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Developing an integrated model of social and health care

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Abstract

The current project is devoted to building of a supply and demand model spanning health and social care using Occupational Therapists as an exemplar. The methodology used for modelling is based on the review of relevant academic papers, meeting with the stakeholders and existing practice of the Centre for Workforce Intelligence, the project's sponsor. The supply model, designed using the stock-and-flow approach, resulted in three possible scenarios depending on the changes in the education commissioning. The demand modelling appeared to be most challenging part of the project since there is no uniform model which can be applied to all the specialities and it is not clear what can be taken as current demand. The work related to demand in Occupation Therapy resulted in four models which represent very simplified real situation, however enable to estimate a the gap between the demand and supply. The analysis of predictions for the demand and supply has indicated that at the existing level of education commissioning growing demand for Occupational Therapy services could not be fully satisfied. The final part of the report suggests possible lines of action in order to overcome the gap between the supply and demand as proposals for further discussion.

Key words: *Occupational Therapy. Workforce planning. Supply. Demand.*

Acknowledgements

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1 Introduction

1.1 Research background

Our aim is to once again make the NHS the envy of the world.

David Cameron,
Equity and excellence: Liberating the NHS

Social and health care are labour intensive sectors which nowadays employ more than 3 million employees in the UK (1.4 million the NHS and 1.6 million in the adult social care, *Liberating the NHS: Developing the Healthcare Workforce*, 2010). It is crucial to ensure that these labour resources are used efficiently.

Currently the NHS is undergoing a set of reforms, the aim of which is mentioned in the epigraph to this chapter. Financial difficulties of the present system, poor health statistics and reported inefficiencies have led the Government to plan a major restructuring of the NHS and social care services. One of the inefficiencies of the current system is a lack of balance between the supply and demand of the labour force. For example, the report by Wanless (2002) states that the UK 'does not have enough doctors and nurses'. The report claims that the main cause of patient displeasure is long waiting times. It happens because social and health care systems face capacity constraints including insufficient workforce. This problem finds its roots in inadequate labour force and education commissions planning. The overall budget for training and education of medical specialists is over £5 billion (*Liberating the NHS: Developing the Healthcare Workforce*, 2010) and previously Strategic Health Authorities (SHAs) were in charge of allocation of this money. In the White paper *Equity and excellence: Liberating the NHS (2010),* the Department of Health (DP) admits that the current top-down management approach is not effective in case of workforce planning, and argues the necessity of greater autonomy for the employers and reducing its own role in the forecasting of training. With an objective to improve efficiency and overcome the current financial challenges of the NHS the White paper *Liberating the NHS: developing the workforce (2010)* establishes objectives for workforce planning and education, for example securing of supply, provision of quality training, adaptation to public demand, redesigning service models and widening the involvement of the public.

In order to achieve these ambitious objectives the Department of Health aims to delegate the planning of the workforce supply to health and social care providers. For this to be effective, the DH recognises that it is essential to supply local authorities with appropriate tools and has assigned the role of information and intelligence source to the Centre for Workforce Intelligence (CfWI), the sponsor of the current project.

This projects links to the overall activity of the CfWI to supply intelligence and analytical models. The aim of this particular project is to develop an example of a supply and demand model spanning health and social care for Occupational Therapists, and to assess the modelling results.

The White paper *Equity and excellence: Liberating the NHS* (2010) claims that interdependence between the social care system and the NHS is the key to obtaining better results for society and expresses an ambition of breaking down the barriers between the two sectors' funding. Considering this, the selection of Occupational Therapists as a type of health care specialists is not accidental. Occupational Therapists are an exceptional example of professionals whose skills enable them to work across borders of social and health care. Thus from the point of view of the modeller this speciality gives an opportunity to design an integrated model and could be an attempt to move forward with the Government interest in integrated care.

The main objectives of the current project are:

- Literature review of existing models and data sources;
- Production of an example supply and demand model spanning health and social care for Occupational Therapists;
- An assessment of the impact of the modelling results on the Occupational Therapy workforce.

