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Health workforce planning: which countries include Nurse Practitioners and Physician Assistants and to what effect?

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Highlights

- Nurse Practitioners (NPs) and Physician Assistants (PAs) have emerged in many countries.
- Research is scarce if and how they are integrated in workforce planning.
- Of eight countries, three use multiprofessional workforce planning with NPs/PAs.
- Impacts on policy and practice are limited, except for the Netherlands.
- Different skill-mix scenarios should be developed to inform workforce planning.

Abstract

Background. An increasing number of countries are introducing new health professions, such as Nurse Practitioners (NPs) and Physician Assistants (PAs). There is however limited evidence, on whether these new professions are included in countries' workforce planning.

Methods. A cross-country comparison of workforce planning methods. Countries with NPs and/or PAs were identified, workforce planning projections reviewed and differences in outcomes were analysed, based on a review of workforce planning models and a scoping review. Data on multi-professional (physicians/NPs/PAs) vs. physician-only models were extracted and compared descriptively. Analysis of policy implications was based on policy documents and grey literature.

Results. Of eight countries with NPs/PAs, three (Canada, the Netherlands, United States) included these professions in their workforce planning. In Canada, NPs were partially included in Ontario's needs-based projection, yet only as one parameter to enhance efficiency. In the United States and the Netherlands, NPs/PAs were covered as one of several scenarios. Compared with physician-only models, multi-professional models resulted in lower physician manpower projections, primarily in primary care. A weakness of the multi-professional models was the accuracy of data on substitution. Impacts on policy were limited, except for the Netherlands.

Conclusions. Few countries have integrated NPs/PAs into workforce planning. Yet, those with multi-professional models reveal considerable differences in projected workforce outcomes. Countries should develop several scenarios with and without NPs/PAs to inform policy.

Keywords. Workforce planning, Workforce projections, Nurse Practitioner, Physician Assistant, substitution, skill-mix, Human Resources for Health (HRH)

1 Background

An increasing number of countries are changing the composition and skill-mix of their health workforce. Skill-mix is defined as the mix of health professions, and the mix of their skills and roles, which enables them to respond to changing patient needs [1]. Many countries worldwide have introduced new professional roles, such as Nurse Practitioners (NPs) or Physician Assistants (PAs) [2-5]. The reasons include the more complex needs of patients with chronic conditions and/or a geographical maldistribution of health professionals [5, 6]. In addition, the introduction of new health professions has been suggested as one option to enhance efficiency in healthcare. This is because expenditure on workforce accounts for around 60% of total health spending [7-9].

The International Council of Nurses defines NPs as registered nurses with “*the expert knowledge base, complex decision-making skills and clinical competencies for expanded practice*” with a recommended master's degree [10]. For PAs, there is no internationally recognised definition. In the USA “*Physician assistants, also known as PAs, practice medicine on teams with physicians, surgeons, and other healthcare workers. They examine, diagnose, and treat patients*” [11]. The clinical activities of PAs and NPs vary across countries and settings, but in the majority of countries the education is at the Master's degree level. While NPs all have a nursing background, the background of PAs varies, and can include nursing or other allied health professional degrees. The scopes-of-practice of both professions is at the interface of the medical professions and results in task shifting and task re-allocation [3, 12]. These, changes to professional boundaries not only have implications for deployment of the health workforce and for service provision, but also for countries' governance and health workforce planning.

To date there is limited evidence on the extent to which skill-mix changes, - in particular the introduction of new professional roles such as NPs and PAs - are reflected in countries' health workforce planning. Workforce planning is a policy instrument designed to ensure an adequate workforce supply [13]. Its policy goals are to counteract unwarranted cyclical fluctuations in the balance between supply and demand, and to avoid both shortages and excesses in the supply of health professionals. Workforce planning can inform policy decisions, e.g. determine the numerus clausus for medical students, and the development of on educational capacity [14]. In health care, workforce planning exists in many countries, and is undertaken for two main reasons: first, because of the long lead times to educate health professionals, in particular physicians; and second, because of the public (government) financing implications of training physicians (and other professions) at universities.

Workforce planning exists at both the national and the sub-national levels [15-17]. Several factors impact on the effectiveness of workforce planning: the quality of the data, the time span of the forecasts, the number of professions covered (physician-only and other providers), and the type of the model employed (supply-side only-, supply and demand-, needs-based models) [18, 19]. The complexity of models, in terms of data requirements and underlying assumptions, increases from supply- to needs-based models [18].

Workforce planning, if undertaken using only supply or demand-based models, may lead to overestimates of required supply compared to population-needs based models [20]. Such needs-based models employ epidemiological data but are less often used, in part due to more demanding data requirements [15]. The time-spans, the projection periods of models employed in Europe are commonly for a 10-year horizon, although these vary [14, 21]. The EU's Joint Action on Health Workforce Planning and Forecasting identified the need for improved data quality, cross-country cooperation, minimum data requirements and integrated planning models, particularly from a European perspective [19, 22] to improve health workforce planning in Europe.

International research on workforce planning has focused primarily on the medical profession [13-15, 23]. An international study in 18 OECD countries found that although the majority of high-income countries had health workforce planning in place for physicians, most used single-profession models [15]. Few workforce planning models existed for nursing or other health professions, and few adopted an integrated approach [13, 23].

