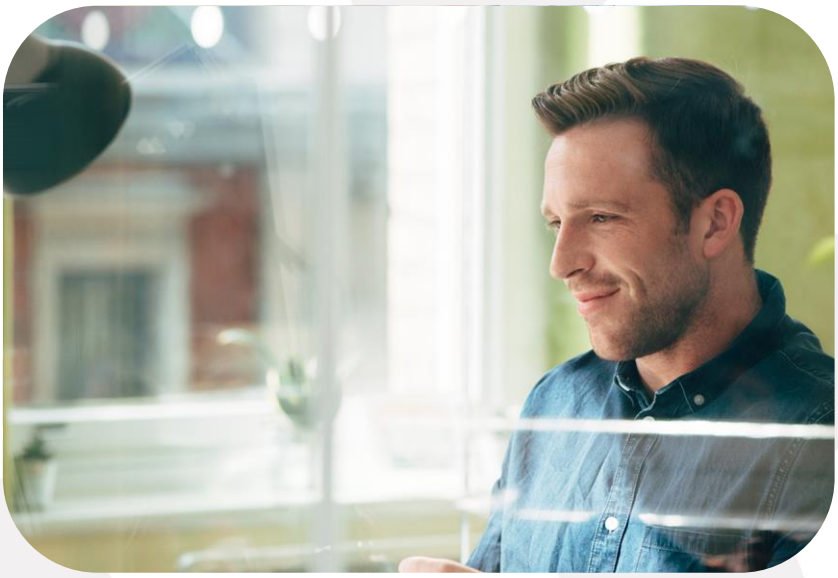
Health Workforce Planning Models, Tools and Processes in Five Countries

An Evidence Review



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Acronyms and abbreviations

ACMMP	Advisory Committee on Medical Manpower Planning (the Netherlands)
AIHW	Australian Institute of Health and Welfare
AHPRA	Australian Health Practitioner Regulation Agency
ARIMA	autoregressive integrated moving average
CBS	Central Bureau of Statistics (the Netherlands)
COAG	Council of Australian Governments
CSO	Central Statistics Office
DoH	Department of Health
EDW	enterprise data warehouse
ESR	electronic staff record
FTE	full-time equivalent
GDP	gross domestic product
GNP	gross national product
HHR	healthcare human resources
HR	human resources
HRB	Health Research Board (Ireland)
HPs	health professionals
HSE	Health Service Executive (Ireland)
HWA	Health Workforce Australia
HW2025	Australia's Future Health Workforce
HWNZ	Health Workforce New Zealand
IMTP	integrated medium-term plan
IT	information technology
NCHDs	non-consultant hospital doctors
NHS	National Health Service (United Kingdom: England, Scotland, Wales, Northern Ireland)
NMTAN	National Medical Training Advisory Network (Australia)
NWSSP	NHS Wales Shared Services Partnership
PHCAG	Primary Health Care Advisory Group (Australia)
PS	public sector
RIVM	National Institute for Public Health and the Environment (the Netherlands)
SAS	staff and associate specialist
SFC	stock-flow consistent (models)
WEDS	Workforce, Education and Development Services (Wales)
WHO	World Health Organization

Glossary

Time series analysis is the statistical process extracting signal or indicator data from variables moving over time.
Multiple regression analysis is a statistical inference procedure used to predict the value of a (dependent) variable based on the value of two or more independent variables.
Simulation-based modelling tools help users build a model of a system based on random or simulated data to understand the performance of that system in the real world.
Scenario modelling is a process for considering the impact of possible future events using either simulation models or statistical inferences from a multiple regression analysis.
Utilisation rate forecasts model supply and demand for factors of production, computing the values of key constraints such as the utilisation rate to understand how the system will evolve.
A **stock** is defined as an accumulation of material or information that has built up in a system over time.
A **flow** is defined as material or information that enters or leaves a stock over a period of time.
A **net flow** is the sum of the gross inflows and gross outflows defined over a given period.
Macroeconomics is the study of the behaviour of the entire economy.
M2F2: The CSO provides a range of demographic forecasts based on the 2011 Census and on a series of assumptions about total fertility rates, F, which take account of births and deaths, and net migration, M. M2 assumes net migration becomes positive by 2018 and rises thereafter to +10,000 by 2021. F2 is the assumption that total fertility rates will decrease to 1.8 by 2026 and remain constant thereafter.

Executive summary

Purpose

Ireland's health sector currently faces significant challenges in the recruitment and retention of health and social care professionals to meet the ever-growing demand for healthcare from an ageing population.

An integrated national response is required to ensure that Ireland has a fit-for-purpose health workforce with the capacity to deliver high-quality patient care. Workforce planning models are required as part of a fit-for-purpose health workforce.

This evidence review examines examples from the health workforce planning frameworks of other countries to highlight the systems, tools, and models used to implement health workforce planning policy and strategies. The aim is to understand the functional requirements of a successful workforce planning approach. Five countries were chosen for examination during an initial scoping exercise by the Health Research Board based on their similarity in size to Ireland or their scattered rural population. The countries chosen were Australia, the Netherlands, New Zealand, Scotland, and Wales.

Review questions

The Department of Health asked the authors to answer four overarching research questions:

1. What is the country's approach to workforce planning?
    a. What assumptions were in your country's operational model when workforce planning was first started and why?
2. What are the operational workforce planning models, tools, and processes used at a national and regional level in your country for healthcare workers?
    a. What was included in your country's operational model when workforce planning was first started?
    b. What is the timeframe of the workforce plans?
    c. What datasets and data variables were required to construct the initial operational workforce planning model in your country?
    d. Is team composition considered as part of the modelling process?
    e. What resources (skills, persons, time, money, and infrastructure) are required in the country to update and maintain the model, tools, and process?
    f. What are the limitations of the model?
3. Who feeds into and uses the national operational health workforce planning models, tools, and processes?
4. What documented benefits and challenges are derived from the use of health workforce planning models, tools, and processes in your country?

Method

The evidence review was confined to the five selected countries. The search was systematic and targeted official repositories, reports, and journal articles from 2009 to 2015 across each country's Department/Ministry of Health websites and associated online workforce planning resources as well

as the following databases: Web of Science, PubMed, CINAHL, Embase, PsycINFO, PsycARTICLES and TRIP. Only data sources and documents in the English language were included. Structured expert interviews were conducted with key workforce planning personnel in four of the five countries in order to get a better understanding of the evolution of workforce planning processes and the institutional context within which these models now sit.

Findings: general

This review found that the onset of health workforce planning in each country emerged autonomously as a national response to either financial constraints, forecasts of the changing demands on health systems from demographic pressures, or issues surrounding future supply.

Workforce planning did not necessarily begin with an integrated approach regarding team composition in mind, particularly in cases where data were limited or ambiguous and an imminent shortage of doctors was the perceived predicament. It is generally more likely that countries consider each healthcare profession separately for planning purposes. Integrated approaches to workforce planning that considered team composition and skill mix tended to be initiated from a country-specific orientation, responding to the evolution of its particular healthcare systems and needs.

All countries studied started a baseline analysis using existing data (usually from payroll and professional regulatory bodies). Once a baseline was established, the models were iterated, typically using surveys and structured dialogues with representative bodies. Most of the countries started out their workforce planning journey focusing on the medical profession, followed by nursing and midwifery, and subsequently other healthcare professions.

Workforce planning is as much a *process* as a modelling tool for policy-makers. Advancements on data collection and modelling evolve with the development of the planning system. In the countries examined, it was possible to start a rudimentary process with available data. Analysis and modelling was initiated using relatively simple linear interpolation models to conduct forecasting and scenario exercises.

Workforce planning has evolved as much as a *qualitative* process as a *quantitative* process. The models and their demand and supply forecasts are relevant only to the extent that they are informed with a qualitative understanding of the system from service-level inputs.

Using the data collection and modelling process as part of a structured dialogue with healthcare professionals was key to any workforce planning model's success. Communication and training were at least as important as the modelling methodology employed. Clear connections to policy levers, for example, aligning strategic or medium-term financial planning with workforce planning were key to legitimising and institutionalising the workforce planning approach.

Findings: country's models, tools, and processes

The review authors present synoptic summaries of the five country findings under the subheadings: approach, tools, timeframe (length of planning cycles), data, team composition, resources, benefits, and challenges.

Australia

Approach – To develop solutions integrating workforce planning, policy, and reform with complementary reforms to education and training. The workforce planning project HW2025 estimated future workforce supply using a dynamic stock-and-flow model.
Tools – The workforce planners use a bespoke workforce planning tool, and predominantly advanced Microsoft Excel models. The key tool is scenario modelling to test the effect of likely policy decisions on future workforce supply and demand.
Timeframe – The modelling/forecasting outcomes are generated every two to three years and presented in formal reports.
Data – Data are predominantly collected via labour force surveys; additional data come from colleges/universities and graduate information, immigration data, hospital statistics and so on. The workforce planners rely mainly on quantitative data, with less of a focus on qualitative data.
Team composition – Modelling is currently undertaken on a strictly speciality-to-speciality basis; interconnectivity is acknowledged in some obvious interlinked specialities. Team-based models of care are being considered.
Resources – Resources are focused on a team of planners (11 to 15 people), a number of whom are data analysts or IT developers. The planners store data in an enterprise data warehouse (EDW).
Benefits – Consultation with the different specialities supports the development of appropriate methodologies for modelling work. Other forums also exist that give voice to relevant stakeholders throughout the planning process and help to highlight issues.
Challenges – Data collection and consultation is a sensitive process, and data quality varies. Technical issues impinge on the data and modelling work: there is a need to improve the IT systems to support current work and improve the data-sharing capabilities.

The Netherlands

Approach – The Advisory Committee on Medical Manpower Planning (ACMMP) oversees the forecasting process in order to adequately regulate health coverage and university budget management.

Tools – The workforce planners use a forecasting simulation model that considers both demand and supply of the workforce and allows for the development and testing of different scenarios. The model is known as a cohort component model. The components are inflow to or outflow from the active workforce. Scenarios are added to and tested within the model.
Timeframe – Each profession plans on a two- to three-year cycle to forecast for a 10 to 20-year period. Data are updated annually.
Data – Data collected for workforce planning purposes include number of active professionals; number of full-time equivalents; types of providers; where they work; their skills; the services they provide; workloads, gender, and age. Data sources used for the model include government bodies, national registries for health professionals, and so on. Modelling is undertaken using a macro approach based on a composite of empirical data and expert opinion.
Team composition – The forecasting model considers vertical integration (from medical professions to nurses and from dentists to oral hygienists) and horizontal integration (from one medical specialist to another and to general practitioners).
Resources – The ACMMP has seven to eight staff engaged in workforce planning. They also consult with experts from different medical specialists every three to six months. The ACMMP can also consult with some research bureaux and other organisations to obtain additional data.

Benefits – An evaluation of the model for medical manpower planning focusing in particular on GP planning found that the ongoing replication and adjustment of the workforce planning model and the factors within allow for the model to closely follow actual developments in the health workforce sector. The evaluators found the model to be of significant policy value and also to have been successful in stabilising the labour market for general practitioners.
Challenges – One of the noted weaknesses of the model, iterated in Ono *et al.*, is that it does not fully allow for substitutions between different professions to allow planning from a broader skill mix.

New Zealand

Approach – New Zealand has developed its own approach to workforce planning which reflects the country size, population numbers and population distribution. It develops workforce service forecasts undertaken by speciality taskforces. The forecasts/reports present what future health workforces will look like in key areas such as aged care, diabetes, and so on.
Tools – The emphasis is on pressure points and trends, with less emphasis placed on solely traditional numerical forecasting. The workforce service forecasts are reliant on reliable data and workforce intelligence. Data modelling tools are used on the quantitative side but qualitative analyses and tools also form a large part of the New Zealand approach.
Timeframe – The planners look at a two- to three-year 'people planning' horizon to feed into longer-term plans.
Data – Data are collated, modelled and analysed on a national basis. The data come from a variety of sources, for example, regulatory bodies, and district health boards.
Team composition – Integration is very important in the New Zealand workforce planning process, particularly looking at ways to develop team-based models of care.
Resources – Maintaining the model is labour-intensive work, with 17 staff working on workforce planning. There is reasonable financial investment in the workforce planning sector and in the development of eHealth.
Benefits – There is empowerment through engagement and collaboration, and a focus on dialogue has made it a valuable and successful project to date.
Challenges – Widely varying data quality has been a challenge. There is a recognised need to be more strategic and more systemic in future planning outlooks.

Scotland

Approach – The skills for health six-step methodology underpin the primary approach to workforce planning in Scotland. A key aim of planning is to develop a consistent framework for future planning and ensure that the right competencies and skills are available within the workforce.
Tools – The workforce planners use a mixture of workforce trees, skill mix analysers, nursing and midwifery workforce tools, and emergency department multi-professional tools.
Timeframe – The planners are working towards all staff groups submitting annual three-year outlook plans.
Data – Collection and use of data has evolved from available baseline data, such as payroll data, to education outputs; profile of deployment; human resources data, and so on.
Team composition – Planners are striving towards more multidisciplinary planning, but medical and nursing are still treated as separate workforces rather than interrelated disciplines.
Resources – Resources are focused on supporting a core workforce planning training group; this team is the gatekeeper for workforce planning and is key to engaging stakeholders.

Benefits – The planners have developed a strong network across the health workforce to support and inform the workforce planning work. After 10 years, they are skilled enough to easily spot gaps in data, and so on. They have forged better links with the third-level education sector.
Challenges – An overreliance on quantitative data (numbers) may allow for repetition of mistakes in the wider planning context. Knowledge gleaned from the close working relationship between the planners and stakeholders (health professionals, professional regulators, and educators) emphasises the need for qualitative data (experiences).

Wales

Approach – The model governing the forecasting process follows the principles of Prudent Healthcare and is guided by the NHS Wales planning frameworks.
Tools – The six step methodology is used and supported by a number of Workforce, Education and Development Services (WEDS) benchmarking tools: workforce interactive tool, skill mix analyser, age profiling tool, agency and locum tool (and under development a new staff and associate specialist [SAS] doctors tool). The models used are typically advanced Microsoft Excel models.
Timeframe – Each health board or trust submits an annual rolling three-year integrated medium-term plan (IMTP).
Data – The electronic staff record (ESR) collects a multiplicity of quantitative data on the staff employed within health board and trusts; data such as headcount of full-time equivalent staff, salary costs, education information, and so on. Qualitative information and data are collected via consultations and discussions as part of the workforce planning cycle.
Team composition – A whole system approach to planning exists; developing skill mix and the development of multidisciplinary teams is a key objective of Welsh workforce planning.
Resources – Planning expertise has been subsumed into human resources (HR), with planning becoming part of the HR business manager's role. A workforce planning network has been formalised and up to 30 staff have been trained in workforce planning to diploma level. There is a core workforce planning team in WEDS.
Benefits – The modelling process starts a vital conversation about the future workforce. Workforce planning engenders a new way of thinking by managers with regard to planning and expectations. The planners have developed adequate tools for capturing the data they need.
Challenges – Some issues remain around five-year education planning cycles, as they do not align directly with the IMTP three-year planning cycle. It is difficult for frontline staff to see beyond short-term planning cycles. There is still a need for more training in workforce planning across the health workforce.

Conclusion

The review of the health workforce planning models, tools, and processes used across the five countries demonstrated that there are commonalities in the data required for workforce planning. The simplest approach to capturing data begins with what already exists (i.e. typically, payroll data), and evolves from there across the spectrum of available data. The majority of the country approaches to workforce planning begin with collating and modelling quantitative data. Using existing numbers is certainly of great importance to the notion of forecasting numbers into the future. Nevertheless, many of the countries have found integrating a more qualitative approach to be beneficial, as it permits stakeholders, such as healthcare professionals, their managers and educators, to join in the conversation on the future development of the healthcare sector's workforce and services.

Workforce planning is as much a process as a discrete modelling tool for policy-makers. Advancements in data collection, database construction and maintenance as well as statistical modelling must evolve within systems of dialogue and feedback to understand the evolution of the healthcare planning system. It is possible to start a rudimentary process with available data and iterate from there on the quantitative side, while creating the qualitative feedback systems concurrently. In the five countries reviewed, dedicated and trained workforce planners are required. In some countries they were a standalone entity, while in others they were part of the human resources team. The workforce planners cannot prepare an adequate plan without formal communicators with health professionals, educators, and regulators. Using the data collection and modelling process as part of a structured dialogue with health professionals is the key to any workforce planning model's success.

Challenges for health workforce planning included the quality and collection of data, where each country's planning systems had difficulty collecting appropriate comprehensive data. Many of the countries find that a combination of more traditional quantitative data modelling with a more qualitative approach to planning allows them to better understand the experiences of healthcare professionals and plan for them. Benefits of workforce planning included strengthening the links with affiliated sectors like third-level education and finance. Fundamentally engaging in health workforce planning allows for a new outlook on healthcare management to emerge.

1 Introduction

This review describes the health workforce planning models, tools, and processes used in a range of comparator countries to learn from their experiences, and to understand which tools and processes are best suited to the Irish context.

The health sector in Ireland is currently facing significant challenges in the recruitment and retention of health and social care professionals, including doctors and nurses. Specific, targeted efforts are under way to address these recruitment and retention issues (for example, the implementation of the Strategic Review of Medical Training and Career Structure, and the Taskforce on Staffing and Skill Mix for Nursing). Nevertheless, an integrated national response is required to ensure that Ireland has a fit-for-purpose health workforce with the capacity to deliver safe and good-quality patient care. This evidence review examines examples of health workforce planning frameworks from five countries, in order to describe the systems, tools, and models they used to implement health workforce planning policy and strategies. Based on a brief scoping review completed by the Health Research Board (HRB), which indicated that a number of countries were completing systematised integrated (or multi-professional) health workforce planning estimates, the Department of Health sought to examine health workforce planning models, tools, and processes from Australia, the Netherlands, New Zealand, Scotland, and Wales.

1.1 Review questions

The Department of Health asked the authors to answer four overarching research questions:

1. What is the country's approach to workforce planning?
    a. What assumptions were in your country's operational model when workforce planning was first started and why?
2. What are the operational workforce planning models, tools, and processes used at a national and regional level in your country for healthcare workers?
    a. What was included in your country's operational model when workforce planning was first started?
    b. What is the timeframe of the workforce plans?
    c. What datasets and data variables were required to construct the initial operational workforce planning model in your country?
    d. Is team composition considered as part of the modelling process?
    e. What resources (skills, persons, time, money, and infrastructure) are required in the country to update and maintain the model, tools, and process?
    f. What are the limitations of the model?
3. Who feeds into and uses the national operational health workforce planning models, tools, and processes?
4. What documented benefits and challenges are derived from the use of health workforce planning models, tools, and processes in your country?

