derived from the specialty of the attending medical officer.

The APC dataset contains patient and diagnosis data for public hospitals while the PHDB dataset contains data on private hospitals.

Episodes of care with O&G-related ESRGs are counted as in-scope services for O&G demand (see Table 1).

Table 1: In-scope ADRG/ESRG codes for O&G APC and PHDB data, 2015–22

ADRG code	ADRG Description	ESRG Code
N01	Pelvic Evisceration and Radical Vulvectomy	718
N04	Hysterectomy for Non-Malignancy	715
N05	Oophorectomy and Complex Fallopian Tube Interventions for Non-Malignancy	719
N06	Female Reproductive System Reconstructive Interventions	719
N07	Other Uterus and Adnexa Interventions for Non-Malignancy	719
N08	Endoscopic and Laparoscopic Interventions, Female Reproductive System	712
N09	Other Vagina, Cervix and Vulva Interventions	713
N10	Diagnostic Curettage and Diagnostic Hysteroscopy	714
N11	Other Female Reproductive System GIs	719
N12	Uterus and Adnexa Interventions for Malignancy	718
N60	Female Reproductive System Malignancy	718
N61	Female Reproductive System Infections	717
N62	Menstrual and Other Female Reproductive System Disorders	717
O01	Caesarean Delivery	723
O02	Vaginal Delivery with GIs	722
O03	Ectopic Pregnancy	719
O04	Postpartum and Post Abortion with GIs	719
O05	Abortion with GIs	711
O60	Vaginal Delivery	722
O61	Postpartum and Post Abortion without GIs	724
O63	Abortion without GIs	717
O66	Antenatal and Other Admissions related to Pregnancy, Childbirth and the Puerperium	721

4.2.3 NAPEDC data

To determine O&G episodes within the NAPEDC data, principal diagnosis codes (based on ICD-10 codes) are mapped to Emergency Department Diagnosis Groups (EDDG).

Table 2: In-scope ECDG codes for O&G NAPEDC data

ECDG code	ECDG Description
E1390	Gynaecological disorders
E1410	Postpartum and post abortion conditions
E1420	Antenatal and other obstetric conditions
E1590	Perinatal disorder

4.2.4 NNAPD data

To determine in-scope outpatient O&G services within the NNAPD data, the Non-Admitted Services Classification (Tier 2) is used. Tier 2 categorises a hospital's non-admitted services into classes which are generally based on the nature of the service provided and the type of clinician providing the service.

Table 3: In-scope Tier 2 classification codes for O&G NNAPD data

Tier 2 classification	Description
20.37	Assisted Reproductive Technology
20.38	Gynaecology
20.39	Gynaecological oncology
20.40	Obstetrics (Pregnancy without complications)
20.53	Obstetrics (Complex pregnancy)
20.54	Maternal fetal medicine

4.3 Definition of Demand Activity

O&G separations and services from each data source are grouped into 4 categories:

1. MBS billings
2. Public Hospital (Admitted)
3. Private Hospital (Admitted)
4. Public Hospital Non-admitted (Emergency Department and NNAPD)

It is worth noting that the number of services or separations alone is not a sufficient metric for comparison, as each require varying levels of resources, particularly in terms of workforce effort. This measure does not consider the severity of conditions, complexity of procedures, or degree of medical input required.

To address this, services or separations are converted into a more universal metric known as units of demand activity. This metric is weighted to better represent the relative effort required by specialists for each service or separation and allows for a more accurate comparison of resource use within each category.

MBS billings

The weighting factor is calculated as the benefits paid for in-scope services (year x provider location x patient sex x patient age x patient location) divided by the reference cost which is the average benefit paid for in-scope services for a given specialty and year. The number of services is then multiplied by this weighting factor to calculate the weighted demand activity.

An adjustment is applied to O&G specialist telehealth items in the historical data used in the demand activity projections. Previous analysis undertaken relating to the telehealth impact on

FTE estimation indicated that telehealth items required 20% less FTE than the equivalent face to face items. This 20% adjustment factor is applied across all telehealth items claimed by O&G specialists in the historical data.

Public and Private Hospital (Admitted) separations

Public and private hospital separations within the APC and PHDB dataset are weighted through the application of NWAU cost weights, which reflect the relative cost or resource intensity associated with different types of care. These cost weights are linked to separations based on DRG classifications.

Public Hospital Non-admitted (NAPEDC and NNAPD)

Emergency Department (ED) episodes are also weighted using NWAU cost-weights and linked to patient records based on ED-specific classification codes. For episodes up to 2020, the Urgency Related Group (URG) classification is used, while the Urgency Disposition Groups (UDG) applies for 2021, transitioning to the Australian Emergency Care Classification (AECC) from 2021 onwards. These cost weights are used to calculate the weighted length of stay.

The NNAPD services are weighted using NWAU cost-weights published by the Tier 2 classification. The NNAPD services are combined with NAPEDC episodes by applying an adjustment factor to NNAPD services to improve comparability. The adjustment factor is calculated based on the relative ratio of cost-weighted NNAPD service volumes to cost-weighted NAPEDC episode volumes.

4.4 Projection of Demand Activity

The process of projecting the count of services over the forecast period consists of the following key steps:

1. Calculate and project service utilisation using a Generalised Linear Model (GLM) - The covariates in the GLM model include year, patient age group, patient sex, and patient/provider location. Population projections are used for estimation of the population at risk.
2. Demand activity projections are then converted to FTE by comparing demand activity against the supply FTE from AFHW dataset. Specifically, it involves the following steps:
    a. Estimate historical FTE-to-activity ratios by state/territory and use that to project the FTE-to-activity ratio for the forecast period.
    b. Multiply the projected FTE-to-activity ratio with the demand activity projections for each state/territory for each forecast year. This forms the baseline projection.

4.5 Assumptions

#	Caveat/Limitation	Description and implications
1	COVID-19 impact	The effects of COVID-19 are not explicitly accounted for but are captured implicitly through two ways: 1. the latest hospital and MBS data, available up to 2022, incorporates pandemic-driven changes in demand, which subsequently influence future predictions 2. the provision of COVID-19 telehealth and telephone MBS item codes reflects some of the pandemic-related adjustments. The model may not fully reflect the long-term shifts in demand patterns resulting from the pandemic.
2	Specialty derivation from APC/PHDB data	Specialty for APC and PHDB dataset is derived from the ESRG as per the mapping table, assuming it matches the main attending medical officer's specialty. However; 1. more than one attending medical officer may be involved in an episode of care; 2. other specialists may also contribute to a patient's care, e.g. anaesthetists and radiologists; 3. registrars/advanced trainees and other junior medical officers may also be involved. The measure of demand activity may underestimate the true value of demand for a given episode of care. However, these discrepancies will likely have little impact when demand activity is converted to FTE.
3	Services provided by GPs with RANZCOG certification and/or procedural qualifications (GP O&Gs)	The hospital demand data includes services provided by GPs with RANZCOG certification and/or procedural qualifications (GP O&Gs). However, the data does not allow for distinguishing between services delivered by GPs and those by O&G specialists. Consequently, the demand estimation method accounts for the activities performed by GP O&Gs, even though they are not included in the supply. All O&G services within the MBS data claimed by GPs are excluded from demand estimation.

#	Caveat/Limitation	Description and implications
4	Activity for patients in each ESRG	The time spent by a clinician caring for a patient is assumed to be consistent with other patients within the same ESRG, regardless of the patient's condition. However, in practice, the time spent by a clinician and consequently the actual level of demand, may vary between patients within the same ESRG.

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All information in this publication is correct as at April 2026