Integrating other professions into workforce planning is important for estimating the consequences of skill-mix changes and changes in the division of work between different health professional groups on the number of future health professionals required. Yet, research is scarce. The 2013 OECD report identified multi-professional workforce projection models in only the Netherlands, Norway, Switzerland, Japan and the United States (U.S.). Some of these models allowed for "horizontal" and/or "vertical substitution", between professions. Horizontal substitution refers to substitution within a profession (e.g. GPs taking over clinical activities from medical specialists), whereas vertical substitution refers to changes between at least two professions (e.g. NPs performing certain "medical" activities) [15].

Recognizing these recent changes in the division of work between physicians and NPs and/or PAs in several high income countries [24, 25], this study assesses if and how these new professions are covered in workforce planning. The study's research objectives are as follows: first, to analyze if and how countries with new professions (NPs/PAs) integrate these into their workforce planning; second, the extent to which "substitution" is covered; and third, the implications for policy and practice.

The remainder sections are structured as follows: after describing the methods employed, the results section provides an overview of workforce planning in relation to physicians and the two new professions (NPs, PAs) in eight countries, this is followed by a more in-depth, case-based analysis of workforce planning in three countries (Canada, the Netherlands and the United States). The final section derives conclusions and explores the implications for policy and practice.

2 Methods

The study used a cross-country comparative design, using descriptive data and case-based analyses [26]. The study was based on the following four phases: (i) identification of countries with NPs/PAs based on previous studies; (ii) a cross-country comparative review of workforce planning in these countries based on a literature scoping review of national workforce planning models, (iii) in-depth, case-based analyses of countries' workforce projections, including the extraction of data to assess differences in physician-only vs. multi-professional (physicians/NPs/PAs) workforce planning, and (iv) a review of policy documents to assess the implications for policy and practice.

2.1 Country coverage

First, we identified countries in which NPs/PAs emerged as new professions working in clinical practice. We focused on these two professions, since the potential for task shifting between them and physicians is of relevance for workforce projections. We identified the countries with NPs from a previous study conducted in 39 countries [24]. The countries in which NPs exist as a profession were Australia, Canada, Finland, Ireland, the Netherlands, New Zealand, the four nations of the UK and the U.S.. The eight countries have in common that extensive task shifting has occurred in the past, leading to considerably advanced clinical nursing practice for NPs. Tasks covered were authority to: prescribe medications, order medical tests, undertake medical diagnoses/advanced health assessments, make decisions on medical treatments and referrals, be the first point of contact and take responsibility for a panel or group of patients. More details on the study are provided elsewhere [24]. We also identified whether PAs exist in these countries, through a review of previous research [3, 25, 27].

2.2 Cross-country review of workforce planning mechanisms

Second, we performed a cross-country comparative review of workforce planning methods and material for the eight countries identified. A scoping review was undertaken retrieving articles in Medline, Web of Science and Google Scholar with search terms covering 'workforce planning', 'manpower projections', 'skill-mix', 'substitution', 'task shifting' and related terms on 'new division of work', 'NPs', 'PAs' (Physician Assistant or Physician Associate) and their related terms. Inclusion criteria were articles published for at least one of the countries identified, material on multi-professional workforce planning, with elements of "substitution" covered. A comprehensive review of the websites of national and/or subnational workforce planning authorities was conducted for each of the countries, to identify the workforce planning models used. We extracted information on if and how these providers are included in national or subnational workforce planning by searching the projection models and (grey) literature for any mention of the word(s), multi-professional, skill-mix, NPs, PAs (Physician Assistant or Physician Associate). In those workforce projection models or reports where NPs and/or PAs were mentioned at least once, we performed thematic analyses to distinguish how these providers were accounted for, whether they were: (i) mentioned at least once, but not covered in the workforce planning/projections (e.g. listed as potential influencing factor); vs. (ii) integrated in workforce planning/projections (e.g. as one of several scenarios).

2.3 In-depth, case based analysis of NPs/PAs in workforce projection models

Third, for those countries that had integrated NPs and/or PAs into their workforce projections, we extracted the data from the respective projection scenarios, differentiating between skill-mix (multi-professional) models and physician-only models, where available, to show the extent of projection differentials. Comparisons of the results were of descriptive nature. Moreover, we assessed if and how various levels of “substitution” were accounted for, on what basis information was obtained (empirical studies, expert knowledge) and to what extent final results between physician-only models (‘status quo’) and new skill-mix change models (‘skill-mix’, including NPs/PAs) were accounted for. Data were extracted manually and entered in excel spreadsheets distinguished by country, and differentiating between the type of workforce planning mechanisms, professions, care sector (primary care, specialist care, all care sectors), and full-time equivalent vs. headcounts, as available. The concept of ‘substitution’ has been used in earlier research on workforce planning, where “substitution ratio” is defined as the percentage of physicians’ work or total number of tasks that can be performed by another non-physician provider [28].

2.4 Impacts on policy and practice

Finally, we identified the effects on policy and practice. We reviewed policy papers, recommendations by workforce planning authorities and other grey literature to identify if the inclusion of NPs/PAs in multi-professional workforce planning was having an impact. We considered an indication of impact to be any recommendation for change by a countries’ workforce authority which arose out of a workforce projection model. Following and expanding on a previous conceptual model of countries’ workforce planning mandates [13], we identified the impact of skill-mix projections on medical student intake levels or in other workforce-related changes to policies and practice (e.g. educational capacity or training intake). Furthermore, we distinguished between those with a direct and those with no direct impact. Direct impact was where workforce planning structures had a prescriptive or advisory mandate on student intake levels or educational capacity while no (direct) impact was the absence of any of the above.