1.2 The health of the health workforce

This review takes account of the current macroeconomic situation as it has applied to the health system since 2008. The panel of figures, in Figure 1 below, shows the percentage change since 2008 of many of the main variables that form the focus of this review. The sixth figure reports the

projected dependency ratio using the Central Statistics Office (CSO) M2F2 assumption set. All figures are sourced from the CSO and databank.per.gov.ie.

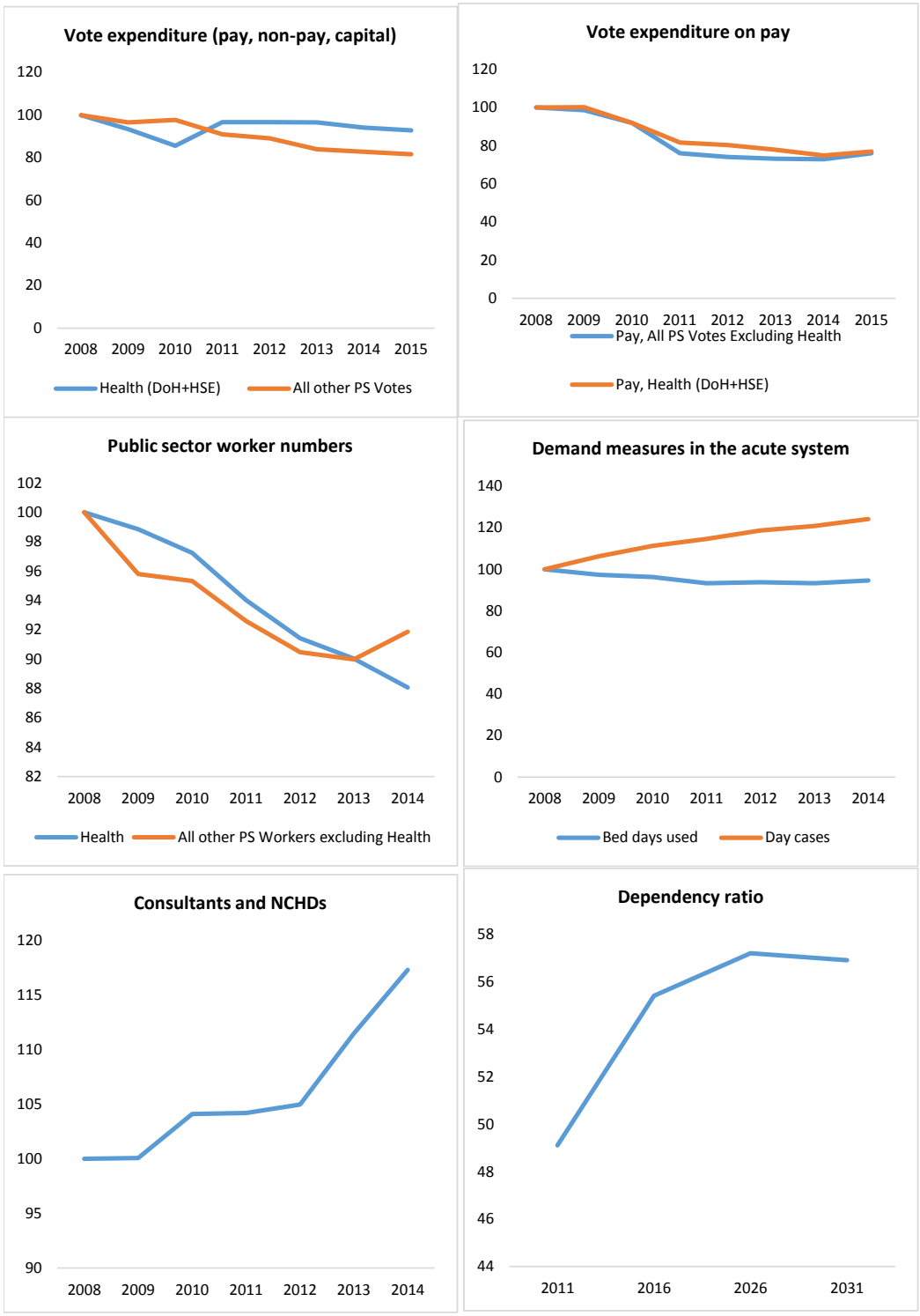


Figure 1 Data on health service expenditure, demand, supply, and future demand

These figures show a series of trends. First, the allotted expenditure on health across all categories has fallen by about 8% since 2008, while for all other voted expenditure blocks the change is about 19%. When we focus on pay alone, we can see roughly the same drop in pay for health workers as for other public sector workers, emphasising the workforce element of the spend. In absolute terms, the supply of labour to the health system has fallen to 91% of its 2008 level, while other public sector workers have fallen by approximately 12%. Demand in the system has grown, as measured by the number of day cases seen, 24% higher than levels seen in 2008, while bed days used has remained roughly static. The supply of consultants and non-consultant hospital doctors (NCHDs) is about 20% above its 2008 level; and we know that demand on the system, represented here by the dependency ratio, will increase sharply until at least the mid-2020s.

The CSO concludes that the overall picture is a health system that has experienced a reduced capital investment over a number of years and with heavy investment in recurrent spending. Day cases continue to rise while the number of bed days used has remained static or reduced, indicating an increased use of day cases and a reduced length of stay for inpatients, displacing demand from its acute bed system to its community care services. In addition, there are reduced staff numbers (excluding doctors) who are being paid less on a per capita basis than they were in 2008.

Workforce planning models are one set of tools which can be used in conjunction with an overarching focused policy strategy to achieve these goals in a planned, balanced, and rational manner.

1.3 Scopes of health workforce planning

Health workforce planning is initiated in order to achieve a balance between demand and supply for both a short-term and a long-term outlook with regard to the different groups of healthcare workers.[1] On a basic level, planning/forecasting through modelling is undertaken by recognising and analysing the major imbalances existing within health workforces.[2] A basic workforce planning model consists of separate supply and demand forecasting, analysis of the outcomes of the forecasting, and action planning, or in simpler terms, analysis of supply, demand, gap and solution.[2, 3] The main aspects that are prudent for consideration in the workforce planning and modelling process include 'variables on supply and demand side, the algorithm to join them, the method to be used for the definition of the estimations, the assumptions to start from, the modalities for the presentation of the results (one or more scenarios)'.[2] The engagement of the whole workforce planning process, particularly discourse around modelling itself, is influential to wider health workforce policy, as it promotes a conversation that should allow the stakeholders concerned with healthcare workforce to become actively involved. This permits stakeholders to have input into broader health workforce policy. The conversation it engenders gives space to identify current and emerging trends within the sector and ideological approaches to healthcare.[4]

1.4 Outline of review

The rest of this review will proceed as follows. Section 2 gives a brief overview of the theory and methods of workforce planning. Section 3 discusses the methods employed to conduct this evidence review. Section 4 details the workforce planning, tools, and processes used in the five countries studied. Section 5 summarises the review.

2 Workforce planning: a theoretical overview

Chapter 1 described the policy context and background of this review. This chapter focuses on four interrelated elements. Section 2.1 focuses on definitions and the theory behind all stock-flow consistent systems. Section 2.2 discusses data usage and data; issues related to measurement of demand, supply, and migration in workforce planning systems. Section 2.3 discusses modelling prerequisites; these prerequisites will map to the data requirements we identify in Chapter 4. Section 2.4 discusses the limitations of all of these model types.

2.1 Stock-flow consistent systems theory

We begin with some definitions for the sake of clarity. **Stock-flow consistent (SFC) models** are discrete dynamical systems capable of matching many stocks to many flows over time.

A **stock** is defined as an accumulation of material or information that has built up in a system over time.[5] For our purposes, we will think of stocks as classes of workers counted over a given time period; so, for example, we can define the stock of physiotherapists employed directly by the Health Service Executive (HSE) in 2016 in terms of a given number.

A **flow** is defined as material or information that enters or leaves a stock over a period of time. Again, we will think in terms of movements in the number of physiotherapists employed by the HSE in 2016. Some have retired or stopped working, some newly trained physiotherapists have joined, some have emigrated, and others have immigrated. The **net flow** is the sum of the gross inflows and gross outflows defined over a given period.

Example:
If there were 1,000 physiotherapists working within the HSE at the end of 2015, and during 2016, 50 retired, 100 new positions were created, 25 emigrated from Ireland and 59 entered the country, the net flow would be (−50 + 100 – 25 + 59 = 84), which would be added to 1,000 to give a new stock figure for 2016 of 1,084. Based on demographic, financial planning and needs-based analysis, a forecast of demand and supply for 2017, 2018, 2019, and beyond can be built. When this forecast is connected to appropriate policy levers, such as financial planning, dialogue systems with colleges supplying healthcare workers, and the relevant finance departments, that is a workforce planning model.

There are many inflow and outflow 'types' that change the value of a stock over a defined period of time. Table 1 shows the main flows any SFC model should count.

Stock-flow consistent models were built by Godley and Cripps[6] and extended by Godley and Lavoie[7] and Kinsella *et al*.[8] for financial systems within macroeconomics. The basic idea comes from accounting: everything should come from somewhere, and go somewhere.[9]

Table 1 Examples of flows (in and out) affecting stocks of workers by category, geography, and grade

Inflow type	Outflow type
New graduates	Retirement
Immigration	Illness/death
Return to practice	Career change/promotion/demotion
Increases in hours worked	Decreases in hours worked
Later/delayed retirement	Emigration
Overseas students and immigrant workers	Temporary leave of absence

Figure 2 shows the relationships between stocks and inflows and outflows over time.

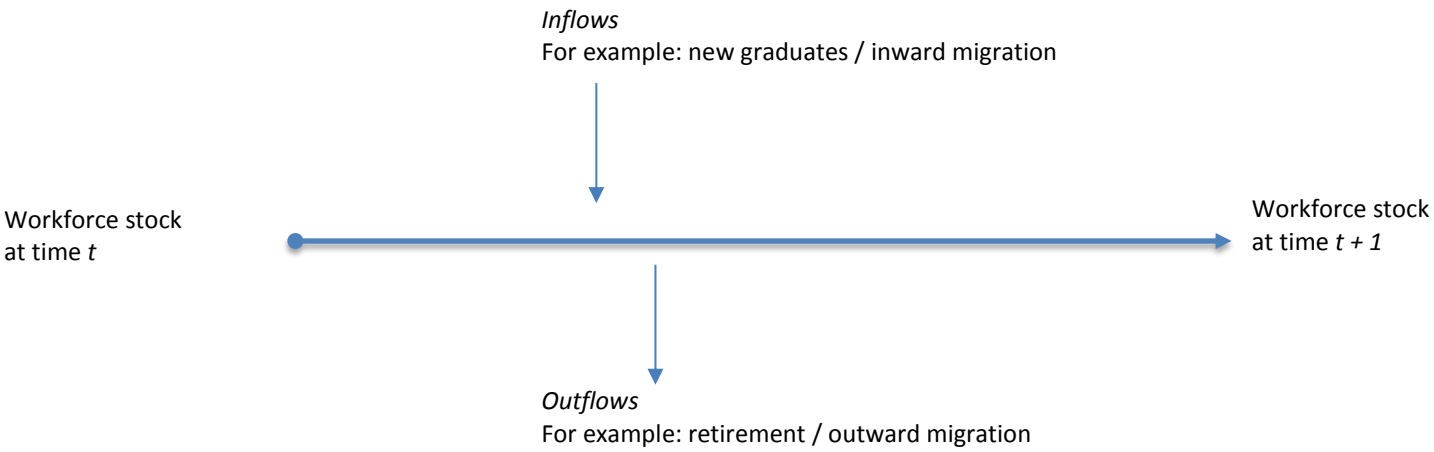


Figure 2 Stock-flow conceptual diagram

Each workforce planning model needs to respect four principles:

1. Stock-flow consistency: everything comes from somewhere and goes somewhere;
2. Distributional consistency: 'where' elements are within the system needs to be counted;
3. Coordination consistency: who collects what data, and how, must be standardised in order to ensure principles 1 and 2; and
4. Time consistency: we must be counting the same groups over the same periods of time.

Any model capable of simulating alternative trajectories of several stock items – in this case, medical doctors with different specialities, nurses with different specialities, physiotherapists, occupational therapists, and more – needs to track each inflow and outflow type precisely, and type these stock and flow changes geographically or at service level, and hence must adhere to these principles.

The method most workforce plans are built on is simulation modelling using a static stock-and-flow approach, together with scenario analysis.[1] Typically, there are differences in how supply and demand are modelled. Supply modelling is simulation based, whereas demand modelling typically applies survey-based utilisation rate forecasts over a given time horizon, usually three to five years.

These are then combined with population projections and other forecasted variables to derive the rate of change in demand over the projection period.

The forecasting method is typically an autoregressive integrated moving average (ARIMA) model of the standard (*p, d, q*) form, where for each speciality:

$$Stock_{t+1} = \mu + \phi_1 Stock_t + \cdots + \phi_p Stock_{t-p} - \theta_1 e_{t-1} - \cdots - \theta_q e_{t-q}$$

Where p is the number of autoregressive terms, d is the number of non-seasonal differences needed for stationarity, and q is the number of lagged forecast errors in the prediction equation. The moving average parameters θ are defined so that their signs are negative in the equation, following the Box–Jenkins methods for identifying, fitting, checking, and using these models. The order of difference d is typically one period or if periods are quarters of a year, d will be 4. The variable p is the number of autoregressive terms to be used, and q is the number of lagged forecast errors e in the prediction equation, with representing the slope coefficient. Most statistical software is capable of estimating sets of these equations, with some system dynamics packages, such as Vensim®, capable of modelling these in a systemic manner complete with feedbacks and scenario analysis options.

The choice of which forecasting approach to take depends on the vision of the workforce planner, the data available, and the resources available to delve as deeply as possible into a workforce plan.

2.2 Measurement issues in workforce planning models

Given that health spending in the Irish context is largely at State level, it is appropriate to discuss state-level constraints on the system. In 2013, of the €18.4 billion spent on health, 71% came from the Government, 14% from voluntary healthcare payments, and 15% from the household sector via out-of-pocket expenditures.

In general, expenditure must be monitored at the macroeconomic (or system) level as well as at service level. Expenditure on all types of healthcare professionals, and healthcare workers more generally, is captured by the total and per capita health workforce expenditure in a given period, the proportion of total expenditure on health relative to GDP, GNP, and hybrid-GDP, government expenditure on the health workforce as a proportion of general government expenditure on health, and government expenditure on its health-related workforce as a proportion of recurrent general government expenditure on health.

Models must estimate levels using measures of economic growth (typically, the average predicted annual percentage change in GDP, total public health sector expenditure, public health sector expenditure on personnel and non-personnel expenditure), projected changes in remuneration in given years in the future (for example, as a result of the Haddington Road Agreement) and other recurrent costs (salary bands and indexing for each type of staff), alterations in annual real wage costs and other non-wage compensation (these can include health-related personal benefits, pension entitlements, measurements of job security), and with the estimated private sector expenditure in healthcare and personnel costs now coming from the System of Health Accounts.

Data issues to be surmounted in every case include the lack of a standardised and centralised database (in line with principle 2 above – distributional consistency), boundary problems in distinguishing between resources better labelled 'labour' and other activities in the healthcare system, the public/private mix required, a partial coverage of costs, ignorance of or outdated estimates of unit costs, inconsistent information on pay and conditions across various data sources, differences in the methodologies for collecting and processing data, and potential double or triple counting due to multiple qualifications, multiple positions or unrecorded promotions.

The literature suggests beginning with a baseline measurement and forecast, followed by a range of scenarios, and iterating from there. In the Irish context, Behan *et al.*[10] used data from several sources – including the National Skills Database, registry data from the Health Service Personnel Census, surveys of private hospitals and clinics, surveys of independent voluntary agencies providing services to people with disabilities and which employ nurses directly, and surveys of Catholic voluntary nursing homes – to produce a baseline estimate of 26 specialities.

Once a credible baseline measure exists, when combined with demographic forecast data and other sources of relevant forecast data, any number of forecasts or policy change scenarios can be performed. Examples of policy change scenarios include: assessing the consequences of reforms on government expenditure and tax increases, simulation of increase turnover rates by speciality, increasing or decreasing numbers of medical or nursing graduates, changing the national training capacity for specialities, mid-career changes, and changes in the age of retirement.

2.3 Modelling prerequisites: the minimum data set

Once a minimum data set has been constructed in line with recommendations from the World Health Organization (WHO) and the EU Joint Action on Health Workforce Planning and Forecasting,[11] the following is required to begin modelling the Irish health system effectively:

- An initial database of the workforce as it stands, based on payroll data, data on healthcare which takes place in or is provided by the private sector, data on unfilled posts, retirement data, trainee-related data, gender, working patterns, emigration rates, full-time equivalent (FTE) rates; and
- An analysis of the current clinical programme models of care delivery, as these determine the strategic direction of each type of stock into the future.

A dialogue with stakeholders needs to be started before and during the set-up of the initial database, as stakeholder involvement in completing and validating the database is essential. Once a baseline exists, a more structured dialogue must take place with relevant representative bodies for sense-checking in terms of configuration, potential crossovers, and the magnitudes involved, as well as gaining an understanding of which scenarios make sense to develop further.

Following these dialogues, a consensus model will emerge, and forecasts and scenarios can be created based on the stock-flow consistent principles highlighted in Sections 2.1 and 2.2 above.

2.4 Modelling limitations

Data are the greatest limitation in all workforce planning model implementations. Either the data are self-selected from survey data, or they have significant gaps and lags, or they do not take account of the clinical programmes and their evolution, the geographic distribution of the workforce, or technological change. The models themselves began life simply by equating demand and supply, and forecasting both. Now they are far more sophisticated,[1] but are only as good as their input data. The data are not the only constraints, of course. The capacity to estimate the forecasting error over the period of the forecast is itself a function of the data, the forecasting method, and the forecasting period. The capacity to start the forecasting exercise from an accurate assessment of the current demand and its relation to the current state of supply, that is, the current imbalance, is a further issue. Finally, the interaction of basic assumptions and baseline measures with parameters can alter the forecasting output.