3 Results

3.1 NPs/PAs and inclusion in workforce planning in eight countries

Of the eight countries in our study where NPs/PAs work in advanced practice at the interface to the medical professions, three countries, the Netherlands, Canada and the U.S. covered these partially or fully in their workforce projections or planning mechanisms (Table 1).

In the other countries we identified no published material that stated that NPs and/or PAs were included in workforce planning. However, in several of these countries (Australia, England, Finland, Ireland and New Zealand) the *relevance* of considering skill-mix changes for workforce planning, particularly with a view to future developments, was highlighted. For example in England future skill-mix changes were covered in a new workforce planning framework that was being developed [19, 33, 34]. Further it was suggested that the increasing levels of education of non-physicians might lead to a partial substitution of GPs in the future, for it was suggested that 70% of typical GP tasks could be taken over by extended non-

physician roles [34]. In Ireland, increasing nurse-led chronic care led by NPs, was suggested as an option to reduce the expected increase in the demand for GPs in the future [35]. In Finland multi-professional workforce planning covers several health professions [19], but no advanced nursing roles or substitution [36]. Projections differentiated between nurses by education, such as Bachelor's or Master's level, although educational qualifications are at best a proxy for, and do not equal, advanced practice.

3.2 Changing skill-mix in workforce planning: experiences from Canada, the Netherlands and the United States (US.)

In the remainder of the section, the focus is on Canada, the Netherlands and the U.S., which included NPs/PAs in their workforce planning and projections methods. We compare the extent to which the results of the multi-professional skill-mix models (those with Physicians, NPs and/or PAs) differ from the physician-only models, report the extent, the estimated percentage, of physician substitution factored into these models, and the evidence level for substitution (table 2).

3.2.1 Canada

In Canada NPs have increased in numbers in recent years, reaching 4,832 in 2016 [40]. There are considerably fewer PAs, estimated at around 500, working primarily in Ontario and Manitoba [41]. In Canada, the governance and planning of its health system and services is highly decentralized [42]. This also applies to its workforce planning, for which the provinces and territories subsume overall responsibility. Workforce planning has been traditionally based on single-profession models, focused on physicians. Yet, some provinces, such as Ontario, have begun including NPs in their planning mechanisms as scenarios or as pilots. On PAs, no published evidence was identified.

In Ontario, a population needs-based physician simulation model was developed in 2010, the first of its kind in Canada, where NPs are covered as one of its four base-case simulations [37]. NPs were estimated to enhance the productivity of family medicine practice capacity by 40%. There is however lack of clarity as to how the 40% was arrived at since the report does not state where the information was retrieved from. Nor is it explained whether the 40% are substituting for or supplementing the work of physicians..

In Canada , a NP-specific simulation model was developed for primary care at the federal level [43, 44]. It was based on a single-professional model for NPs and not integrated with other professions. The model was piloted in three provinces (Alberta, Newfoundland, and Ontario). It is unclear if and to which extent this model has influenced provinces' and territories' subsequent workforce planning. With the exception of Ontario, discussed above, no evidence was found that the pilots led to the full integration of NPs into routine workforce planning or projections.

3.2.2 The Netherlands

Health workforce planning is largely centralized in the Netherlands, for which the Advisory Committee on Medical Manpower Planning (ACMMP) was established in 1999. Its aims and mandate are to undertake projections of the future supply and demand of the health professional workforce. ACMMP advises the government on future workforce requirements, in order to inform the yearly inflows of students and develop educational capacity. The Committee has reflected skill-mix changes in the health workforce in its medical workforce planning since 2006, by including Nurse Specialists (“Verpleegkundig Specialisten”, also referred to as NPs) and PAs in its workforce planning.

The number of Nurse Specialists in the Netherlands has increased considerably over the years to 2016. In that year, 2,765 Nurse Specialists were registered, compared to 151 in 2010. A study among alumni of the Master [of] Advanced Nursing Practice (MANP) and the Master Physician Assistant (MPA) – that both provide entry to work as a Nurse Specialist – showed that 2,638 Nurse Specialists were practicing in 2016; providing capacity equivalent to 2,333 FTEs [45]. Of the five existing specialisations, approximately 85% of Nurse Specialists work in hospitals, with the remainder in elderly care and mental health care. PAs often work in general practices as “Praktijkondersteuner Huisartspraktijk”. It was estimated that 8,400 GP-PAs were employed in general practices in 2016, compared to 3,700 in 2011 [46]. About 30% of these GP-PAs are specialized in (primary) mental care. Most GP-PAs work part-time. For 2016, it was estimated that their capacity is 4,272 FTEs compared to 1,864 FTEs in 2011. Their role is mainly to undertake routine medical tasks according to protocols, such as examinations, treatment and management of minor diseases or stable patients with chronic conditions [47].

In the Netherlands, Nurse Specialists and PAs are routinely added to one scenario of the medical workforce projections in order to capture “vertical substitution”, where other professionals are taking over tasks from physicians [16]. In its 2013 and again in its 2016-advice to the MoH on medical specialists and GPs, both horizontal and vertical substitution were included in the capacity planning models to estimate the future need for medical specialists and GPs respectively, 12 to 15 years ahead. Horizontal substitution was estimated by the ACMMP in 2016, to add 1.2% -1.6% per year to the GP work load from specialists, due to an expected shift from hospital/inpatient to ambulatory and primary care settings. Vertical substitution was estimated to reduce the required GP workload by 10 to 16% in 10 years (i.e. 1.0% to 1.2% per year), resulting in the highest estimated efficiency gain in the model.

For medical specialists, vertical substitution was estimated, in 2016, to reduce the demand for this workforce by the equivalent of 0.3% to 0.5% of its capacity per year. This estimate reflected the rapid increase in the training and employment of Nurse Specialists and PAs in the Netherlands. Underpinning this forecast was the assumption that the trends in education would continue, and that a continuing proportion of the tasks of physician could be transferred to NPs and PAs.

Based on its workforce projections, the ACMMP advises the Dutch Ministry of Health (MoH) every three years on the suggested number of inflows to medical schools and specialty training, which are the key policy instruments to steer supply. Figure 1 and 2 show the advice of the ACMMP to the MoH in 2016 with regard to the required annual inflow to GP and medical specialist training, respectively, for the periods to 2025/8 and on to 2034 under three scenarios.

The three scenarios of both models differ with regard to the estimated GP and medical specialist demand (i.e. 'required capacity') in the future. All three scenarios are based on the changes in the patient population, while scenarios 2 and 3 include vertical substitution as an additional factor for the demand projections. Scenario 1 (as implemented in the planning model) include the estimated effects of demographic, epidemiological, and socio-cultural developments among patient populations on the future demand for GPs and medical specialists. These scenarios also include the effects of expected changes on the workforce in terms of time savings, technical developments and horizontal substitution (the latter factor refers to the expected shift of tasks from medical specialists to GPs as mentioned above). In scenarios 2 and 3, the effect of skill-mix change is added to the previously mentioned factors of scenario 1. The deployment of Nurse Specialists and PAs decreases the required capacity of GPs by an estimated substitution rate of 0.6% (scenario 2) or 1.2% per year (scenario 3), and of medical specialists by 0.3% (scenario 2) or 0.5% per year (scenario 3).

A comparison of scenario 1 with scenarios 2 and 3 reveals that the projected shortage of GPs and medical specialists in 2028 and 2034 is expected to be significantly lower where there is a substitution effect resulting from the employment of Nurse Specialists and PAs in primary and hospital care. The impact of vertical substitution is likewise reflected in the smaller increase in required training inflows in 2028 and 2034 in scenario 3 when compared to the scenarios 1 and 2.

3.2.3 The United States (U.S.)

Health workforce planning is in the remit of the U.S. National Center for Health Workforce Analysis which carries out workforce projections [38]. It has developed a Health Workforce Simulation Model (HWSM) which estimates the future demand for and supply of multiple health professions, covering physicians, and taking account of NPs and PAs in primary care [48]. NPs and PAs have a long tradition in the U.S. By 2017, there were an estimated 166,280 NPs employed in the U.S. and 106,200 PAs, without counting the self-employed, hence actual numbers are higher [49, 50].

In the 2013 supply and demand projections for primary care physicians, NPs and PAs were included in order to estimate their effect on reducing projected primary care physician shortages [38] (Fig. 3). The supply-demand based model projected workforce, demographic and population-specific developments; as well as the expanded health insurance coverage implemented under the Affordable Care Act. The projections found that the demand for primary care physicians would far outstrip supply in the future. However the projected rapid growth in the number of NPs and PAs working in primary care was estimated to alleviate the projected physician shortages. Based on time series data, NPs and PAs working in primary care were projected to grow by 30% and 58% between 2010 and 2020.

On the advice of an expert committee NPs and PAs were estimated to provide services equivalent to 0.75 of a full-time equivalent (FTE) primary care physician (see Table 2). Hence, by including these mid-level providers, the projected shortage of 20,400 FTE primary care physicians in the physician-only model was reduced to 6,400 by 2020, a decrease of 69%. The

model thus showed that the increasing number of NPs and PAs could largely offset projected primary care physician provider shortages.

3.3 Policy and practice implications

Across the three countries integrating NPs/PAs into their workforce planning models, the implications for policy and workforce planning varied. In the Netherlands, multi-professional skill-mix scenarios (those that included NPs/PAs in the physician models) were considered the most realistic. The ACMMP therefore recommended that in future, smaller numbers of students to be admitted to medical training than would have been recommended on the basis of physician-only models. The ACMMP also projected that NPs/PAs could alleviate projected future shortages of GPs. However, the ACMMP serves in an advisory role to the Ministry of Health, and its recommendations are not always followed, for instance intake levels may be increased to provide a 'safety cushion'.

In Canada and the U.S., no direct changes in recommended student intake numbers or other policy and practice implications were identified, perhaps due to two reasons: the pilot character of the projection exercise in Canada and the nature of workforce planning in the U.S., which is based on projections with a mandate to inform policy-making but with no official mandate to directly recommend student intake levels.

Discussion

Of the eight countries covered in our study, Canada, the Netherlands and the U.S., included NPs and PAs in their workforce planning. In these three countries, the approaches ranged from testing new projection methods to full integration of NPs/PAs into workforce planning. In Ontario, a workforce simulation model for NPs was developed and piloted, though as stand-alone and single-profession method. The Netherlands and the U.S. demonstrated that where NPs and PAs are included in workforce planning, they can result in considerable differences in the projected numbers of GPs or medical specialists required in the future. Scenarios with NPs/PAs compared to physician-only projections were shown to reduce the estimated physician shortages in primary care in the Netherlands and the U.S. Moreover, in the Netherlands, the projected demand for medical specialists was also lower in the skill-mix scenario compared to the physician-only model. The reasons included the high levels of advanced practice of these mid-level providers and the anticipated growth in their numbers.