3 Methods

As previously stated, the health sector in Ireland currently faces significant challenges in the recruitment and retention of health and social care professionals, including doctors and nurses. There are specific, targeted efforts under way to address these recruitment and retention issues. Nevertheless, an integrated national response is required to ensure that Ireland has a fit-for-purpose health workforce with the capacity to deliver safe and good-quality patient care. The brief of this evidence review was to examine examples of health workforce planning frameworks from other countries, in order to highlight the systems, tools, and models used by them to implement health workforce planning policy and strategies. Based on a brief scoping review completed by the HRB which indicated that a number of countries were preparing regular integrated (or multi-professional) health workforce planning estimates, the Department of Health wished this review to examine health workforce planning models, tools, and processes from Australia, the Netherlands, New Zealand, Scotland, and Wales. Other countries, such as England and Canada, also prepare regular workforce planning estimates; however, as time was limited it was decided to concentrate on countries that were similar in size to Ireland or had a scattered rural population. It was also agreed that the search start date would begin from 2009 onwards in order to get a clear picture of the most recent workforce planning developments in the chosen countries: Australia, the Netherlands, New Zealand, Scotland, and Wales.

3.1 Search strategy

Primarily, the main goal in the search strategy was to identify the appropriate repositories of workforce planning information for each country. These country repositories were searched for documents that specifically outlined the models, systems, tools, and approaches for workforce planning used in that country. All of the countries examined have a dedicated website, or websites, for the health workforce planning undertaken in their country, with varying amounts of information available from country to country (see Table 2). These websites were identified through Google searching and emergent searching via information available on each country's Department or Ministry of Health website. In the case of Wales, for example, this information is available across a number of websites with the most directly pertinent information being found on the website of the Workforce, Education and Development Services (WEDS). Initial searching highlighted the existence of the dedicated workforce planning websites, which made identification of the appropriate publication repositories relatively simple.

Searches for pertinent material were also undertaken on the WHO website, the European Commission website and the EU Joint Action on Health Workforce Planning and Forecasting website. Additional searches for country-specific grey literature and reports were conducted through Google and Google Scholar, refining the date parameters to 2009–2015.

With regard to searching for additional literature, specifically journal articles or reports that presented reviews or evaluations of the workforce planning models, a different approach was required. Despite the reasonably clear brief, it was inappropriate to develop a technically specific refined search strategy, as the more parameters added to each search omitted potentially pertinent results. For example, some of the databases used retrieved some pertinent results when each specific country name was added to the search string, but others retrieved fewer results when the country name was added. As a result, a widespread yet purposive search using the term health with

the phrase ‘workforce planning’ and some variants of that phrase – ‘manpower planning’, ‘workforce forecasting’ – refined to the dates 2009–2015 and articles in the English language was employed across the following databases: Web of Science (formerly Web of Knowledge), PubMed, CINAHL, Embase, PsycINFO, PsycARTICLES, and TRIP.

Following this, the retrieved articles were screened by title and abstract and included in the full-text screening phase of the study, if they appeared to meet the inclusion criteria as outlined below. The fundamental inclusion criteria of an included journal article was that it examined, reviewed or commented on specific health workforce planning models, tools or processes related to the defined countries for the study. Documents were excluded during the full-text screening phase if on closer reading they did not adequately fulfil the inclusion criteria. Reasons for additional exclusions included articles returned that were published in a language other than English, or articles returned with an incorrect approach to the study topic – for example, a discussion on proposed methods of workforce planning as opposed to a review of existing workforce planning tools.

The search strategy for the whole evidence review is mapped out as a flowchart in Appendix B.

Table 2 Country web repositories for workforce planning texts and publications

Country	Website title	Website address
Australia	Health Workforce Australia (archived since August 2014)	http://www.health.gov.au/workforce [formerly] www.hwa.gov.au
Australia	Department of Health	www.health.gov.au
The Netherlands	Netherlands Institute for Health Services Research	https://www.nivel.nl/nl/publicaties www.nivel.nl/en/manpower-planning
The Netherlands	The Capacity Body	www.capaciteitsorgaan.nl/publicatie-categorie/capaciteitsplan-hoofdrapporten/
New Zealand	Health Workforce New Zealand	healthworkforce.health.govt.nz/
New Zealand	New Zealand Ministry of Health	www.health.govt.nz/
Scotland	NHS Scotland Workforce Planning – Community Site	www.knowledge.scot.nhs.uk/workforceplanning.aspx
Scotland	Scottish Government Health and Social Care Directorates	www.sehd.scot.nhs.uk
Scotland	Everyone Matters: 2020 Workforce Vision – workforce policy for NHS Scotland	www.workforcevision.scot.nhs.uk/
Scotland	NHS Scotland Workforce Planning – AHP Calculators	www.ahpcalculators.scot.nhs.uk/home.aspx?referer=AAS&un=nousername
Scotland and Wales	Six Steps Methodology to Integrated Workforce Planning	www.skillsforhealth.org.uk/resources/guidance-documents/120-six-steps-methodology-to-integrated-workforce-planning
Wales	Workforce, Education and Development Services (WEDS)	www.weds.wales.nhs.uk/home
Wales	WEDS – Key Workforce Strategies	www.weds.wales.nhs.uk/key-workforce-strategies
Wales	NHS Wales – Planning Guidance	gov.wales/topics/health/nhswales/organisations/planning/guidance/?lang=en
Wales	NHS Wales – Prudent Healthcare	gov.wales/topics/health/nhswales/prudent-healthcare/?lang=en www.prudenthealthcare.org.uk/principles/
Wales	Health in Wales – Planning Health Services	www.wales.nhs.uk/ourservices/contactus/healthservicesnearyou/planninghealthservices

3.2 Inclusion criteria

A quality approach for inclusion criteria was not required for the country-specific workforce planning documents, as these were documented policy, strategy or procedure rather than research or evaluations. With regard to screening criteria for these documents, if a retrieved document was an official report, policy or working document on health workforce planning strategies, tools, models,

and processes for any of the defined countries – Australia, the Netherlands, New Zealand, Scotland and Wales – then it was appropriate to be included for review.

A different approach was required to screen journal articles which were found in the database searches. Appropriate journal articles sought from the searches were articles reporting on reviews or evaluations of workforce planning approaches that focused on models and/or tools used. In this instance, a quality appraisal-based inclusion criteria tool based on the McMaster University health appraisal tool[12] was employed. The inclusion criteria questions were as follows:

1. Is this a methodologically appropriate review article?
2. Is the paper relevant to reviewing or discussing tools, models, processes of health workforce planning?
3. Is the effectiveness of workforce planning tools, systems or models the subject of the review?
4. If not a review, does the paper effectively describe workforce planning tools and/or models?
5. Is evidence on outcomes of workforce planning developments included?

Articles that answered three or more of these inclusion criteria questions were included in the study; the score for each paper is documented in Table 9 in Appendix C. Nevertheless, there was a dearth of suitable articles that reviewed or evaluated existing workforce planning tools and/or models; thus, only 16 journal articles transpired as relevant for the study following the screening. The majority of these articles predominantly described or summarised models and approaches rather than interrogating their usefulness.

The methodological process and search approach for the whole evidence review is mapped out in a flowchart in Appendix B.

3.3 Expanded review questions

The four overarching review questions and sub questions leading the review, listed in Section 1.1, were expanded into further sub questions which drove both the systematic literature review and formed the basis for the expert interview questions. See Appendix A for a list of the comprehensive question schedule used to extract data from suitable papers and to undertake the expert interviews.

3.4 Expert interviews

Expert interviews were conducted with relevant experts from four of the five countries examined for this evidence review. In this instance, the experts were key stakeholders in the workforce planning process from both a theoretical and practical perspective. Examining the workforce planning process in more depth through interviews is bolstered by 'the expert's experiential and professional knowledge, that is, the relevant technical knowledge and assessment of the field'.[13] The purpose of the expert interviews was to complement[14] and expand on findings from the analysis of texts, and to delve deeper into the workforce planning process as it has evolved in each of the countries reviewed.

The Health Research Board identified and made contact with the appropriate workforce planning departments/institutions and made the necessary introductions with regard to the purposes of the

project via email. The reviewers and expert interviewees negotiated and agreed times and dates through email conversations. The interviews took place over the phone/PC, using a teleconferencing software tool and followed the schedule of questions as presented in Appendix A. The software tool used allowed the conversations to be recorded. Following the expert interviews, the reviewers typed up notes taken during the interviews, then listened back to the audio recording, and transcribed responses to the questions. Data analysis for the expert interviews first involved reading and rereading the transcripts with the research questions in mind. The interview responses were coded to the corresponding research questions, where appropriate (in some cases a question was not directly answered). Similarly, data extracted from the documents were coded to the corresponding research question, where appropriate. The purpose of the expert interviews was largely to allow those with expert knowledge to tell the story of workforce planning in their country. The data gleaned from the interviews were woven together with the data extracted from the documents used in the review and together they formed a narrative that tells the story of workforce planning in each country.

The expert interviews proved to be vital to the overall review, as not all of the five countries reviewed had texts available that clearly and/or thoroughly explicated the health workforce planning process. Therefore, the interviews, in some cases, allowed the reviewers to get a clear impression of how the workforce planning processes and models operated in the country. They allowed the reviewers to seek clarifications from the interviewees where the published literature was unclear or presented conflicting information. Where the analysis of texts had given a clearer picture, the interviews permitted a focused conversation on workforce planning models and processes, and to hone in on areas where there may have been confusion in the published literature. Fundamentally, the expert interviews were a welcome complement to the analysis of texts and allowed for a relatively comprehensive story – of workforce planning systems in four of the five countries – to be told.

3.5 Limitations of this review

This review relied on a relatively small corpus of published documents and expert interviews from five countries and expert interviews from four of the five countries. The countries reviewed were chosen by the Department of Health and the Health Research Board (HRB) following a preliminary scoping exercise which found that the countries selected were currently using integrated (multidisciplinary) workforce planning tools, models or processes that are relevant to investigate within the wider context of progressing workforce planning in Ireland. Identifying the correct repositories which housed the country-specific workforce planning publications was not always clear, so some repetitive searching was necessary until the correct repository was sourced. The availability of journal articles that reviewed or evaluated existing workforce planning tools and/or models in the five countries was limited. Unfortunately, due to the demanding schedules of the proposed expert interviewees, the authors only secured interviews with four of the five countries within the timeframe for the review. This means that for one country, the Netherlands, the story of its workforce planning tools, models, and processes could only be told via data extracted from the published documents. However, the published documents sourced pertaining to the Netherlands did provide relatively comprehensive information.

4 Workforce planning: models, tools, and processes

In Section 4.1, some general information on international approaches to workforce planning and modelling is discussed. In Section 4.2, findings: models, tools, and processes, the data gathered in the review answers the overarching questions (as presented in Section 1.1) including, where appropriate, the more specific expanded questions as listed in Appendix A.

The presentation of findings considers each country separately, with a preamble that discusses the country **approach** to workforce planning, where appropriate. This is followed by common headings which answer the overarching questions leading the review. The common headings are listed as:

- Workforce planning model (incorporating assumptions included in the operational model where applicable)
- Workforce planning tools (incorporating information on timeframe for planning cycles)
- Data sources and collection
- Team composition
- Resources for maintaining the model
- Limitations of the model
- Benefits
- Challenges

These headings are refined further at the end of each country section, where a synoptic blue box presents the main common digestible points of each country's health workforce planning system. The headings used are:

- Approach
- Tools
- Timeframe
- Data
- Team composition
- Resources
- Benefits
- Challenges

The answer to the overarching Question 3 is answered indirectly as a by-product of answering the other questions: Who feeds into and uses the national operational health workforce planning models, tools and processes?

4.1 International approaches to workforce planning and modelling

The tools used for workforce planning purposes are typically advanced spreadsheets, mostly using Microsoft Excel, with locked-in formulas that automatically generate workforce trees and predefined reports, such as skill mix analysers, scenario generators, and so on, based on the data inputted. Each country's forecasting model includes specific tools for supply and demand projections.

Supply side tools are simulation based to measure current stock and simulate changes in inflow and outflow. Demand side tools generally 'take into account the population structure and estimates future changes of the population size',[2] while applying survey-based utilisation rate forecasts over a given time horizon of typically three to five years. The forecasting modelling tools are predominantly statistical methods; those used across health workforce planning are: classical time series analysis and multiple regression analysis. Malgieri *et al.*[2] identify classical time series analysis as the most commonly used quantitative method. Most forecasting models move forward by testing different scenarios to ascertain different future situations. Typically this involves having 'a baseline scenario and one or more alternative scenarios'.[2] The scenarios are typically based on certain assumptions and estimate the likely effects of one or more factors (for example, changing the national training capacity for specialities, or assessing the consequences of reforms on government expenditure and tax increases) on the future health workforce.

The variables included in models tend to be relatively similar from country to country, and the commonly required methodologies and data are well-illustrated across Tables 3 and 4.[15] One caveat, however, is emphasised by Ono *et al.;* [1] their review found that 25 out of 26 models from 18 countries did not 'include wages (or other modes of provider payment) as a variable affecting the future supply and demand for health workers'.[1] They draw attention to the fact that shortages/surpluses in the health workforce can be somewhat alleviated by adjusting wages accordingly, while acknowledging that such a key point is rarely taken into account in the models they reviewed. Ono *et al.*[1] also expressed concern that surprisingly few of the models reviewed attempted to link health workforce projections with health expenditure projection scenarios when such links 'can lead to very different conclusions about the future demand for health workers and any possible future shortages or surpluses'.[1]

A relatively comprehensive review of 60 years of documented research into health workforce planning (for doctors and nurses) was undertaken by Lopes *et al.*[15] Table 3 is a reproduction of their table which summarises the main conceptual methodologies used for different workforce planning approaches. It also describes 'the necessary assumptions for using each of the approaches, along with their advantages, limitations, how these limitations are overcome, requirements and the countries in which their usage was documented'.[15]

Table 3 Main conceptual methodologies used for different workforce planning approaches

Methodology	Description	Assumptions	Advantages	Limitations	Overcoming limitations	Requirements	Documented usage
Supply – training	Projects the availability of healthcare professionals based on the current stock of clinicians, the training process (entries and dropouts), migration flows, attritions and retirement rates	Demand for medical services is assumed to remain constant and the projections are used to reduce the supply gap	Predictions for the future supply can be obtained in a fairly simple and immediate way	Demand for medical services is assumed to remain constant, which may not be true. No critical assessment of the adequacy of current service levels	Incorporate a model of demand: economic or needs based (or both). Evaluate current level of service through waiting lists, overtime hours, foreign workers, etc.	Accurate and up-to-date accounting of the current stock of physicians and nurses, migration rates, entry and dropout rates, and expected retirees. Service usage levels from the healthcare sector	Australia Belgium Canada Chile Denmark Finland France Germany Ireland Israel Japan South Korea Norway Switzerland The Netherlands United Kingdom USA
Supply – productivity	Reorganise services and/or economic incentives to promote higher productivity. Work harder or work smarter	Physicians and nurses act as rational agents and react to economic incentives like wage increases	Does not require a change in the quantity of human resources. Can be implemented immediately	Productivity improvements may not be enough to accommodate large gaps in the supply of professionals	Do not preclude from evaluating the number of professionals necessary given different productivity levels	Operational indicators such as the number of patients served with a given number of FTEs (or headcounts)	Australia Canada Japan Korea Netherlands Norway Switzerland United Kingdom USA
Supply – skill mix	Delegate certain tasks to other health professionals. Substitution can be horizontal (between medical professions) or vertical (between physicians and nurses)	Professionals can assume new roles and perform new tasks.	Does not require a change in the quantity of human resources. Can be implemented immediately[1]	Enforcing such changes can be a political challenge. Does not solve large gaps in the supply	Providing success stories to involved stakeholders, health authorities and medical associations	Education schools that can provide advanced education to the existing workforce	The Netherlands United Kingdom
Supply – worker-to-population ratios	Specifies desirable worker-to-population ratios based on direct comparison with another region of country	Regions and/or countries can be directly compared	Extremely easy to understand and apply. Useful for providing baseline comparisons	Does not take into account the intrinsic differences between regions and countries, the productivity, and skill mix of the available workforce	Does not take into account the intrinsic differences between regions and countries, the productivity, and skill mix of the available workforce	Records of the current workforce to population ratios	Chile France Ireland Israel Switzerland United Kingdom

[1] This point should not be taken as correct, as skill mix would require training before certain tasks can be delegated to other professions, at the very least, and training costs money. Thus, the logic here is faulty and immediate implementation is unrealistic.

Methodology	Description	Assumptions	Advantages	Limitations	Overcoming limitations	Requirements	Documented usage
Demand – economic	Estimates future requirements by projecting the effect of demographic and socioeconomic factors on the current level of service	Current level of service is adequate. Skill mix and distribution of health service is appropriate. Demographic profile of the population and its effect on healthcare demand can be accurately forecasted	Conceptually easy to understand and to apply. Allows decoupling of the various components of demand and their influence on the overall aggregate demand	Tends to produce estimates of healthcare human resources (HHR) demand that exceed practical limits. No critical assessment of the adequacy of current service levels. Ignores the real demand, focusing instead on the effective demand	Take financial constraints into consideration. Evaluate current level of service through waiting lists, overtime hours, foreign workers, etc. Include a needs-based evaluation	Accurate and long-term demographic estimates. Service-usage levels from the healthcare sector. Macroeconomic indicators and statistical data crossing income and usage	Australia Belgium Canada Denmark Finland Germany Japan Norway South Korea Switzerland The Netherlands USA
Demand – needs	Considers the effect of epidemiology on the demand for healthcare services. Projects age- and gender-specific needs based on morbidity epidemiological trends	All healthcare needs can and should be met. Resources are used in accordance with needs	Allows for a fine-grained analysis of the requirements of each medical speciality. Is independent of the current service utilisation ratios. Easy to understand	Absence of economic/ efficiency considerations may render the projections unattainable. Dependent on epidemiological projections which may not be obvious. Does not consider the current level of provision nor the capacity of the country to deliver healthcare	Consider an upper limit for a practical result. Consider projections of the most common health patterns. Incorporate economic considerations in the model	Demographic estimates that are accurate. Service-usage levels from the healthcare sector	Belgium Canada Germany United Kingdom
Demand – service targets	Defines normative targets for the production of healthcare services, which are then converted to HHR requirements	Assumes that established service targets are achievable in terms of financial and physical capital resources	Easy to define, interpret and understand. Facilitates cost estimation. Requires modest data and planning capabilities	May originate unrealistic assumptions. Ignores financial and other active constraints	Incorporate economic considerations in the model	Current level of service	

Source: Lopes *et al*.[15]

The information presented in Table 3[15] is useful to ascertain the different types of assumptions which correspond to the different methodologies that can be used. It also helps to indicate the data/data sources needed for different approaches to workforce planning modelling. Table 4 is another reproduction from the Lopes paper[15]; it is worth reproducing here as it summarises 'the most important indicators for conducting a proper forecast',[15] as gleaned from their review.

Table 4 Data requirements for making use of each of the different documented methodologies

Methodology	Indicators	Data requirements
Supply	**Stock of licensed providers** Baseline stock, age/sex distribution, growth projections **Annual additions to licensed stocks** Graduates, in-migration (foreign-trained, immigrants, on temporary work permits), returned to profession **Education/training programmes** Number of programmes and students enrolled, attrition rates, years to complete programme, number of graduates, costs **Annual attritions to licensed stocks** Retirements, mortality, career changes, emigration, abroad	High
Productivity	**Labour market** Occupational participation rates, occupational employment rates, employment projections, vacancy rates, turnover rates, wage rates, productivity growth, cyclical factors, alternative career options **Employment status** Full-time, part-time, casual, full-time equivalent (FTE), average hours worked, direct patient care hours, no longer practising, not licensed in jurisdiction	High
Skill mix	**Government policy variables** HHR education funding, alternative delivery modes, licensing regulations, professional roles/deployment, recruitment/retention strategies, immigration policy, remuneration	High

Methodology	Indicators	Data requirements
	rates/types, HHR capacity building	
Worker-to-population ratios	**Health labour workforce** Number of active and employed physicians and nurses	Low
Economic	**Population demographics** Total population, age/sex distribution, births/deaths, population projections **Socioeconomic variables** Disposable income, GDP growth projections, ethnic factors	High
Needs	**Epidemiology** Incidence and prevalence rates, hospital discharges, health patterns of the population	High
Service targets	**Utilisation patterns** Number of occupied beds, number of inpatients and outpatients, number of surgeries/screenings/consultations performed, etc.	Low to high

Source: Lopes *et al*.[15]

Most models attempt to strive for some semblance of an integrated approach to their workforce planning methods and models. This integrated approach 'refers to a method that incorporates in its process projections of the workforce supply and the impact of microeconomic and organizational changes in productivity and in the skill mix, of the evolution of demand for health-care services and also of the evolution of health diseases and its potential impact on the health system'.[15] The Ono *et al*. review emphasised the importance of moving from a 'uni-professional to multi-professional'[1] approach to health workforce planning, particularly in the primary care sector, where the authors say the roles and responsibilities of different healthcare practitioners is evolving in response to needs and demand.

4.2 Findings: models, tools, and processes

4.2.1 Australia

In 2008, the Council of Australian Governments (COAG) agreed to the National Partnership Agreement on Hospital and Health Workforce Reform, and established Health Workforce Australia (HWA) as the national agency to oversee and progress health workforce reform.[16] One of the key briefs of the HWA remit was to 'develop solutions that integrate workforce planning, policy and reform with the complementary reforms to education and training'.[16] HWA remained in charge of workforce planning in Australia from 2009 to August 2014. The federal budget of 2014 led to a decision by the government to close HWA, and existing grants and programmes were transferred to the Department of Health.[17] Workforce planning still takes place within the Health Workforce Division of the Australian Government Department of Health.[18] The modelling work began circa 2010 as a foundation for policy development and culminated in the first reports on health workforce planning published in 2012. The workforce planning project, HW2025, estimated future workforce supply, at national level in Australia, using a dynamic stock-and-flow model.[19]

Workforce planning model

The workforce planning project began with the medical workforce as they are the most complex stakeholder group due to their number of specialities, hierarchy and speciality training roles.[18] The first component of the workforce planning modelling was to work out supply and demand data.[18] Initial data for modelling use came from a national registration database, the Australian Institute of Health and Welfare (AIHW) labour force survey, where information, such as hours, postcodes where staff are working, speciality groups (68 subspecialties in total), and so on is filled out by all staff.[16, 18] This information will in future come from the Australian Health Practitioner Regulation Agency (AHPRA).[16] The four key data inputs into the HW2025 dynamic stock-and-flow model were:

1. Workforce stock (in five-year age and gender cohorts);
2. Domestic new entrants;
3. Migration (permanent and temporary); and
4. Net exits, which included all permanent and temporary flows out of the workforce.[19]

There is one example of the Medical Board of Australia workforce survey (registration renewal) form available online.[20] The gatekeepers of the workforce planning process have a bespoke modelling tool which is available free of charge for the professions to use.[18]

Workforce planning tools – scenario modelling

Australia uses scenario modelling to test the effect of prospective policy decisions on future workforce supply and demand.[19] Scenario modelling 'allows alternative "futures" to be modelled (and measured) by varying input parameters'.[16] There are different assumptions for both supply and demand to pertain to the different types of scenarios used. The method used presents a comparison scenario, reflecting current trends in supply and expressed demand, assuming that they continue into the future, and comparing same with an alternative range of scenarios.[19] The comparison scenario is a technical construct used for modelling purposes. It is generated to evaluate the effects of each of the impact planning scenarios on the medical, nursing and midwifery workforces.[16] Health workforce planning is essentially an iterative and ongoing project; time and experience gained will

allow for both the model and the data used to become further refined. The scenarios modelled provide an estimate of likely outcomes given a particular set of conditions.

The scenarios[16] used by Australia are:

- Innovation and reform:
  - Productivity gain scenarios
  - Low demand scenarios
  - Workforce retention scenarios (nurses only)
- Immigration scenarios:
  - Medium self-sufficiency
  - High self-sufficiency
- Other impact scenarios:
  - High demand scenarios
  - Scenarios starting from a position of undersupply
  - Scenarios capping doctors' working hours – doctors only
  - Scenarios reflecting graduate growth – registered nurses only
- Training scenarios

Innovation and reform scenarios encompass 'changes to scope of practice, increased use of [healthcare] assistants, the introduction of new workforces or workforce models and application of technology such as eHealth and Telehealth which may influence the size and characteristics of the health workforce'.[16] The productivity gain scenarios present results of the impact on workforce supply and demand of a 5% productivity gain over the projection period.[16] Low demand scenarios model the impact of changes to the underlying demand for doctors and nurses that may stem from the effects of health reform measures or other systemic changes that would lower the use of health services by the general population, or a reduction in the demand for particular categories of health worker.[16] Workforce retention nurses only scenarios examine the effect of exit rates from previous years across the entire projection period, and provide some insight into the effects of retention strategies on meeting the demand for nurses.[19]

The immigration scenarios are concerned with better management of migration pathways for international healthcare professionals, which can occur in combination with innovation and reform, and training.[16] Other impact scenarios include changes to impacting factors 'such as changes in technology, new skills, roles or service delivery models which may influence the supply of, or demand for, the health workforce'.[16] Immigration scenarios measure two scenarios that are steps on the way to Australian self-sufficiency without large migrant workforces filling the gaps.[16] The first scenario reflects a 50% reduction in international migration (medium self-sufficiency) and the second scenario reflects a 95% reduction in international migration (high self-sufficiency).[16]

There are a number of other impact scenarios. The high demand scenario models the impact of an increase to underlying demand for doctors and nurses that may stem from changed community expectations; for example, effects of ageing, changed work practices, and so on.[16] The starting from a position of undersupply scenario examines the 'impact on the projections of an existing workforce shortage (of 5%) in the base year. This was modelled by assuming demand in the initial year of the projections was 5% higher than the current level'.[16] The capping doctors' working hours scenario 'caps the total number of hours worked by the total medical workforce at fifty hours per week'.[16]

The reflecting graduate growth scenario is conducted for registered nurses only. It models growth in registered nursing graduates over the projection period.[16]

Training scenarios use the 'projected workforce gap calculated in the supply and demand scenario projections as a basis for estimating the number of medical and nursing graduates required to establish a balance between projected supply and demand in a given year under the scenarios'.[16]

Workforce planning tools – modelling process

The modelling process operates by the data modellers taking all the supply and demand data as provided through data sources and analysing it separately.[18] The expert interviewees indicated that they typically have very good activity data from the medical workforce; Medicare data from private billings; and data from hospital diagnostic-related groupings. Forecasting is done by analysing all the relevant data for the past five years, then a forecasting model is initiated; one public, one private.[18] Reports on the modelling/forecasting outcomes are then generated every two to three years.[18]

In technical modelling terms, the hours relative to demand for both public and private services are allocated; the bespoke model works on hours required.[18] This information is used to ascertain how many full-time equivalent workers (headcounts) exist for necessary hours worked. Relevant professionals and stakeholders (including training colleges) are then brought in to discuss how the forecasts look and how the forecasted numbers will work within their professions.[18] This enables the stakeholders to give feedback on any perceived issues.[18] The expert interviewees emphasised the importance of including the professions throughout the process 'bringing them along with you' to ensure they 'buy in' to the workforce planning process. Enabling discourse between planners and professions affords the professions the opportunity to agree on changes, those needed in-house and those needed to move things forward.[18]

A gradual approach to this workforce planning process emerged; workshops were held with the planners and healthcare professions where supply only was discussed. Nevertheless, participants were informed that the forecast would involve both supply and demand.[18] This allowed for an opportunity to sift through the supply data allowing for a bigger picture to emerge.[18] Following this workshop, a methodology consultation was held for both supply and demand, which resulted in the creation of a technical document.[18] The professions were thus able to give feedback on the methodology, which was then agreed, signed off on and accepted.[18] The National Medical Training Advisory Network (NMTAN) helps to approve the methodology for each speciality, considering each one separately as there are obvious differences.[18] The NMTAN has approximately 22 members offering broad representation across the medical profession; membership includes some colleges, the Australian Medical Association, and indigenous and rural doctors.[18] Following the approval of the methodology for each medical speciality, the data can then be collated and inputted into the model.[18]

Data sources and collection

The first iteration of workforce planning in the HW2025 reports used national datasets which had limited availability, predominantly labour force surveys.[21] These labour force surveys collect data on demographics, visa and residency status, qualifications, work characteristics, and career characteristics. Table 5, reproduced from McCarty *et al.*,[21] shows the additional data sources for the different professions (doctors, nurses, midwives) as well as the labour force survey. Future

workforce plans will improve their data collection by identifying better sources and using 'labour force data from the national registration and accreditation scheme, administered by the Australian Health Practitioner Regulation Agency'.[21] A National Health Workforce Statistical Resource, incorporating the National Health Workforce Dataset, has been developed, which provides 'a repository of data and integrated tools to assist in health workforce planning by all levels of government and other organisations'.[21]

Team composition

Modelling is currently undertaken on a strictly profession-by-profession and speciality-by-speciality basis; in some obvious interlinked specialities – such as obstetrics and gynaecology, anaesthesiology, and midwifery – separate studies are still undertaken but their interconnectedness is recognised.[18] An objective of the National Health Workforce Innovation and Reform Strategic Framework for Action (2011–2015) is to 'develop an adaptable health workforce equipped with the requisite competencies and support that provides team-based and collaborative models of care'.[16] The expert interviewees also drew attention to the report of the Primary Health Care Advisory Group (PHCAG), which looked at models of care for chronic disease where there is complex and multiple high usage of health services. The PHCAG predominantly looked at GP care but also included nursing and allied healthcare, and was concerned with team-based models of care.[18]

Table 5 Data sources for workforce planning professions (Australia)

Profession	Data source
Doctors	Workforce headcount and demographics – AIHW Medical Labour Force Survey Graduates – Medical Deans Australia and New Zealand Fellows – Medical colleges Immigration – Department of Immigration and Citizenship[2] Demand – Hospital separation statistics; Medicare utilisation statistics; Australian and New Zealand Intensive Care Society
Nurses	Workforce headcount and demographics – AIHW Nursing and Midwifery Labour Force Survey Graduates – Department of Employment, Education and Training[3] (for registered nurses) and National Centre for Vocational Education Research (for enrolled nurses) Immigration – Department of Immigration and Citizenship Demand – Hospital separation statistics; Community care places; Residential high-care places; Australian and New Zealand Intensive Care Society
Midwives	Workforce headcount and demographics – AIHW Nursing and Midwifery Labour Force Survey Graduates – Department of Employment, Education and Training Immigration – Department of Immigration and Citizenship Demand – Births, Summary Statistics, Births Australia (Australian Bureau of Statistics, Cat. No. 3301.0); Australian Bureau of Statistics, Australian population projections series B

Source: McCarthy *et al*.[21]

[2] Department of Immigration and Border Protection
[3] Department of Education and Training

Resources for maintaining the model

The planners comprise a team of approximately 11 to 15 people based across Melbourne and Canberra.[18] They have some in-house developed bespoke tools that are being updated; they also use Microsoft Excel and other data applications.[18] Their enterprise data warehouse (EDW) holds as much data as they can possibly collect from across the country.[18] When the data (surveys) come in, they undergo an automated process that cleans and validates the data, which is then uploaded to a specific online data tool.[18] The expert interviewees identified the importance of having passionate data analysts/developers to develop the in-house tools and models on an ongoing basis, which saves time and money in the long term.

Limitations of the model

The model is developed by the Australian Government (Commonwealth) and is concerned with the production of a national forecast, as it can only affect national policy.[22, 23] States and territories across Australia do their own workforce planning; however, their data are used for the national forecasting also since they are, at ground level, the health workforce's employers.[18] Therefore, there is 'a regional distributional analysis of national health workforce'.[18]

While consultation is seen as important within Australian workforce planning, Australian planners are less enthusiastic about prioritising a qualitative approach, such as that used in Scotland or New Zealand.[18] Australian planners foremost believe that a mathematical methodology is necessary in order to come up with the right numbers; in order to make effective workforce planning there is a need to begin with hard evidence.[18] While expert interviewees acknowledge that qualitative approaches play a part, they still believe that numbers are more important.

On the technical side, the information technology (IT) platform has some limitations, and the Department of Health is considering options to upgrade the systems to support its work.[18] In addition, the Department is developing IT solutions to support the sharing of data with external stakeholders.[18]

The data collection and consultation process is a sensitive procedure; there can be negative connotations perceived by the varying specialities that can result in a reluctance to share data or engage with the methodology.[18] For example, funding for medical colleges will now be more closely tied to results emerging from the modelling work.[18] The modelling work will also flag up oversupply more explicitly.[18] Significantly, the quality of the data varies as workforce surveys are self-reported.[16, 18, 22, 23]

Changes in or to the model with regard to technical advancements or other changes can be recorded in so far as demand can be changed within the operational models.[18] Nevertheless, there are nuanced issues that exist within the model with regard to how different specialities within a profession are grouped together.[18] An example is in nursing; all nurses in Australia are trained as general nurses and the foremost criteria to work in specialities is to be a registered or enrolled nurse.[18] Some specific specialisms require additional qualifications, such as emergency and critical or intensive care, aged care, health visiting, and mental health.[18] In addition, the flexibility of nurses with regard to specialisms can make specific forecasting and modelling difficult.[18]

Benefits

The purpose of the NMTAN is to facilitate the generation of policy advice to help improve the coordination of medical training in order to meet Australia's workforce need.[19] Consultation takes place with NMTAN, which helps to guide priorities around the next group of specialities for modelling.[18] The nursing and midwifery network will also advise on methodology and nursing speciality-appropriate elements to cover.[18] There are also other forums that give voice to relevant stakeholders throughout the planning process, such as the Committee of Presidents of Medical Colleges; they have a strong interest in the data side and are working on developing the data collection aspect with the modellers.[18] Furthermore, there are ongoing discussions and consultations, providing the ability to keep in touch with the workforce planners and share information when necessary.[18] The key value of the consultations is the opportunity they afford to highlight issues in training or in various sectors or in the system.[18]

Colleges have started to make changes in response to the first sector forecasts, which has brought improvements when planners revisited for a subsequent forecasting exercise.[18] The example given by the expert interviewees was psychiatrists. Colleges had been able to improve on training availability in an effort to try to reduce the undersupply in psychiatrists, and the supply was increased, though some shortages remain.[18] The National Registration Scheme reputedly provides good data on 14 medical specialities, which is beneficial to students as it gives a reasonably clear picture of job availability into the future and thus helps with decisions on training with regard to job prospects at the end of it.[18]

Challenges

Workforce planning has not significantly affected cost reductions, yet efforts to keep working hours at an acceptable level results in higher costs as more personnel evidently cost more. The health workforce itself is the largest cost in the health sector. Some ways to mitigate against high costs have involved the shifting of responsibilities from higher paid to lower paid staff, for example, from doctors to nurses.

AUSTRALIA

Approach – To develop solutions integrating workforce planning, policy and reform with complementary reforms to education and training. The workforce planning project HW2025 estimated future workforce supply using a dynamic stock-and-flow model.

Tools – The workforce planners use a bespoke workforce planning tool and predominantly advanced Microsoft Excel models. The key tool is scenario modelling to test the effect of likely policy decisions on future workforce supply and demand.

Timeframe – The modelling/forecasting outcomes are generated every two to three years and presented in formal reports.

Data – Data are predominantly collected via labour force surveys; additional data come from colleges and graduate information, immigration data, hospital statistics, etc.

Team composition – Modelling is currently undertaken on a strictly speciality-to-speciality basis; interconnectivity is acknowledged in some obvious interlinked specialities. Team-based models of care are being considered. The workforce planners rely mainly on quantitative data, with less of a focus on qualitative data.

Resources – Resources are focused on a team of planners (11 to 15 people), a number of whom are data analysts or IT developers. The planners store data in an enterprise data warehouse (EDW).

Benefits – Consultation with the different specialities supports the development of appropriate methodologies for modelling work. Other forums also exist which give voice to relevant stakeholders throughout the planning process and help to highlight issues.

Challenges – Data collection and consultation is a sensitive process, and data quality varies. Technical issues can impinge on the data and modelling work; there is a need to improve the IT systems to support current work and improve the data-sharing capabilities.