We identified few countries that included skill-mix changes in their workforce planning. These findings are generally in line with the previous literature [15, 19]. The OECD report found that out of 18 countries covered, five countries (Japan, the Netherlands, Norway, Switzerland, and the U.S.) cover multiple health professions [15]. The OECD study assessed vertical *and* horizontal substitution and covered more professions beyond NPs and PAs. The handbook on workforce planning methodologies published by the EU Joint Action on Workforce Planning concluded that most workforce projections focus on physicians only and fail to integrate the changing skill-mix and responsibilities of health professions into their models [19].

It is unclear why only three out of the eight countries which employ PAs and NPs in their health services include them in their workforce planning. In the U.S., PAs and NPs have been

employed since the mid-1960s and the workforce has now reached a considerable size, hence their inclusion in workforce projections. In Canada and the Netherlands, numbers have been smaller, but have grown rapidly over the last ten years [29]. In other countries numbers remain small, thus in New Zealand and Ireland, for example, NPs comprise only 0.3% and 0.2%, respectively, of the nursing workforce [29]. The reasons for the small numbers and indeed the differences in growth rates are not fully understood. They are likely to relate to employment conditions, lack of role clarity, and to resistance to their recognition and employment by those professional groups most affected by their employment.

A further reason for the lack of inclusion of NPs and PAs in workforce planning models is likely related to issues of data availability and quality. Not all countries with NPs and/or PAs have complete and accurate routine data on total headcounts, practicing professionals and FTEs. In England and Finland, for instance, since NPs and other advanced practice nurses are not a regulated profession requiring mandatory registration in that role, routine data are either not available or not complete [29, 51].

This study faces several limitations: first, profession coverage was restricted to NPs and PAs. Skill-mix changes and substitution for physicians by other professions was not covered. Second, country coverage was restricted to high-income countries in North America, Europe and Australia/New Zealand, other regions were not included, yet may be relevant due to the severe shortage of physicians in some of those regions, such as in many low-income countries. Finally, there was limited evidence on the potential for substituting physicians: In the Netherlands, while the estimates appeared precise (1-1.6% for GPs, 0.3-0.5% for medical specialists) in the projections, it should be noted that these are based on an extended process of cross-validating multiple sources. This includes reviewing existing studies, a consultation round among the medical professional associations, and a group discussion among experts from professional organizations, medical training organizations, and healthcare insurance. These expert groups (“Chambers”) function as occupation or sector-specific advisory boards of the ACMMP. They are deliberately composed of different stakeholders to balance interests in the complex task to generate estimations for the parameters (like vertical substitution) for the Dutch health workforce planning model. Experts of the Chambers are instructed and consulted to provide their estimations based on expectations what will happen in the next 10 to 15 years instead of what should happen according to their stake or mission.

There is a limited but growing number of studies that provide empirical evidence on the effects of “vertical substitution”. Research suggests that between 67-93% GP-provided activities could be provided by NPs [29, 52-54]. Yet, in practice there are often large variations and the quality of the evidence is limited, suggesting more high-quality evaluations are required, particularly in different country contexts. With an increasing number of countries early on in the process of implementing task shifting involving NPs, PAs or other mid-level providers, workforce projections could serve as a strategic instrument to visualise potential effects on the medical and other health professions. Some countries, such as the Netherlands, have begun to integrate new professional roles in their workforce planning, to account of the changing composition of the workforce. In order to improve the planning for a sustainable, people-centred workforce, countries could consider three interrelated strategies: first, to improve workforce data and intelligence that takes into account new professional roles and changing population needs; second, to quantify the extent of changes to the division of work between physicians and NPs/PAs (the extent of “substitution”) in different clinical

settings, and third, to evaluate the effects of integrated, multi-professional workforce planning methods on education, policy and practice.

Conclusions

Workforce planning is a mechanism that facilitates long-term planning and investment in the health workforce. Models need to adapt as the skill-mix of the health workforce evolves. Yet, few countries have integrated skill-mix changes into their workforce planning. Those that have integrated mid-level providers into their planning models have revealed considerable differences between physician-only and skill-mix model projections. Results suggest that physician-only models are likely to overestimate the extent of physician shortages. Given the rapidly growing numbers of NPs/PAs and their high levels of advanced practice, they should be fully integrated in workforce planning. The challenges facing such integration include the limited availability and quality of data. Moreover, to date few evaluations have been carried out of skill-mix versus single-profession projections of the accuracy of results and of differences in their impact. In order to plan for a people-centred workforce, countries should not only improve their workforce data and data on changing population needs, but also evaluate the effects of integrating new professional roles into their workforce planning models to better inform education, policy and practice.