4.2.2 The Netherlands

Workforce planning model

The role of the Advisory Committee on Medical Manpower Planning (ACMMP), which oversees health workforce planning in the Netherlands, is to prepare estimates for the training capacity of medical and dental training, based on the expected need for care, in order to adequately control health coverage and university budget management.[24] In the Netherlands, they use a forecasting simulation model[25] which looks at both demand and supply of the medical workforce. It allows for the development and testing of different scenarios using a 'different hypothesis and it calculates the needed influx into specialist training (a specified range is calculated for each specialism)'.[2] The model has been described as encompassing similar techniques as used for population projections and is described by Van Greuningen *et al.* as a cohort component model.[25] Four factors – demographic, epidemiological, sociocultural developments, and changing organisation of work – are typically modelled to ascertain the yearly proportional change in demand for medical specialists.[26] The main objectives of the model used in the Netherlands are:

- To assess any existing gaps between the supply and demand of different categories of doctors; and
- To estimate the requisite yearly inflow into medical education institutions and training programmes based on the forecasted expectation of gaps between supply and demand over a 10–20-year period.[1]

The Netherlands' workforce planning model uses a macro approach which is based on a composite of empirical data and expert opinion. The ACMMP evaluates how each factor influences supply and demand for medical care currently and forecasted into the future:[1, 24]

The ACMMP board is comprised of professional representatives from the medical professions, medical schools, health insurers, and training hospitals. The board advises the Ministry of Health on the yearly inflow of medical and dental graduates in twenty-six different types of medical and dental specialty training, and also advises the Ministry of Education on the related national numerus clausus for entry to medical and dental school.[27]

From a supply-side perspective, the model carefully assesses '*the inflow in various medical specialities based on past trends in graduation rates from medical education programmes and entry into the labour market and the projected outflow based on evidence about the length of physicians' career and retirement patterns*'.[1] From a demand-side perspective, the model 'includes several factors to estimate any current unmet demand/need and future changes over the projection period: demography, epidemiology, socio-cultural factors and current unmet needs'.[1] The ACMMP ascertains the likely influence of each factor involved in demand for medical specialist services through a combination of empirical data and expert opinion;[1] the model also includes undertaking consultation with the medical specialist associations in expert focus group meetings.[27]

The professional groups that are considered for the model are: physicians (doctors), dentists, dental hygienists, clinical pharmacologists, clinical chemists and clinical physics. That further breaks down into 35 different medical specialists, eight recognised semi-specialist occupations in the medical field, dentists, dental hygienists, and three technical professions in hospital (clinical pharmacologists,

clinical chemists and clinical physics).[1] Each profession plans on a 2–3-year cycle to forecast for a 10–20-year period,[2] while data are updated annually.

Workforce planning tools – scenario modelling

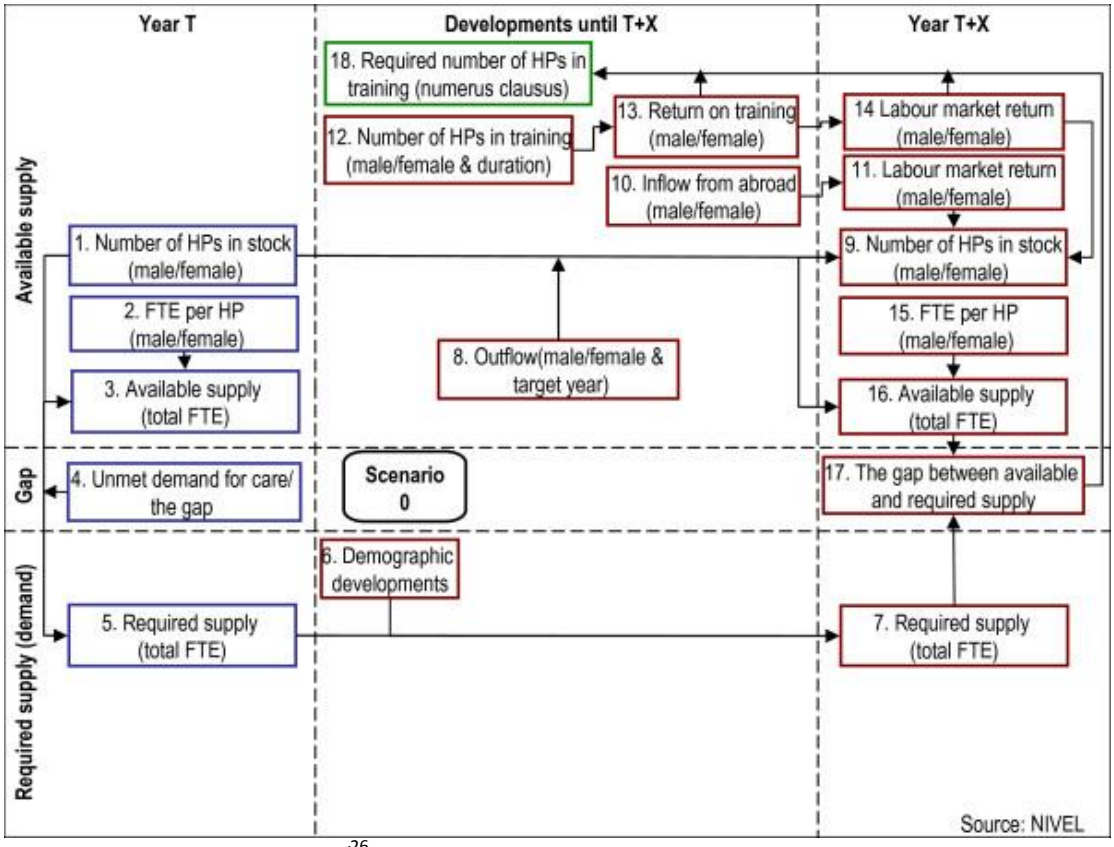
Malgieri *et al.*[2] describe the forecasting process in the Netherlands:

[The process starts out with] *estimating the present demand, expressed in FTE supply, by correcting the present demand with unmet demand or abundance of demand. Then, they make a projection of the demand eighteen years later, by taking into account demographic, epidemiological, and socio-cultural developments mixed with policies. Based hereon, they develop different scenarios, using different estimates for efficiency, horizontal and vertical substitution, professional developments, and working hours changes. For each of the scenarios, they calculate the needed influx into specialist training, given the expected retirement of the present supply, the supply in training at the moment, the immigration of specialists, the feminization, and the yield of the training. The experts decide on which of the scenarios are the most likely. This results in a specified range for the needed influx in medical training for each specialism. This range is presented to government with unanimous support from health insurance companies, training institutes, and professionals.*[2]

As previously stated, the Dutch model is described as a cohort component model, where the components are inflow to or outflow from the active workforce. The model has three different stages:

1. The launch year
2. Present to future situation
3. The target year

The launch year describes the latest year of data that is used as a basis for making the projections from, while the target year is the projection year; the present to future situation looks at the developments in between.[25] The data and assumptions used in the model are typically 'based on five-year averages from preceding periods (zero to five years, zero to ten years and zero to fifteen years back), except for the inflow in training'.[25] The main components included in the model when workforce planning began[26] are represented in Figure 3 below.



Source: Van Greuningen *et al*[26]

Figure 3 The basic version of the workforce planning model (the Netherlands)

There are four main steps involved in the Dutch workforce planning model, which are:

1. Calculating the current situation;
2. Developments between baseline year and target year;
3. Calculating the future situation;
4. Calculating the gap.

The elements included as significant informing components for the workforce planning model[26] are displayed in Table 6 below. The original baseline model had additional elements included in it in 2001 and 2004, but were modified and thus some elements were subsequently added as three different scenarios. The first scenario added epidemiological and sociocultural developments and the influences of same to the model, as well as technical, efficiency, and developments regarding horizontal substitution within the medical profession.[26] The second scenario added the change of working hours per full-time equivalent (FTE) to the projection of the future demand; the element accounts for healthcare professionals now tending to work fewer hours. The third scenario was added to the simulation model in 2006 and accounts for developments regarding vertical substitution – the shift of activities between health professionals of different professional/educational levels, for example, shifts between GPs and nurse practitioners.[26]

In order to understand the impact that certain assumptions would have on the required capacity of the health workforce, the ACMMP has a standard procedure of calculating nine possible scenarios

per professional group. The assumptions are adjustable in the model.[2] By way of example, migration inflow is a variable considered in the Dutch forecasting model; a project to determine outflow from the Netherlands to other European countries therefore began in 2014. This project is based on monitoring existing data from 2000 onwards and will contribute to greater knowledge about both the outflow and inflow. Another example is how both vertical and horizontal integration are accounted for in the forecasting model. The model therefore develops:

- Scenarios that take into account vertical substitution from medical professions to nurses; and
- Scenarios that take into account horizontal substitution from medical specialists to general practitioners.[2]

The relative accuracy of the model is assessed via running tests on the historical data, on the reliability of the model itself, and through sensitivity tests.[2]

Table 6 Elements included in the workforce planning model with corresponding data

No.	Element	Data source
1	Health professionals (HPs) available in baseline year	Registration of HPs
2	Amount of FTE per HP in baseline year	Surveys
3	Available supply (total FTE) in baseline year	Calculation using 1 and 2
4	Unmet demand for care in baseline year	Expert estimations
5	Required supply (total FTE) in baseline year	Calculation using 3 and 4
6	Demographic developments	Population projections and patient registration
7	Required supply (total FTE) in target year	Calculation using 5 and 6 and 19–25, when applicable
8	Outflow	Medical registration, information work status, surveys and unexpected outflow
9	HPs available in target year	Calculation using 1, 8, 10, 11, 12, 13 and 14
10	International migration	Medical registration, past migration, and expert estimations on future migration
11	Labour market return on migration	Information training, medical registration, and information on work status
12	Number of HPs in training	Information from HP training
13	Return on training	Information training, medical registration, and information on work status
14	Labour market return on training	Medical registration and information on work status
15	Amount of FTE per HP in target year	Surveys
16	Available supply (total FTE) in target year	Calculation using 9 and 15
17	Difference between available and required supply	Calculation using 7 and 16
18	Required number of HPs in training	Calculation using 17
19	Epidemiological developments	Expert estimations and empirical data if available
20	Sociocultural developments	Expert estimations and empirical data if available
21	Change of working hours per FTE	Expert estimations and empirical data if available
22	Technical developments regarding the profession	Expert estimations and empirical data if available
23	Developments regarding efficiency	Expert estimations and empirical data if available
24	Developments regarding horizontal substitution	Expert estimations and empirical data if available
25	Developments regarding vertical substitution	Expert estimations and empirical data if available

Source: Van Greuningen *et al*[26]

Data sources and collection

The ACMMP does not collect its own data but uses available databases and data analyses from an array of other existing data collection sources. This is data that are not specifically collected for planning purposes but for general data purposes relating to the bodies that collect them. The data sources used for the workforce planning model include, for example, national registries for health professionals (BIG registry) and government bodies – Central Bureau of Statistics (CBS) – and national demographic and healthcare needs data collectors – National Institute for Public Health and the Environment (RIVM).[2] Experts associated with each medical speciality are also involved in discussing any of the changes in working processes that may affect the capacity of the workforce in the future.[2]

Data for demand and supply come from different data sources.[2]
For the supply side:

- BIG registry
- Central Bureau of Statistics (CBS)
- NIVEL (GP database of Netherlands Institute for Health Services Research)
- Kiwa Carity
- Tax registry
- Registration Committee for Specialisms (RGS)
- Pension funds for doctors
- Unemployment agency (UWV)
- Dutch Ministry of Education, Culture and Science (DUO)

For the demand side:

- National Institute for Public Health and the Environment (RIVM)
- Production data (DIS)
- Population forecasts (CBS)
- Billing data health insurance companies (Vektis)
- Analysis production documents (Kiwa Carity)
- Consumer polls (NIVEL)
- Central Planning Bureau (CPB)
- Waiting lists (MediQuest)

Data collected for workforce planning purposes include number of active professionals; number of FTEs; types of providers; where they work; their skills; the services they provide; workloads; gender and age.[2, 24] There are data available that include detailed personal registers for each medical speciality and for each training programme. With regard to training programmes, data are also collected, and accordingly available, on myriad factors,[2] including:

- Success rates and completion of/withdrawal from training programmes;
- Number of applicants per vacancy;
- Male-to-female ratio;
- Age of applicants at entry;
- University of origin.

Data pertaining to the current health workforce in the Netherlands show, for example, the number of actively working healthcare professionals; number of FTEs; types of providers; geographical location of work; skills of health professionals; services provided by health professionals; workloads; and demographics.

In the Netherlands, a medical specialist is only permitted to treat a patient as long as their registration (in the national register of medical specialists) is valid. Registration must be renewed every five years: 'The supply of care is measured by multiplying the number of professionals actually offering services to patients by the average FTE (full-time equivalent) they are working.'[2]

Team composition

Malgieri *et al.*[2] note where a country's forecasting model might take into consideration possible integration between (vertical substitution) and/or within (horizontal substitution) professional groups.[2] In the case of the Netherlands, the forecasting model considers vertical integration (from medical professions to nurses and from dentists to oral hygienists) and horizontal integration (from medical specialists to each other and to general practitioners).[2]

Resources for maintaining the model

The ACMMP itself employs seven staff with backgrounds in healthcare (or healthcare education), research, academic, or advisory expertise; there is also one administrative member of staff. They also utilise a regular pool of experts (approximately 100) working in the field in the appropriate medical speciality, who are consulted once every three to six months. The ACMMP can also consult some research bureaux and other organisations to obtain any additional necessary data.[2]

Limitations of the model

Van Greuningen *et al.*[26] have identified several weaknesses within the model. They note that the simulation model is complex because of the 'many elements, heuristics, submodels and data sources'[26] included. They also note the inability of the model to properly simulate ongoing changes within the health workforce system, such as 'horizontal and vertical substitution, skill-mix perspectives and the mutual interaction between professional and educational systems in health-care'[26]; this is also highlighted by Ono *et al.*[1] The national level of workforce planning is signalled as a potential limitation, as it may not adequately account for labour market tensions at a regional level, particularly in areas such as GP recruitment: existing GPs finding successors for their practices, and so on.[26] Another limitation of the model is that there is a delay of two years before data become available; also, the relationship between reported FTE and actual hours worked is not determined.[2]

Benefits and challenges

From an economic perspective, the Dutch model of health workforce planning applies a principle of finding equilibrium between supply and demand in the labour market in the current situation and in the future.[26] The ongoing replication and adjustment of the workforce planning model and the factors within allow for the model to closely follow actual developments in the health workforce sector.[26] Van Greuningen *et al.*[26] suggest that the model used for health workforce planning in the Netherlands is of 'significant policy value and has been successful in stabilizing the labour market for physicians'.[26] Nevertheless, a noted weakness of the model, as iterated in Ono *et al.*,[1] was that 'it

was not yet fully able to include substitutions between different professions to allow planning from a broader "skill mix" perspective'.[1]

THE NETHERLANDS

Approach – The Advisory Committee on Medical Manpower Planning (ACMMP) oversees the forecasting process in order to adequately regulate health coverage and university budget management.

Tools – The workforce planners use a forecasting simulation model which considers both demand and supply of the workforce and allows for the development and testing of different scenarios. The model is known as a cohort component model. The components are inflow to or outflow from the active workforce. Scenarios are added to and tested within the model.

Timeframe – Each profession plans on a 2–3-year cycle to forecast for a 10–20-year period. Data are updated annually.

Data – Data collected for workforce planning purposes include number of active professionals; number of FTEs; types of providers; where they work; their skills; the services they provide; workloads; gender and age. Data sources used for the model include government bodies, national registries for health professionals, etc. Modelling is undertaken using a macro approach based on a composite of empirical data and expert opinion.

Team composition – The forecasting model considers vertical integration (from medical professions to nurses and from dentists to oral hygienists) and horizontal integration (from one medical specialist to another and to general practitioners).

Resources – The ACMMP has seven to eight staff engaged in workforce planning. They also consult with experts from different medical specialities every three to six months. The ACMMP can also consult with some research bureaux and other organisations to obtain additional data.

Benefits – An evaluation of the model for medical manpower planning focusing in particular on GP planning found that the ongoing replication and adjustment of the workforce planning model and the factors within allow for the model to closely follow actual developments in the health workforce sector. The evaluators found the model of significant policy value and also to have been successful in stabilising the labour market for general practitioners.

Challenges – One of the noted weaknesses of the model, iterated in Ono *et al.*, is that it does not fully allow for substitutions between different professions to allow planning from a broader skill mix.

4.2.3 New Zealand

Health Workforce New Zealand (HWNZ) was established in 2009. The 2008 financial crisis left New Zealand with an increase in the emigration of healthcare workers, in particular to Australia, resulting in criticism of an 'unsustainable reliance on immigrant doctors and nurses to meet health care workforce needs'.[28] This therefore led to the establishment of HWNZ. Its aim is 'to work with key organisations to ensure the New Zealand public has a health workforce fit to meet its needs'.[29] This is achieved by collaboration between HWNZ, educational bodies and employers 'to ensure that workforce planning and postgraduate training aligns with the needs of current and future service delivery'.[29] When the workforce planning process was started, they had to rely on incomplete and unreliable data which varied in terms of quality.[30] This varied quality of data emanated from various different regulatory authorities; as such they were unable to ascertain future workforce numbers for any of the health professions.[30]

Workforce planning model

The modelling work itself looks at the continuum of the workforce; the qualitative work with clinicians allows for the gaining of intelligence on the workforce for future planning.[30] The quantitative side of the modelling work is based on past trends, statistical knowledge, and contains as many elements as possible.[30] There is also an assessment of patient demand based on patient needs and demographics.[30] HWNZ looks less towards traditional numerical forecasting and puts more emphasis on pressure points and trends.[31] It gathers information on modelling trends, including: retirement patterns, recruitment rates, international labour market trends, service demands, and the popularity of some training programmes compared with others.[31] The planning model focuses on a two- to three-year 'people planning' horizon which feeds into the longer-term 5–15-year plans.[32]

It is important to demonstrate the value to the healthcare professions of data collection and monitoring and thus far this is happening in New Zealand.[30] Professions have full access to the model and sufficient input into it.[30] They have now got to a point where their model is dynamic and updated quarterly.[30] The model began with medicine, then nursing, followed by allied health professionals.[30]

Workforce planning tools – workforce service forecasts

Expert interviewees stated that since the 2009 financial crisis there has been a progressive, incremental increase in medical and nursing students[31] as well as implementation of recruitment and retention programmes costing circa NZ$10,000,000.[30] Stakeholders in the planning field had ascertained that using numbers alone would not work for the specific idiosyncrasies of the New Zealand health system.[30, 31] Workforce service forecasts were developed to suit the system that was being planned for.[31]

Workforce service forecasts were initiated by HWNZ to ensure that New Zealand's healthcare workforce was fit for purpose.[33] The workforce service forecast process started with 14 topic-specific areas: aged care, anaesthesia, dermatology, diabetes, youth health, eye health, gastroenterology, Māori workforce, mothers, fathers and babies, mental health, musculoskeletal, Pacific workforce, palliative care and rehabilitation.[33] The approach involves 'scenario building for the effective delivery of service aggregates'[31] in order to both accommodate uncertainty[28] and encourage innovation. The

model for forecasting is based on 'service aggregates, such as care of aging populations and mental health',[28] rather than 'based on professions or craft groupings, such as geriatrics and psychiatry'.[28] Clinicians lead on what is an inductive process, where in liaison with a forecasting project manager they develop a vision for how they think the workforce should look within the next 5–10 years, including new service configuration and new workforce models.[33] It is quite a qualitative process and, due to the clinician-led process, closely related to practice.[30]