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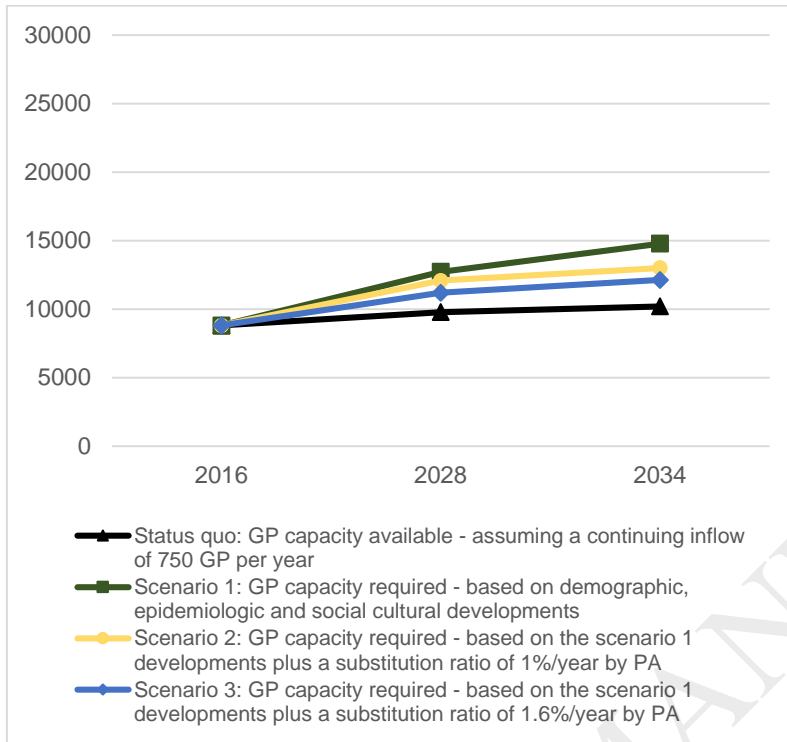
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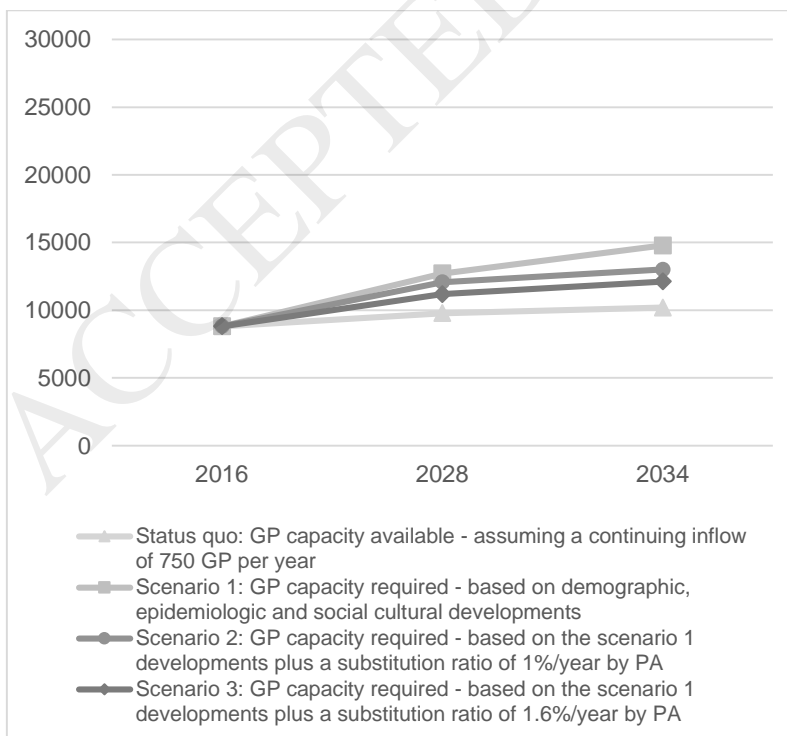
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---Fig. 1: The Netherlands: Projected future supply and demand for GPs, by three scenarios (FTE)---

colour: for online publication



Black and white: for print

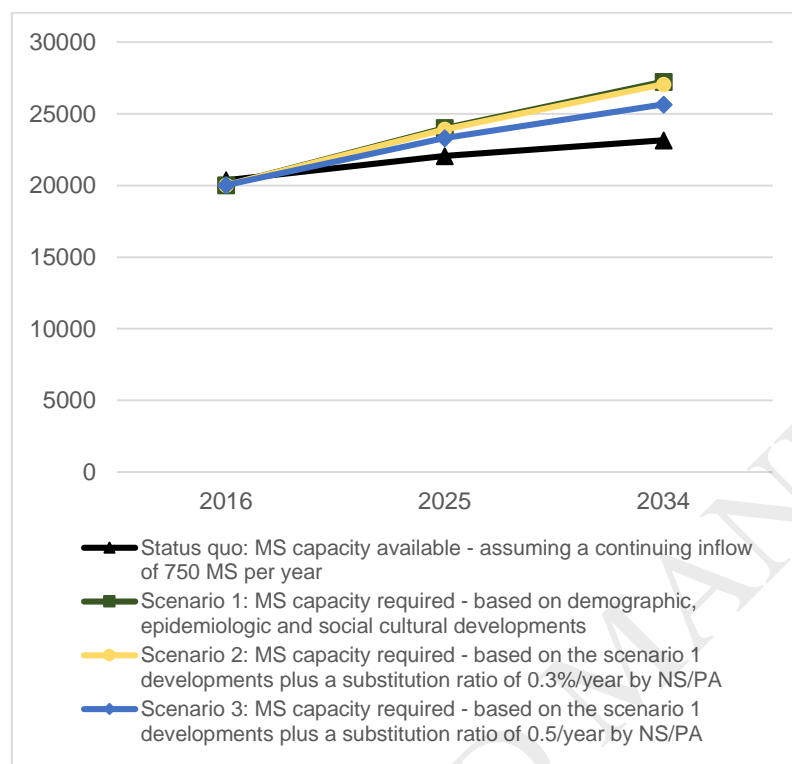


Source: authors' presentation, data from ACMMP [28, 47]. Notes: GP=General Practitioner, NS=Nurse Specialist, PA=Physician Assistant,

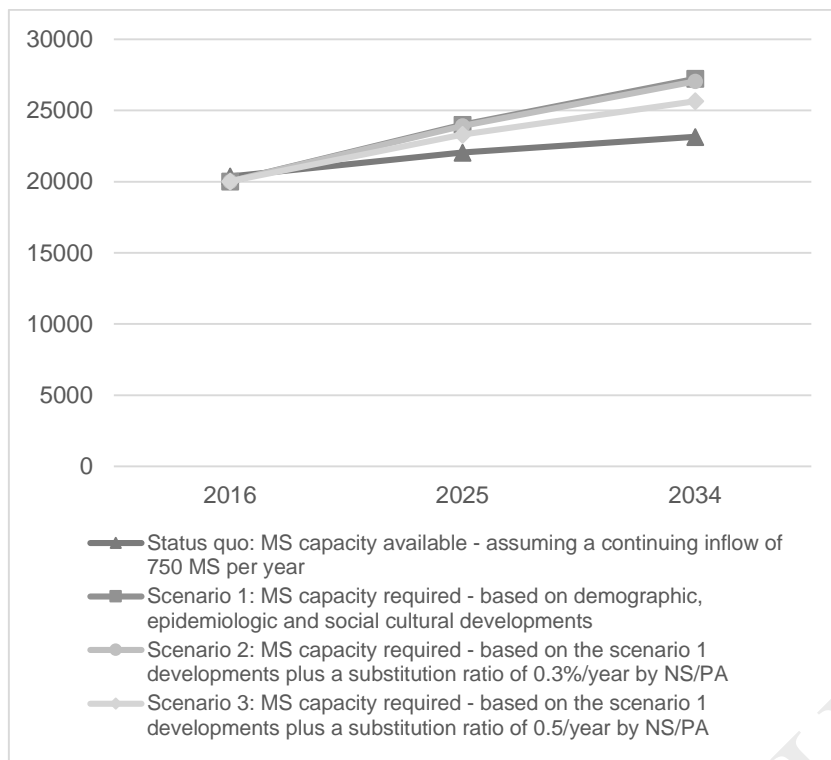
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---Fig. 2: The Netherlands: Projected future supply and demand for medical specialists, by three scenarios (FTE)

Colour: for online publication



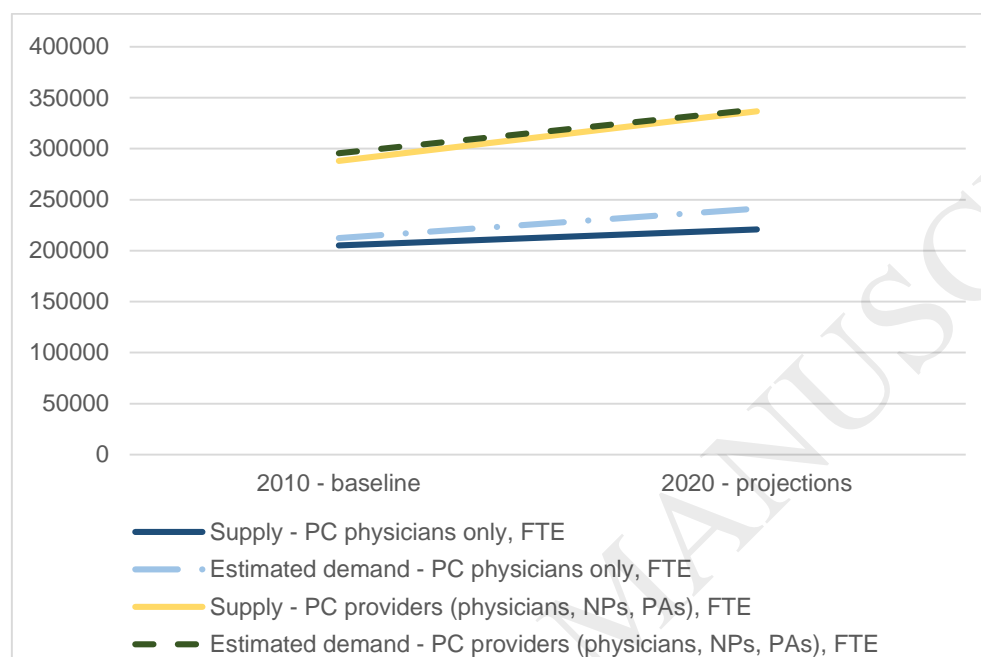
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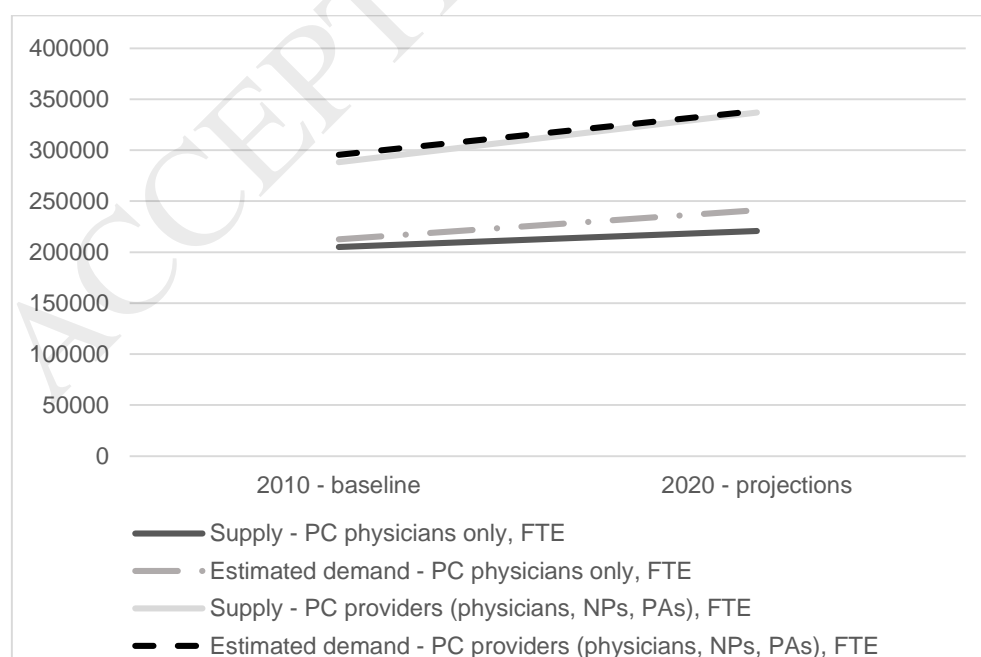
Source: authors' presentation, data from ACMMP [28, 47]; *Notes:* MS=Medical Specialist, NS=Nurse Specialist, PA=Physician Assistant