Each of the key workforces that focuses on models of care, identified as 'doctors, nurses, midwives, allied health workers, non-regulated workers [such as health care assistants], and those in leadership and managerial roles'[31] have had taskforces developed for them by HWNZ. Figure 4 below, from *The Role of the Health Workforce New Zealand* document, is a diagram which maps out the orientation of the hierarchy of workforce planning and taskforces in New Zealand.[31] Each taskforce comprises a steering group which includes representatives drawn from across the health sector, and a smaller working group which will, 'implement defined programmes of work to improve professional development, recruitment and retention'.[31] These taskforces are seen as increasingly important, providing very good advice and steerage within and to the Ministry of Health.[30] The expert interviewees emphasised the commitment to improving on and contributing to workforce planning from the professions often via the taskforces.[30] Hence, the aim of the planning taskforces is to ask clinicians to consider future trends, anticipate new trends and consider and match future workforce need accordingly to them.[30] The assumptions underlying the forecasts is that any proposed clinical scenario must 'maintain or preferably improve the quality of the patient experience and outcome – on an individual as well as a population level – largely through better access to health care and at a reduced per capita and/or per intervention cost'.[28]

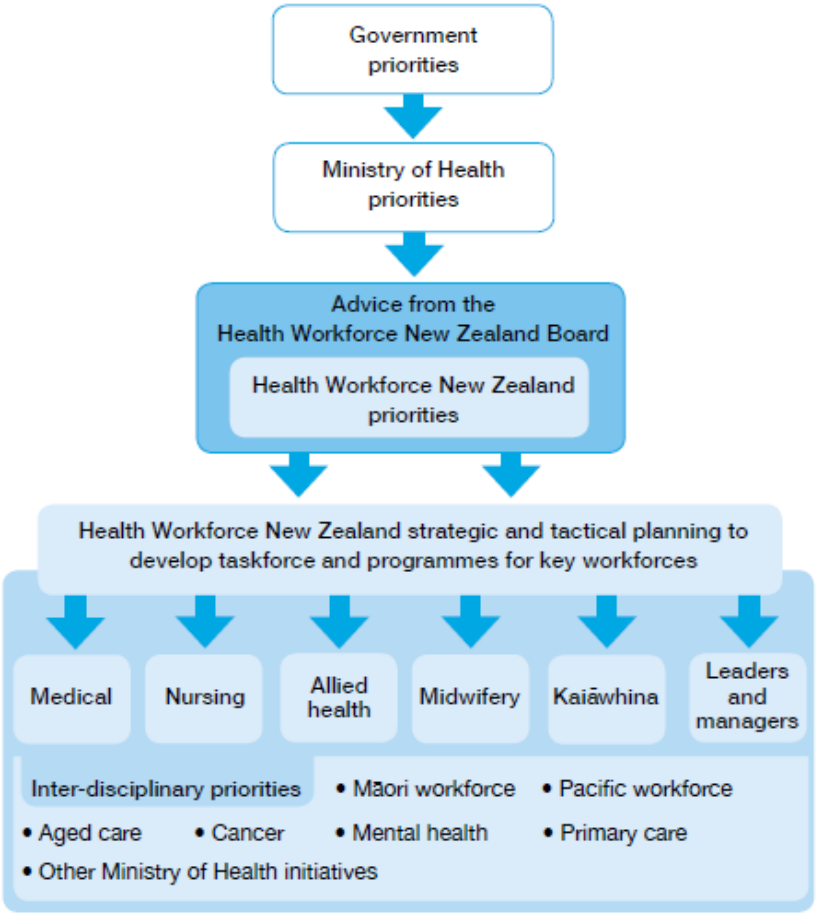


Figure 4 Developing sustainable workforces and new models of care (New Zealand)

Kaiāwhina in Figure 4 refers to the non-regulated workforce.

Data sources and collection

Data are collated, modelled and analysed on a national basis; however, work is in progress to develop network(s) to support regional cooperation to input into national data, which is a five-year programme.[30] The model will attempt to factor in structural and technological change on an ongoing basis.[31]

Data and workforce intelligence, as referenced in the report *The Role of Health Workforce New Zealand*[31] and in the *Health of the Health Workforce* reports,[34, 35] comes from a variety of sources. These include 'regulatory bodies such as the Medical Council of New Zealand (MCNZ) and Nursing Council of New Zealand (NCNZ), the wider Ministry of Health, district health boards (DHBs) and other employers, OECD reports, the New Zealand Census and Workforce Service Forecasts commissioned by HWNZ'.[31] With regard to data for workforce planning, data collation began by looking at the supply side.[30] At this stage, there is approximately three years of data coming from the Medical Schools Outcomes Database, although this has not been consolidated with following a graduate through their whole specialist training and working life.[30] Currently, the planners are working with the Medical Council, a regulatory body, to overlay the data from the Medical Schools Outcomes

Database with survey data collected by the Medical Council, which could possibly be developed into annual practice.[30] If this was achieved, data could then be lined up together, so a student could also be monitored for workforce data purposes.[30] There are issues surrounding having knowledge on age and demographics of the workforce, whereby regulatory authorities are reluctant to provide individualised data.[30] There is an issue with regard to information pertaining to geographical distribution, etc. It is possible to identify the home location of a worker but not their location of work, nor can the current data collection process identify whether the person works in the public or private system.[30] However, permission has since been granted to change the legislation so that more detailed data can be gathered in the future.[30]

It is incumbent upon the different medical specialities and healthcare professions to ensure the completeness of survey forms.[30] Data collected pertains to the regulated workforce but there is also an unregulated market that is not well covered in terms of data gathering.[31] A five-year action plan with a 20-year vision has been developed in order to advance the skills and status of the non-regulated workforce, which commenced at the end of 2015.[35] Nevertheless, many of the regulatory authorities do have an interest in improving the workforce data. An example is the nursing community who, through feedback and consultation, favourably reduced the number of questions (by 10) in the survey.[30]

Team composition

Team composition is vital in this workforce planning process, particularly in looking at ways to develop more team-based models of care.[30] An example is in primary care where there is a lack of GPs. One solution that HWNZ proposes is not just finding ways to encourage more people to train to be GPs but also to develop the role of other healthcare professionals.[30, 31] Looking at allied healthcare can involve redefining and/or understanding the role of nurse practitioners, and so on, in order to allow teams to deliver primary community care effectively.[30, 31]

Resources for maintaining the model

Maintaining the model is labour-intensive work; currently, there are 17 FTEs working on workforce planning, which includes three administrative staff.[30] There is one principal technical specialist and the remainder are analysts. There is a reasonable financial investment in the workforce planning sector and in the development of eHealth.[30]

Limitations of the model

The particularities of being a small country means that authorities do not see traditional workforce forecasting as serving them well when they are planning their health workforce.[31] Hence, the development of their alternative approach to forecasting lies in the use of workforce service forecasts; the forecasts are reliant on reliable data and workforce intelligence. 'Data about each individual in the workforce is important for forecasting, and to identify where there are shortcomings in workforce distribution'.[31] The main limitations with the data for the forecasting work are data lags where there are significant delays in accruing data. The issue of the varying quality of data also persists: 'issues include data that is summarised, inconsistent, out-of-date or collected ad hoc.'[31]

Benefits and challenges

Acknowledged benefits of workforce planning highlight the empowerment that is garnered through engagement; the ongoing collaborative nature of workforce planning, and the associated dialogue it stimulates has made it a valuable and successful project thus far.[30] It has been a constructive experience, according to the expert interviewees.[30] There is also a recognised ongoing need to be more strategic and more systemic in future planning cycles.[30]

NEW ZEALAND

Approach – New Zealand has developed its own approach to workforce planning which reflects its country size, population numbers, and population distribution. Workforce service forecasts undertaken by speciality taskforces have been developed. The forecasts/reports present what future health workforces will look like in key areas, such as aged care, diabetes, etc.

Tools – The emphasis is on pressure points and trends with less emphasis placed on solely traditional numerical forecasting. The workforce service forecasts are reliant on reliable data and workforce intelligence. Data modelling tools are used on the quantitative side but qualitative analyses and tools also form a large part of the New Zealand approach.

Timeframe – The planners look at a two- to three-year 'people planning' horizon to feed into longer-term plans.

Data – Data are collated, modelled and analysed on a national basis. The data come from a variety of sources, for example, regulatory bodies and district health boards.

Team composition – Team composition is very important in the New Zealand workforce planning process, particularly looking at ways to develop team-based models of care.

Resources – Maintaining the model is labour-intensive work, with 17 staff working on workforce planning. There is reasonable financial investment in the workforce planning sector and in the development of eHealth.

Benefits – There is empowerment through engagement; collaboration and a focus on dialogue has made it a valuable and successful project to date.

Challenges – Widely varying data quality has been a challenge. There is a recognised need to be more strategic and more systemic in future planning outlooks.

4.2.4 Scotland

NHS Scotland delivers frontline healthcare services, and correspondingly undertakes workforce planning, via 14 regional NHS Boards, which are supported by seven special NHS Boards and one public health body which provides further important specialist and national services.[36] The three expert interviewees from Scotland were all involved with workforce planning from its inception in 2005, which was set out in the National Workforce Planning Framework Guidance document known as *HDL-52*.[37] The 2005 Guidance gave the impetus to NHS Boards to outline markers, develop key methodologies and finalise information requirements for workforce planning. There was investment in workforce planning across NHS Boards and participants received a considerable amount of training. NHS Scotland has a National Workforce Planning Forum, where workforce planners from each NHS Scotland Board are represented; this promotes engagement and qualitative discussions in an ongoing basis. The forum has three work streams:

- Information and intelligence
- Modelling and profiling
- Workforce planning education

The goal of Scottish workforce planning is 'to provide NHS Boards (and their component services) with a consistent framework to support evidence based workforce planning'. Also to 'ensure the highest quality of care for patients by ensuring NHS Scotland has the right workforce with the right skills and competences deployed in the right place at the right time'.[38]

Workforce planning model

Six step methodology

Around 2007–2008, the Skills for Health Six Step Methodology[39] was adopted, initially informally, by NHS Scotland as a guideline that was suitable for all staff to follow. A revised Guidance document, *CEL 32*,[38] published in 2011, was subsequently issued as a national guide to support workforce planning. It was designed to support and assist those leading the development of workforce plans at service, NHS Board and regional level. The Guidance document (*CEL 32*) reinforces and enshrines the use of the six step methodology as the primary model for workforce planning.[36]

- **Step 1:** Defining the plan
  This step involves NHS Boards stipulating why a workforce plan is necessary and how it will support the achievement of wider corporate goals and objectives. It is necessary to make the purpose, scope, and ownership of the workforce plan explicitly clear.
- **Step 2:** Service change
  This step is concerned with the goals and benefits of change, the future context for how services will be delivered, options for future service delivery, drivers for and/or constraints against future changes and what any preferred option(s) might look like. The step helps to ensure appropriate engagement with a range of stakeholders in the planning process.
- **Step 3:** Defining the required workforce
  This step outlines the workforce required to meet predicted service needs and requires all local and national key issues which will impact on workforce design and deployment to be taken into account.
- **Step 4:** Workforce capability
  This step is concerned with describing the characteristics of the current workforce (i.e. baseline data), how any supply data can inform workforce forecasting, and identifying what options can be implemented in managing future supply.
- **Step 5:** Action plan
  This step identifies actions and sets out how these will be progressed and managed by the NHS Board. It needs to include length of plan, progress since previous plan, and priorities in education and training. Attention has to be paid to improving data quality.
- **Step 6:** Implementation and monitoring
  This step allows for reflection on actions, looking at progress against the plan, and taking account of any new drivers and any unintended consequences of developments. The monitoring process will be through the agreed NHS Board Committee. The Scottish Government has an expectation to publish plans annually in August.

All NHS Scotland boards are obliged to apply the criteria set out in the guidance document for their planning; they have to submit a workforce planning narrative and projection templates for one to three years for all staff groups.[40] The *Pan Scotland Workforce Planning Assessment and Recommendations* report recommends a three-year workforce narrative which aligns to three-year service plans (medium term outlook), and to develop a consistent annual reporting template to meet the annual reporting requirements of the Scottish Government and support annual projection submissions.[41] Despite the wider argument which considers that other staff groups should be included in planning, for example scientists and allied healthcare professionals, workforce projections are only really needed for core groups (such as nurses, midwives, doctors, and dentists), particularly because these groups influence the number of commissioned places that are required at universities.[40]

Further workforce planning information to support the six step methodology includes a tiered model of assessing information; collating demographic and epidemiology information, which in turn:

- Informs service model and service demand;
- Informs workforce requirements;
- Informs education needs.[41]

NHS Scotland boards also use the 5x5 risk matrix which '*uses a risk matrix as a graphical representation of the likelihood and consequence scores of risk. The matrix consists of a graph containing rows and columns, the rows show **likelihood** scores and the columns the **consequence** scores. The two scores are multiplied and a scoring for each risk is calculated; the higher the score the greater the risk to service provision*'.[41] Use of the 5x5 risk matrix has strengthened the six step methodology and brought a systematic approach to risk assessment into use.[41]

Workforce planning tools

Accompanying the six step methodology, which is engaged across the boards for workforce planning, there are also a variety of specific tools used. They use a mixture of workforce trees, skill mix analysers, nursing and midwifery workforce tools, and emergency department multi-professional tools (the nursing and emergency tools are mandatory across all levels).[40] Workforce trees help to 'visualise and model the current and future shape and size of the workforce, showing ratios and cost'.[38] Figure 5 illustrates a workforce tree in use from the *AHP Capacity Calculator User Guide*.[42]

At the ground level of everyday workforce planning, specific workload planning tools such as the Nursing and Midwifery Workload and Workload Planning Tools, which were made mandatory in April 2014, are applied across a range of environments. Aspects of the tools feed into the wider workforce planning process. The Nursing and Midwifery Workload and Workforce Planning project for Scotland selected the use of the following five tools:[43]

1. **Professional judgement.** This tool is used in all settings. It takes into account all activity and includes numbers of patients and clinical workload variations.
2. **Acuity-quality.** This tool is used in adult acute, paediatric and neonatal inpatient settings. Includes a quality tool to measure effective staff achievement of agreed standards of care.
3. **Timed clinical-care activities.** This tool is used in mental health care and inpatient settings for people with learning disabilities, and by community-based children's and specialist nurses. Based on a set of standardised care activities and the number of clients.
4. **Community benchmarking profile.** This tool is used in community settings other than those included in point 3 above. It requires the benchmarking of workforce data with mortality, morbidity and other variables.
5. **Birthrate Plus.** This tool is used in maternity services. It is based on the requirements of prenatal or postnatal women as well as information from, for example, early pregnancy assessment, non-labour triage, and clinic-based and inpatient care. It is validated and endorsed by professional bodies.[43]

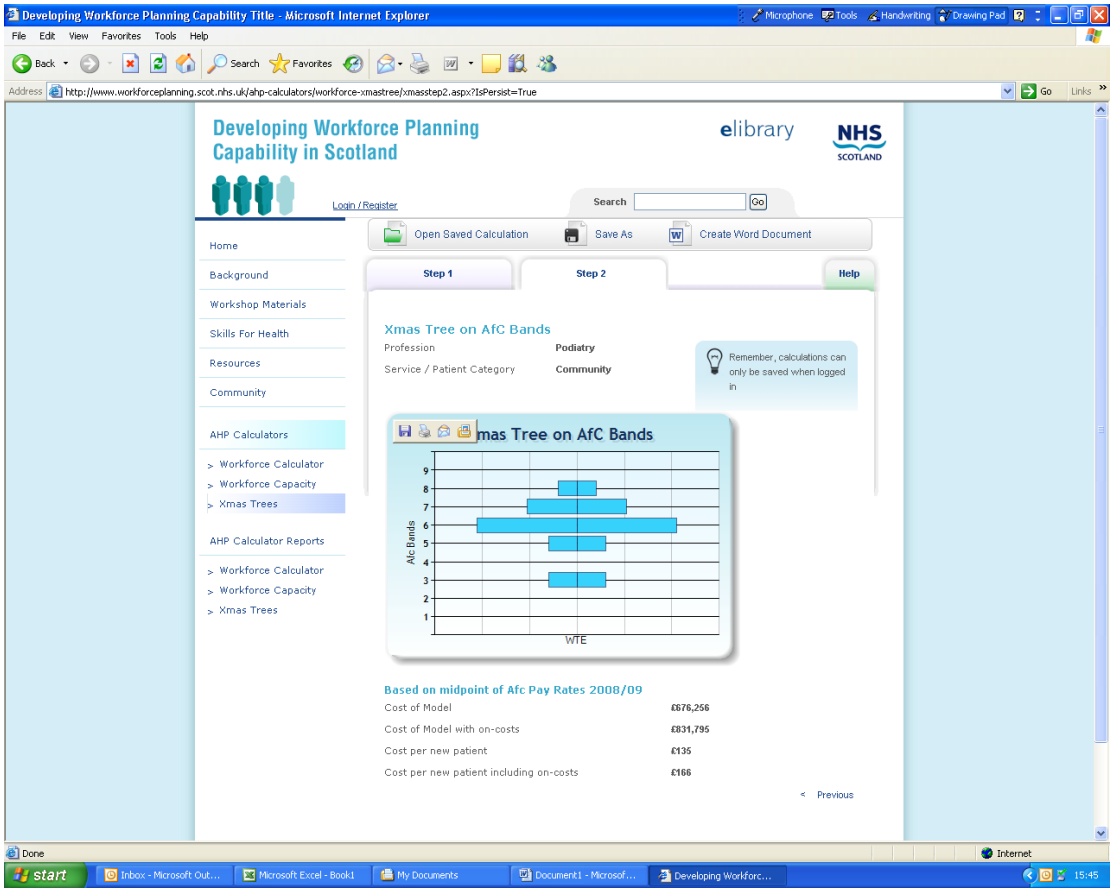


Figure 5 Example of a workforce tree from *AHP Capacity Calculator User Guide*

Data sources and collection

When Scottish workforce planning began, work was undertaken on how and where to start collating information and data to back up the decision-making around planning.[40] The work focused on starting with payroll as the predominant information source for data collection needs, the rationale being that everybody gets paid, that is guaranteed. Therefore, it is a good starting point for a baseline profile.[40] Scottish workforce planners have always used the Scottish Workforce Information System (SWISS) which is fed by payroll and is a workforce database/repository.[24, 40] The next step was to ascertain where the money goes – the profile of investment.[40] This information was matched up with payroll data, allowing for a bigger picture to emerge.[40] The next step was looking at education outputs. Following this, a profile of deployment was consolidated on the ground, using qualitative and quantitative data in order to determine where people are actually working.[40] This can be started at local level using small samples to begin with; it is not necessarily a substantial data-gathering task.[40] Human resource (HR) departments were also a useful source of data, providing information on vacancies, alongside geographical and professional-related information.[40] Some of the key sources of data identified in the 2011 Guidance[38] are included in Table 7.

Table 7 Some key data sources used in Scottish workforce planning

Organisation	Website address
Scottish Public Health Observatory	www.scotpho.org.uk/home/home.asp
ISD Scotland	www.isdscotland.org www.isdscotland.org/Health-Topics/Workforce/Publications/data-tables.asp www.isdscotland.org/Health-Topics/Workforce/
NHS Education for Scotland	www.nes.scot.nhs.uk
Labour Market Statistics	www.scotland.gov.uk/Topics/Statistics/Browse/Labour-Market
Skills for Health	www.skillsforhealth.org.uk
Centre for Workforce Intelligence[4]	www.cfwi.org.uk

When data were collated from the different sources, coding methodologies were developed to establish core categories of staff and to define relevant terms, such as what constitutes a vacancy.[40] This established controlled groups of staff across all streams of nursing, midwifery, medicine and dentistry.[40] Projected numbers over a three-year parameter were required. The Scottish Government then used these numbers to plan university places; with five-year plans for intake numbers.[40] The five-year plan reflects three years of training and a two-year consolidation period.[40] Medicine is different, due to the longer training periods, but the five-year plans are still appropriate, and are applied to ascertain an average.[40]

[4] The Centre for Workforce Intelligence was subsumed into the English Department of Health in March 2016; information pertaining to its work is found at: https://www.gov.uk/government/collections/workforce-planning-for-health-public-health-and-social-care

The importance of baseline data to prompt the discussion which initiates and guides workforce planning has been emphasised by the Scottish expert interviewees.

Team composition

The Scottish experts reported that the view from the governmental administration tends towards a silo-type approach to workforce planning, whereas at ground level there is a more multidisciplinary approach, particularly within day-to-day planning. Medical and nursing workforces are treated and planned as separate entities, perhaps without recognition of the strong relationship between both practices on the ground.[40] There is a need for all health workforce planning practices to address this aspect.[40]

Resources for maintaining the model

The Scottish experts reported that there is/was a core workforce planning training group which provides initial workforce planning training in order to familiarise each service (group) with what is expected of them locally with regard to planning. For example, in the first year of the Scottish workforce planning project there were four people on the team in the NHS Grampian Board who had part of their roles dedicated to workforce planning.[40] The initial training in workforce planning, that NHS Grampian administers, begins with a training session in steps 1 to 3 from the six step methodology.[40] This is followed by a break for reflection and time to undertake some further work on these steps. Then a second training session goes through the remaining steps 4 to 6.[40] Now that this has been somewhat established, the training is carried out over two split, half-day sessions, which is the optimum method of delivery in the view of the workforce planning core training group.[40] The core training group also administers the annual skills training template as part of the process of training and completion of plans.[40] This permits each service (group) to analyse its existing data, clean it up and provide accurate data to make the plan, allowing a good local analysis of local data before it is forwarded on to the informing workforce planning.[40] As it stands, most services do not have significant changes from year to year.[40]

Limitations of the model

Supplemental staffing (such as agency and non-FTE staff) was not considered within the workforce planning model at the outset, which is considered an oversight by the expert interviewees, as it is a considerably large aspect of health provision.[40] There is a strong need for supplemental staffing to be considered in workforce planning after accounting for core groups and their permanent-type staff.[40] There are challenges with regard to the different medical specialities, and a wider problem around demography in terms of staff groups – age, gender profile, and so on.[40]

The model does not solve the real problems with regard to the attraction and retention of healthcare professionals.[40] For example, problems with regard to the retention of junior doctors are ultimately a medical workforce problem, which results in a knock-on effect through to consultant.[40] In areas and environments where recruitment is a problem, junior doctors may not necessarily complete their medical specialities training which creates a lack of consultants into the future.[40] This is also the case within the nursing workforce as more advanced practitioners are sought.[40]

A further limitation or potential problem that workforce planners anticipate with the model is the possible need to develop new roles in the future, perhaps even ones that are not thoroughly understood yet, and how the model will process that information.[40]

Benefits and challenges

One of the perceived benefits derived from 10 years of workforce planning in Scotland is the ability to understand where the gaps in data are and so forth.[40] A strong network has developed across workforce planning and there are good links with different stakeholders.[40] There are better links with education now to start preparing for future workforces.[40] There is consensus that it has enhanced how planning is undertaken and it is difficult to imagine doing so without it.[40]

At the beginning, the workforce planning process was centralised, but it has since devolved to a more local basis (with an identified planner in each local hub).[40] However, as time progresses, the centralised component is still important for overseeing the project as a whole, according to the Scottish respondents.[40] The expert interviewees asserted the importance of putting a face on the point of contact for workforce planning, which makes it easier to encourage engagement from service-level staff.[40] When interaction with professions/services began to kick-start the planning process, the services were unclear about where they were trying to get to. Therefore, more time was invested in helping them understand where they wanted to get to, in order to plan for the best available, affordable, and adaptable service for them.[40] So, in some terms the more simplistic qualitative tools alongside time spent discussing key points with services are more important than the quantitative data side.[40] This is particularly so with regard to getting services onside to be positive about time spent on workforce planning, to develop meaningful and realistic plans, and to see engaging in workforce planning as a practical and helpful process.[40]

The development of workforce planning has highlighted particular facets of the sector, such as the importance of laboratory scientists, allowing important, yet perhaps less recognised, aspects of the wider healthcare sector to cooperate with regard to planning and advocating for their planning.[40] This helps facilities to become more efficient.[40]

An overreliance on quantitative data outlooks restricts broader thinking and permits replication of past mistakes.[40] On-the-job learning has led to a natural progression to the need for a more qualitative approach to workforce planning.[40] Seeing that healthcare must be modernised, it is necessary to meet and manage demands, complexity, and environments. Therefore, thinking around workforce planning also needs to evolve concurrently.[40] In addition, it is important not to allow finance to take precedence over workforce and service quality.[40] Quality of care should be the primary concern in planning.[40]

SCOTLAND

Approach – The Skills for Health Six Step Methodology underpins the primary approach to workforce planning in Scotland. A key aim of planning is to develop a consistent framework for future planning and ensure the right competencies and skills are available within the workforce.

Tools – The workforce planners use a mixture of workforce trees, skill mix analysers, nursing and midwifery workforce tools, and emergency department multi-professional tools.

Timeframe – The planners are working towards all staff groups submitting annual three-year outlook plans.

Data – Collection and use of data has evolved from available baseline data, such as payroll data to education outputs; profile of deployment; human resources data, etc.

Team composition – Planners are striving towards more multidisciplinary planning, but doctors and nurses are still treated as separate workforces rather than interrelated disciplines.

Resources – Resources are focused on supporting a core workforce planning training group; this team is the gatekeeper for workforce planning and key to engaging stakeholders.

Benefits – The planners have developed a strong network across the health workforce to support and inform the workforce planning work. After 10 years, they are skilled enough to spot easily gaps in data, etc. They have forged better links with the third-level education sector.

Challenges – An overreliance on quantitative data (numbers) allows mistakes to be repeated. Knowledge gleaned from the close work the planners do with stakeholders (health professionals, professional regulators, and educators) emphasises the need for qualitative data (experiences).

4.2.5 Wales

The Welsh Assembly first published its intention to design a new integrated approach to workforce planning for NHS Wales in 2007.[44] Since then, the workforce planning process has evolved. The model governing the forecasting process in Wales is guided by the NHS Wales planning framework(s).[44-46] All organisations that provide health services must comply with the frameworks. The NHS Finance Wales Act, 2014 imposed a three-year rolling financial duty on local health boards and trusts.[44] This means that each year each health board or trust must submit an integrated medium-term plan (IMTP).[47] This gives them an opportunity to demonstrate that they can plan financially over a three-year time horizon rather than just annually; however, they must still submit a refreshed, or rewritten version of this plan annually.[44] The planning cycle for annual plans[46] is illustrated in Figure 6. The aim of the planning and other work undertaken by the Workforce Education and Development Services (WEDS) team, an arm of the NHS Wales Shared Services Partnership (NWSSP), is to ensure that NHS Wales has a workforce with the skills to meet the demands of modern-day healthcare.[24, 48] The goal of health workforce planning is to '*[locally] create a workforce with the right skills, competences, qualifications and motivation to provide modern, flexible services wherever and when these are needed. Nationally, to support the development and commissioning of education and training programmes which meet the need for new and changing roles across the health and social care sectors*'.[24]

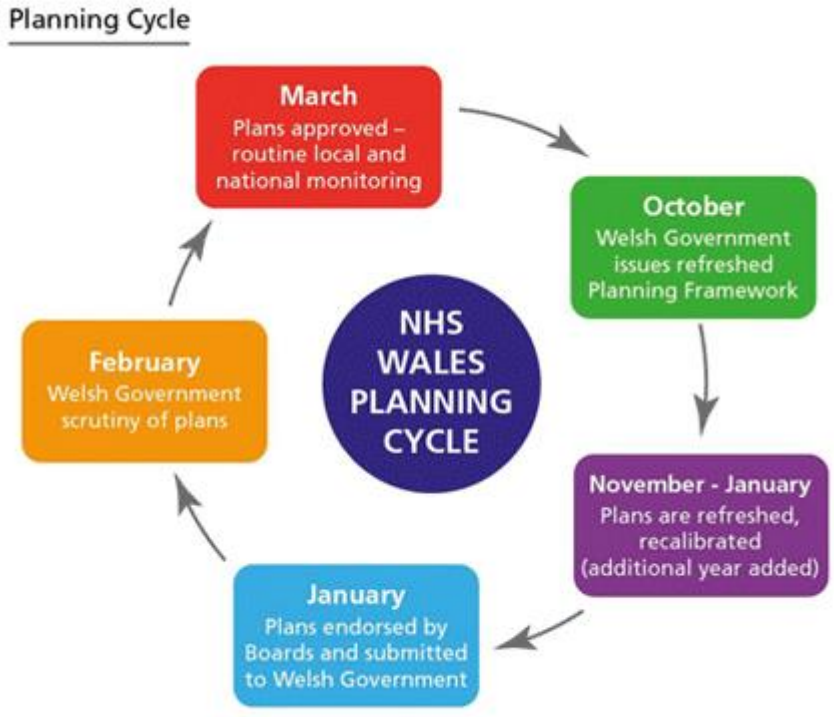


Figure 6 NHS Wales annual planning cycle

Planning in the Welsh health system is guided by the principles of prudent healthcare.[47] The principles of prudent healthcare were set out by the Bevan Commission in January 2015; the aim is to achieve clinical excellence through thoughtfully using available resources and meeting patients' needs appropriately.[44] The principles, as articulated by the Bevan Commission and the Welsh Government,[49, 50] are:

- Achieve health and well-being with the public, patients and professionals as equal partners through co-production;
- Care for those with the greatest health need first, making the most effective use of all skills and resources;
- Do only what is needed, no more, no less; and do no harm.
- Reduce inappropriate variation using evidence-based practices consistently and transparently.

Prudent healthcare principles aim to ensure that health professionals are operating at the apex of clinical competence and that patients requiring healthcare are seen by the most appropriate person.[47] The Welsh workforce planning outlook is also guided by the organising principles of quality, safety and addressing health inequalities.[44] Clear guidance has been given to all health organisations to consider these organising principles and make plans with them in mind.[44] The expert interviewees stated that finance, service, and workforce are the three driving components of planning for health. Also, it is important to consider how the workforce is used as well as planned. The annual IMTP requires the workforce to be considered in every facet; the document(s) that sets out the framework[44] is relatively explicit about what is required to be seen in each plan, which brings much clarity to the process.[47] The expert interviewees emphasised that workforce redesign and restructuring is also included in the IMTPs; this is of importance to allow for a focus on how things will be redesigned within the workforce when change occurs. Plans open up a good deal of dialogue between the NHS Boards/Trusts, commissioners, providers and the planners, they work closely to help the process develop.[47] IMTPs are not accepted, agreed and signed off on until there is consensus, thus there is close engagement between all major stakeholders in this regard.[47]

Workforce planning model

Like Scotland, Wales uses a six step methodology based on the Skills for Health Six Steps Methodology to integrated workforce planning;[39] however, Wales has developed its own interpretation of the methodology.[47] The following stages for the methodology are iterated in the *Developing the Workforce Elements of Integrated Plans Guidance*[51] document.

- **Stage 1**: Understand your population/healthcare environment
  Stage 1 involves defining the need for the workforce; this is achieved by analysing the environment and identifying the drivers for change.[51]
- **Stage 2**: Talk to your stakeholders
  This stage reaffirms the importance of working in partnership with stakeholders, both internally and externally. Engaging stakeholders and building and maintaining good working relationships is key to developing and implementing effective workforce plans.
- **Stage 3**: Create a vision and define outcomes
  This step is influenced by the work undertaken in the first two steps. Issues, needs and drivers for change have been identified and the existing workforce has been profiled. Now vision, outcomes, and priorities for the workforce can be described and key workforce themes/goals/outcomes identified.
- **Stage 4**: Forecast future service and workforce configuration
  This is the step where the development of options for delivery of the future workforce tales place. Analysis of workforce demand and supply is undertaken to identify any gaps that could impact on service delivery.

- **Stage 5**: Articulate key actions or changes required to deliver a vision and outcomes
- This stage allows for the identification and articulation of the key workforce actions and changes required to develop the workforce. Objectives will be linked to identified outcomes and priorities from Stage 3.
- **Stage 6**: Describe ongoing governance and delivery mechanisms.
  The final stage describes the governance arrangements necessary to underpin delivery, including how the workforce elements of plans will be monitored and reported.[51] This will be linked to the objectives identified in Stage 5.

The planning framework has integrated the six step methodology and provides clear guidance for what is required in the IMTP plans.[44] The expert interviewees emphasised how the model used and the planning process itself provide the ability to gain clarity on major service change issues; it also provides assurance that plans have been worked through population needs, financially balanced, and so forth.[47]

Workforce planning tools

The six step methodology is supported by the Workforce Configuration Tool, which collects quantitative workforce data.[36] Data used by the configuration tool are downloaded from the electronic staff record (ESR), which is the tool that converts data into graphical representations of the current and future workforce.[52] The workforce configuration tool allows users to define and use a number of simple assumptions to model the potential future workforce and its financial implications.[53] The data used in the configuration tool also allow for the presentation of data in workforce tree format,[53] as shown in Figure 7. Other tools that are available for NHS Wales planners to use include:

- The Workforce Interactive Tool
- The Skill Mix Analyser
- iView – a free online service that provides monthly benchmarking data
- The Age Profiler and Retirement Tool
- StatsWales
- NHS Wales Staff in Post Tool – based on StatsWales information[53]

The WEDS benchmarking tools – workforce interactive tool, skill mix analyser, age profiling tool, agency and locum tool (and under development a new staff and associate specialist (SAS) doctors tool) – are available via a SharePoint site with permission from the organisation's workforce and organisational development directors, and hence are reasonably widely available.[47]

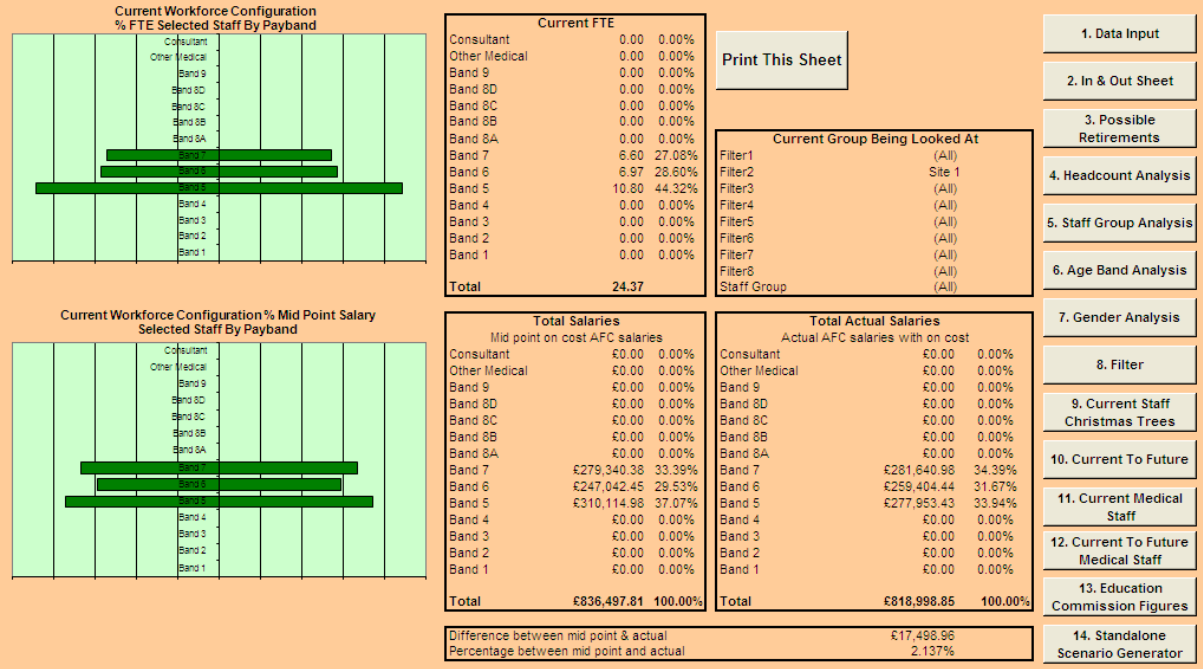


Figure 7 Example of a workforce tree from the Welsh workforce configuration manual

Data sources and collection

The ESR collects a multiplicity of data about the staff employed within NHS Wales Health Board and Trusts. Each Health Board and Trust has a workforce information manager who has access to data on the existing workforce.[52] Nevertheless, many of the tools, thus data sources, are more widely available than just via the organisation's workforce information managers.[47] The skill mix analyser tool[54] uses the three data sources set out in Table 8 in order to provide benchmarking information for the seven Welsh health boards and three Welsh trusts.