---Fig. 3: United States: Projected supply and demand of primary care physicians, comparison of physician-only and skill-mix scenario, 2010 and 2020 (FTE) ---

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Source: authors, based on the following data [38]. *Notes:* PC=Primary Care, NP=Nurse Practitioner, PA=Physician Assistant

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Tables 1-3

Table 1. NPs and PAs, data availability and inclusion in workforce planning, by country

Country	NPs exist [A]	NP routine data [B]	PAs exist [C]	PA routine data [D]	NPs/PAs covered in workforce planning/ projections? [E]
Australia	Yes	Yes	Yes	n/a	No (but relevance of NPs for planning highlighted)
Canada	Yes	Yes	Yes	Yes	Yes (NPs in one scenario, in Ontario), and NP simulation model (piloted in three provinces)
England (UK)	Yes	No [^]	Yes	n/a	No (but skills-based planning; and partial substitution of medical tasks by nurses/PAs/others referred to as option in the future)
Finland	Yes [^]	No [*]	n/a	n/a	No (although multi-professional workforce planning exists)
Ireland	Yes	Yes	Pilots	n/a	No (although Advanced NPs and other professions suggested to take up greater role in chronic disease management and reduce the requirements for GPs)
Netherlands	Yes	Yes	Yes	Yes	Yes (NPs, PAs)
New Zealand	Yes	Yes	Pilots	n/a	No (but relevance for workforce planning highlighted)
U.S.	Yes	Yes	Yes	Yes	Yes (NPs, PAs)

Sources: authors' compilation, based on [A] Nurse Practitioner or similar title [24], [B] [29], [C] Physician Assistant or similar title [27, 30, 31]; [D] [27, 32], [E] [17, 27-37]. *Notes:* NP=Nurse Practitioners, PA=Physician Assistants, n/a=not available (no evidence identified), UK=United Kingdom, U.S.=United States, [^]= titles vary, but nurses with Master's degree and prescribing authority are educated and authorised to work in advanced practice, ^{*}=data on nurses with Master's degree exist, but not all work in clinical practice.

Table 2. Type of workforce planning, inclusion of NPs/PAs in Canada, the Netherlands and the United States (U.S.)

<i>Country</i>	<i>Type of workforce planning</i>	<i>How are NPs/PAs providers included?</i>	<i>Extent of physician substitution (% used in model/assumptions)</i>	<i>Evidence level for "substitution"</i>
Canada (Ontario)	Needs-based	NPs in Ontario's 2010 needs-based planning	NPs: 40% productivity gain suggested if NPs work in family physician practice	n/a
The Netherlands	Demand-based	NPs/PAs in "Substitution scenario" (GPs/NPs/PAs) in GP planning NPs/PAs in "Substitution scenario" (Physicians/NPs/PAs) in Medical specialist planning	NPs/PAs: estimated to cover 1.0% to 1.6% of the future GP capacity per year NPs/PAs: estimated to cover 0.3% to 0.5% of the future medical specialist capacity per year	Cross validation of desk research (empirical studies, case studies), consultation of professional associations, and expert group consultation
U.S.	Supply-demand based	Physicians, NPs and PAs forecasts in one model	NPs/PAs calculated at estimated 0.75 FTE of primary care physician, discussed as strategy to alleviate PC physician shortage	Estimates, by expert committee

Sources: Canada [37], the Netherlands [16, 21, 28], U.S. [38, 39]; Notes: FTE=full-time-equivalent, GP=General Practitioner, n/a=not available (no evidence identified), NP=Nurse Practitioner, PA=Physician Assistant, PC=Primary Care, U.S.=United States