Table 8 Three data sources that provided benchmarking information for the skill mix analyser

Data source	Area	Units
ESR Data Warehouse	Staff in post	FTE (contracted) headcount
StatsWales	Population	2009–2012 Estimates 2013 Projections
NHS employers	Midpoint salary	Basic salary cost (on-costs not included)

Source: NHS Wales[54]

Alongside ongoing quantitative data collection, which resides in the ESR, qualitative information and data are collected as part of the workforce planning cycle.[47] This information is typically captured by organisations during the autumn and submitted at the end of the financial year.[36] The WEDS team collects additional qualitative data throughout the year via discussions with its more informal network of stakeholders.[36]

Quantitative data come via a set of standard forms that are completed for broad staff groups, including FTE plans for workforce, for the next three years, detailed education commission, and so

on.[47] Information is thus provided on, for example, the numbers of nurses needed to be trained. A newer element added to the data collection process is the primary care element.[47]

Team composition

Health workforce planning in Wales is positive about the development of multidisciplinary teams and developing skill mix.[44, 51, 55] An objective of the overall workforce planning process is to 'encourage team working between service providers, often across multi professional and multi organisation boundaries'.[51] This is particularly prevalent in proposed planning for primary care.[44] IMTPs for primary and community care are stipulated to 'include workforce plans that deliver appropriate capacity and capability of multi-skilled primary care teams with the most appropriate professionals delivering care'.[44] There is also an openness to investigate and develop new models of care where appropriate.[47] A whole-system approach to planning is of great importance.[47]

Resources for maintaining the model

Over time, the number of specialist planners for workforce planning has reduced in Wales, and in many cases planning expertise has been subsumed into human resources (HR), with planning becoming part of the HR business manager's role.[47] The expert interviewees emphasised that a workforce planning network across Wales that existed informally for many years has since been formalised; as part of this up to 30 people have been facilitated to undertake postgraduate diplomas in workforce planning. The NWSSP is working with the Skills for Health organisation to develop more bespoke training in this regard.[47] The core workforce planning team in the NWSSP comprises the head of service, a planning manager, a senior analyst and a further small team of analysts; there are also plans to recruit one more analyst in due course.[47] The models used are typically advanced Microsoft Excel models, thus tweaked in-house, with a number of other specific models developed by outside commercial companies.[47] Indeed, there is a growing appetite for this type of modelling.[47]

Limitations

Specific limitations of the workforce planning model for Wales were not explicitly identified in the literature nor in the expert interview.

Benefits and challenges

The major benefit that comes from the workforce planning process, regardless of tools, and so on, is that engaging with the modelling process starts an integral conversation about the future workforce.[47] It is a bottom-up rather than top-down process.[47] The positive aspects of workforce planning include engendering a new way of thinking by managers with regard to planning and expectations.[47] The expert interviewees believe that the tools in use would appear to be gathering good enough data. Workforce themes are pulled out from analysing the individual local level plans.[47] The main themes were published in January 2015 as the *NHS Wales Workforce: Key Themes and Trends* document.[55] While the expert interviewees definitely see the benefit of the integrated planning approach, it is still an ongoing process.

There remain some issues around five-year education planning cycles, as they do not align directly with the IMTP three-year planning cycle.[47] However, expert interviewees stressed that organisations were never really able to effectively plan for five years ahead and that the three-year cycle is challenging enough. Other challenges that exist within Welsh workforce planning include financial

pressures and service delivery on the ground.[47] It remains difficult for those working on the ground to think beyond very short-term planning cycles.[47] Workforce planning is a rigorous process, and local health boards are in need of further training with regard to planning, expertise, and upskilling.[47] There is also a need to invest in and upskill backroom or administrative staff in the health system, which is a challenge in itself.[47]

The integration of medical workforce planning is also a major challenge.[47] Modelling has been commissioned from central workforce intelligence which has helped with regard to integration for planning.[47] Again, this is an ongoing iterative process.[47]

WALES
Approach – The model governing the forecasting process follows the principles of prudent healthcare and is guided by the NHS Wales planning frameworks.
Tools – The six step methodology is used and supported by a number of Workforce Education and Development Services (WEDS), an arm of the NHS Wales Shared Services Partnership (NWSSP), benchmarking tools: workforce interactive tool, skill mix analyser, age profiling tool, agency and locum tool (and under development a new staff and associate specialist (SAS) doctors tool). The models used are typically advanced Microsoft Excel models.
Timeframe – Each Health Board or Trust submits an annual rolling three-year integrated medium-term plan (IMTP).
Data – The electronic staff record (ESR) collects a multiplicity of quantitative data on the staff employed within Health Boards and Trusts; data such as headcount of full-time equivalent staff, salary costs, education information, and so on. Qualitative information and data are collected via consultations and discussions as part of the workforce planning cycle.
Team composition – A whole-system approach to planning exists; developing skill mix and the development of multidisciplinary teams is a key objective of Welsh workforce planning.
Resources – Planning expertise has been subsumed into human resources (HR), with planning becoming part of the HR business manager's role. A workforce planning network has been formalised and up to 30 staff have been trained in workforce planning to diploma level. There is a core workforce planning team in WEDS.
Benefits – The modelling process starts a vital conversation about the future workforce. Workforce planning engenders a new way of thinking by managers with regard to planning and expectations. The planners have developed adequate tools for capturing the data they require.
Challenges – Some issues remain around five-year education planning cycles, as they do not align directly with the IMTP three-year planning cycle. It is difficult for frontline staff to see beyond short-term planning cycles. There is still a need for more training in workforce planning across the health workforce.

5 Conclusion

The questions guiding this evidence review sought to understand each approach to health workforce planning in the five countries, particularly as reflected in the models, tools, and processes used. Fundamental workforce planning components that were of interest to the review included whether team composition or integration was considered in the initial planning process, what data used were used, resources necessary for workforce planning, and limitations of the models used. The documented benefits and challenges of workforce planning for each country were also considered.

From a multidisciplinary perspective, the models and workforce planning processes reviewed did not directly answer questions relating to how models began and evolved. Rather, they show that the onset of health workforce planning has emerged independently in each country as a response to changing demands on their health systems coupled with corresponding issues surrounding future supply. The majority of the countries started out their workforce planning journey focusing on the medical profession first (typically with an initial focus on hospital doctors, except in the case of the Netherlands, where GP care has been that country's main focus), with nursing and allied healthcare projections coming further down the line.

It is clear that most workforce planning systems and/or models are attempting to strive for some semblance of an integrated approach to their workforce planning methods and models. However, integrated approaches tend to be initiated from a country-specific orientation, responding to the evolution of their particular healthcare systems and needs. Workforce planning does not necessarily begin with an integrated approach in mind, particularly in cases where data are limited or ambiguous, and an imminent shortage of doctors is the perceived predicament. When health workforce planning is sincerely undertaken, with the goal of committing to, maintaining and evolving a system, then the country in question needs to start where it has existing data. Advancements on data collection and data modelling must evolve with the evolution of the planning system; but it is possible to start a rudimentary process with available data.

There are commonalities in the data required for health workforce planning across the five countries. The simplest approach to capturing data for workforce planning begins with what already exists, typically payroll data, and evolves from there across the spectrum of available data. Labour force surveys can be employed as a method to capture specific data about individuals across the workforce. Depending on the country, surveys can record information on headcounts of full-time equivalent staff, where individuals work, their skills, the services they provide, workloads, gender and age, and so on. The multiplicity of data collected varies from country to country according to the types of data collection processes that the country already had in place. The similarity is that no country began workforce planning by instigating data collection first.

The majority of approaches to workforce planning begin with collating and modelling quantitative data. Using existing numbers is certainly of great importance to the notion of forecasting numbers into the future. Nevertheless, many of the countries have found integrating a more qualitative approach to be of benefit. The positive aspect of qualitative approaches is the permission for stakeholders such as healthcare professionals, their managers and educators to join in the conversation on the future development of the healthcare sector. The ability to discuss key issues and points of interest with representatives of healthcare services can often be a boon to the

workforce planning process, a point emphasised by the workforce planning experts in a number of the countries.[30, 40]

What became evident from undertaking the review, particularly elucidated via the expert interviews, is that all the countries use startlingly similar advanced spreadsheet (typically Microsoft Excel) models to undertake their modelling/scenario modelling/forecasting. Some countries have developed specific bespoke models in-house (for distinct aspects of the modelling process) or outsourced them to commercial companies. The upshot of this is that the models typically used are not complex and are easily replicated and expanded on. Thus, workforce planning can be engaged without a high expenditure on database design at inception. Expenditure is necessary on core manpower to oversee and implement any workforce planning, as the gatekeepers of the process, particularly the planners (experts) who engage with healthcare staff across the board, are the key to its success, a point which was reinforced by all the expert interviewees. These workforce planning experts are vital in sharing the importance of the planning process and training stakeholders appropriately both in attitudes towards and methods for workforce planning; they are also crucial to forging and maintaining relationships with core frontline staff involved in workforce planning. Ultimately, appropriately allocated financial resources will be necessary in order to develop a sophisticated workforce planning system, which also undergoes some type of systematic evaluation. However, this can emerge in a gradual manner, in conjunction with a determined approach to the overall advancement of health workforce planning.

The costs of creating and maintaining workforce databases and planning models vary widely, from four or five full-time equivalent positions in Scotland to 17 full-time equivalent positions in Australia, with a proportionate upfront cost in setting up these data gathering, modelling, and dialogue processes. For Ireland to proportionally mirror the experience(s) of the countries reviewed, five to eight full-time equivalent positions would be required to maintain and develop a comprehensive workforce planning system, with a more focused upfront investment in data gathering, model, and database building.

Challenges that emerged in health workforce planning often centred on quality and collection of data, in particular, where each country's planning systems had difficulty collecting complete and sufficient data. In some cases, there are also issues attached to comprehensively collecting data from the disparate data sources. Some countries found that a traditional focus on quantitative data alone did not sufficiently capture the minutiae of healthcare work planning. For them, it was necessary to develop a more qualitative approach to run concurrently with quantitative data capture, in order to better understand the experiences of healthcare professions and to plan efficiently with them. Overall, the main benefit of health workforce planning that emerged through undertaking this evidence review was the space for discourse that it allows. Initiating a workforce planning process in most of the country's healthcare systems allowed those involved to feel that their voices were being heard and considered to some extent. Developing successful models for one healthcare profession typically could be replicated at a basic level, with adjustments, for other professions which made undertaking modelling generally worthwhile. Health workforce planning also allowed for better, stronger links to be forged across sectors that impact on the healthcare workforce, such as third-level education, finance departments, and so on. Fundamentally engaging in health workforce planning allows for a new outlook on healthcare management to emerge.

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Appendix A – Questions leading documentary research and expert interviews

1. What is the country's approach to workforce planning?
    a. What assumptions were in your country's operational model when workforce planning was first started and why?
        i. Have the assumptions in the operational model changed over time?
        ii. If so, what was the rationale for the change(s)?
2. What are the operational workforce planning models, tools and processes used at a national and regional level in your country for healthcare workers?
    a. What was included in your country's operational model when workforce planning was first started?
        i. Has this changed over time and why?
    b. What is the timeframe of the workforce plans?
        i. What is the planning cycle in years, short or medium term cycle? Does it feed in to a longer term planning cycle?
    c. What datasets and data variables were required to construct the initial operational workforce planning model in your country?
        i. How have data requirements and data variables for this model developed over time?
        ii. Are the data provided locally or regionally?
        iii. How are the data used nationally and regionally?
    d. Is team composition considered as part of the modelling process?
        i. Is there a focus on team composition and/or expertise?
        ii. Who do they engage with; is there cross-sectoral integration?
    e. What resources (skills, persons, time, money and infrastructure) are required in the country to update and maintain the model, tools and process?
        i. Are resources centralised or via other authorities such as hospital groups/specialities and so on?
    f. What are the limitations of the model?
3. Who feeds into and uses the national operational health workforce planning models, tools and processes?
    a. How do they feed into them and how do they use the outputs?
    b. What processes are in place in your country to ensure the operational model results are used?
    c. How is the use of the operational model results monitored, evaluated and reviewed?
    d. How are the data used nationally and regionally?
    e. How does the national or regional operational model trigger the need for responses to health worker shortages, health worker surpluses, health worker distribution that does not align with health needs, obsolete health worker skills and new health worker skills and how does the country respond to the triggers in the short term, medium term and long term?
    f. How have total staff requirements changed?
    g. How have total staff costs changed?
4. What documented benefits and challenges are derived from the use of health workforce planning models, tools and processes in your country?

Appendix B – Search strategy flowchart

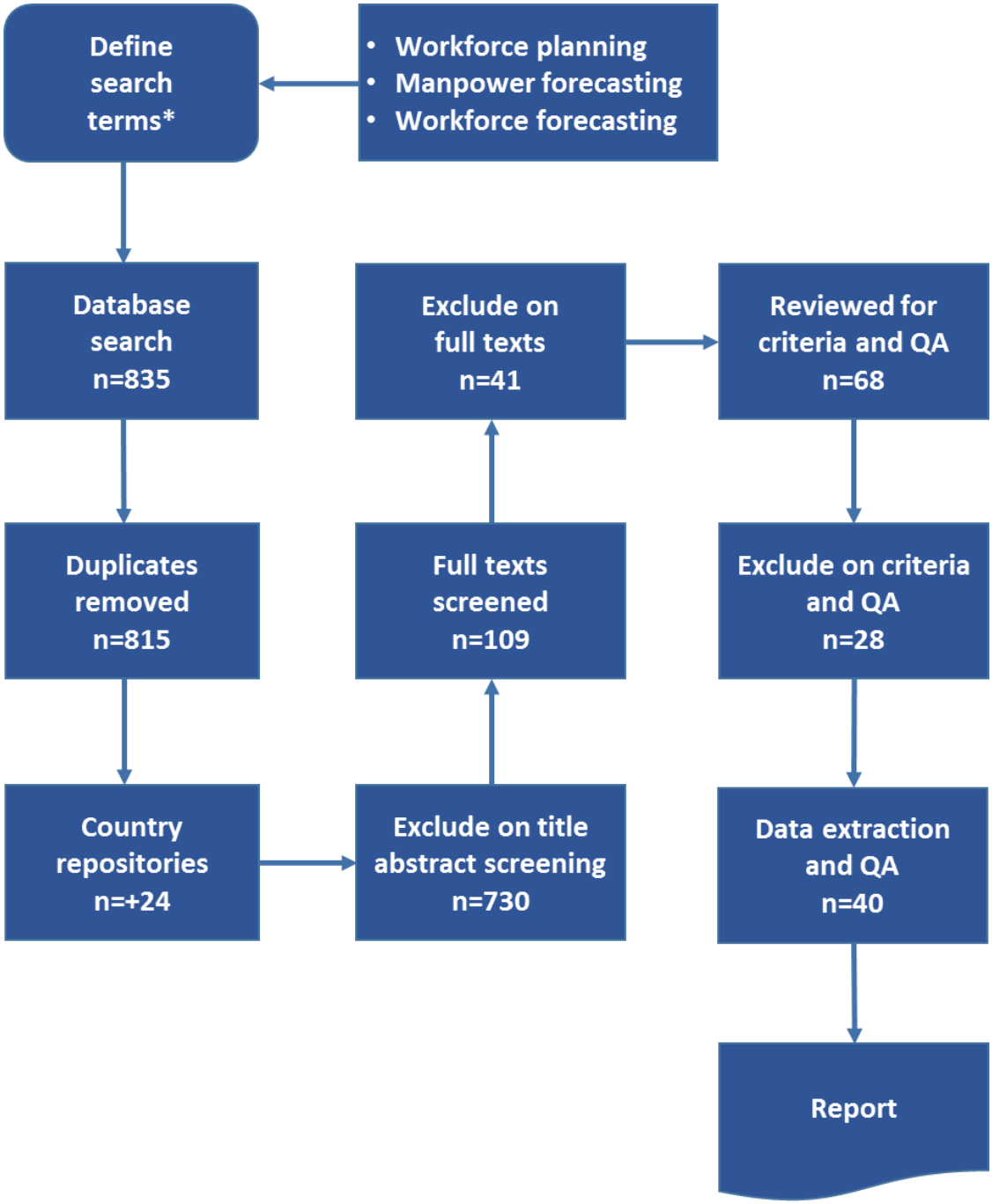

Figure 8 Flowchart for evidence review search strategy process

*Search terms defined as 'workforce planning'; 'manpower planning'; 'workforce forecasting'.

Appendix C – Quality appraisal table

Paper	Method review[1]	Relevant[2]	Subject effectiveness[3]	Effective description[4]	Evidence outcomes[5]	Country	Total score
Crettenden *et al.* 2014	Yes	Yes	Yes	Yes	Yes[6]	Australia	5
Flynn *et al.* 2010	No	Yes	Yes	Yes	No	Scotland	3
Gorman 2015	No	Yes	Yes	No	Yes	New Zealand	3
Grafen *et al.* 2015[56]	No	Yes	Yes	Yes	No	Scotland	3
Jackson *et al.* 2015[57]	No	Yes	Yes	Yes	Yes	United Kingdom	4
Kellagher *et al.* 2010[58]	No	Yes	No	Yes	No	Scotland	2
Kuhlmann *et al.* 2015	No	Yes	Yes[7]	Yes	No	Netherlands	3
Lockhart *et al.* 2010[59]	No[8]	No	No	No	No	Scotland	0
Lockhart *et al.* 2010a[60]	No[9]	No	No	No	No	Scotland	0
McCarty *et al.* 2013	Yes	Yes	Yes	No	No	Australia	3
Naccarella *et al.* 2013	No[10]	Yes	Yes	No	Yes	New Zealand	3
Ono *et al.* 2013	Yes	Yes	Yes	No	Yes	Australia Netherlands	4
Segal *et al.* 2011[61]	No[11]	No	No	No	No	Australia	0
Simpson *et al.* 2010[62]	No[12]	No	No	No	No	Scotland	0
Van Greuningen *et al.* 2013	No[13]	Yes	Yes	Yes	Yes	Netherlands	4
Van Greuningen *et al.* 2012	Yes	Yes	Yes	Yes	Yes	Netherlands	5

Table 9 Quality appraisal scoresheet for journal articles used in workforce planning evidence review

[1] Method review: Is this a methodologically appropriate review article?
[2] Relevant: Is the paper relevant to reviewing or discussing tools, models, and processes of health workforce planning?
[3] Subject effectiveness: Is the effectiveness of workforce planning tools, systems or models the subject of the review?
[4] Effective description: If not a review, does the paper effectively describe workforce planning tools and/or models?
[5] Evidence outcomes: Is evidence on outcomes of workforce planning developments included?
[6] Merely summarises the results from the three Health Workforce Australia reports.
[7] Technically, this is more of a descriptive piece which describes the Dutch model of health workforce planning.
[8] This paper ultimately served as context for the Scottish experience, in nursing workforce planning.
[9] Also context for the Scottish experience, in nursing workforce planning.
[10] This paper reported on an evaluation study undertaken using semi-structured interviews.
[11] This paper reports on a study which suggests an alternative approach to health workforce planning.
[12] This paper is context for the Scottish experience, in nursing workforce planning.
[13] This paper reports on research which tested the workforce planning model in the Netherlands.

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