The study will aim to build a model of supply and demand of Occupational Therapy workforce using methods developed by the Centre for Workforce Intelligence and gained from the research papers. That is why the initial part of the work will be devoted to literature review documented in chapter 2. The descriptive analysis of the current workforce (chapter 1.3) was performed in order to obtain understanding and insight of the current issues of the profession. Furthermore the project continues with

investigation and discussion of drivers of supply and demand for Occupational Therapy (chapter 3) which result in designing final models (chapter 4). Chapter 5 discusses the results of the modelling and analyses the gap between supply and demand of the Occupational Therapy workforce.

1.2 Sponsor background

The Centre for Workforce Intelligence was founded on 1 July 2010 as a body commissioned by the Department of Health. As the national authority on labour force planning, it provides recommendations and informational support for strategic scenario planning to the NHS and the system of social care. Performing research and analysis, the Centre specialises in three main areas, namely:

- Support of decision making in the health and social care systems, providing labour force intelligence and matching the workforce to the needs of the patients;

- Strengthening leadership throughout the system and support of senior leaders in charge of labour force planning;

- Being a source of best practice and providers of resources to develop the workforce planning capability at all levels.

During its short period of existence to date, the CfWI has developed a variety of analytical models and tools to support workforce planning across social and health care. For example, the CfWI recommended the optimal numbers of medical trainees and identified the risks of any imbalances in supply and demand for medical and non-medical employees.

The Centre for Workforce Intelligence aims to develop an integrated approach within both social and health care. Among priorities for the future the CfWI establishes improvement of the workforce modelling, including building up a supply and demand model for use across health and social care, and undertaking research on developing joined-up workforce strategies. Thus the current project and its objectives are dictated by the CfWI strategy and are in line with the CfWI business plan for 2011.

1.3 Current Occupational Therapy workforce: descriptive analysis

OTs are key to patient pathways and getting people out of hospital and back to the community, they are key integrators

David Cameron,
a speech on NHS Reform, 16 May 2011

The College of Occupational Therapists (COT) calls occupational therapy a philosophy that associates people's wellbeing with what they do. By occupation they mean any kind of activity an individual is engaged in. The official definition by the British Association of OTs is:

'Occupational therapists are health and social care professionals who help people of all ages carry out activities they need or want to do, but as a result of physical or mental illness, disability or being socially excluded, are prevented from doing'.

Occupational Therapists provide assistance for people who suffer disability because of accidents, aging problems or physical or mental illness. OTs help people in activities of daily life, including doing shopping or housework, caring for children or practising hygiene. Their methods include evaluation and treatment of physical and psychiatric conditions by practising certain activities to overcome disability and stimulate individuals' independence in all spheres of their lives.

OTs work in a variety of places including community centres, education institutions, hospitals, patients' homes, residential homes, prisons, and council departments. They perform their work in the following areas of care: mental health services, equipment for daily living, paediatrics, injury rehabilitation, learning disability, environmental adaptation (NHS Careers).

A course of therapy normally starts with evaluation and setting goals for the treatment, followed by personalized intervention by a therapist (including assessment of the environment and advice to relatives) in order to reach the set objectives, finishing with an evaluation of the outcome (DH 2002).

Occupational therapists play an important role in preventive care by decreasing the need for further longer term treatment which in addition saves a significant amount of

public funds. Another positive outcome of occupational therapy is enhancing human capital and creating a capable workforce.

OTs are regulated by the UK Health Professional Council and all practising specialists have to register with this professional body. Currently there are 25,395 registered occupational therapists in England (Health Professions Council, August 2011).

The OT workforce is distributed between those who work for the NHS, which is the major employer – more than half of currently registered OTs are employed by the NHS – and those who work for local councils and other organisations.

During the last five years of the previous century and the first five years in the current century there was an average annual increase of 600 OT employees in the NHS (Figure 1). Since then the growth rate has slowed down – up to 200 employees a year. The majority of OT staff working for the NHS in 2010 are female: almost 90% against 10% males.

Figure 1 Number of NHS OTs (FTE and headcount) during 1995-2010 period.
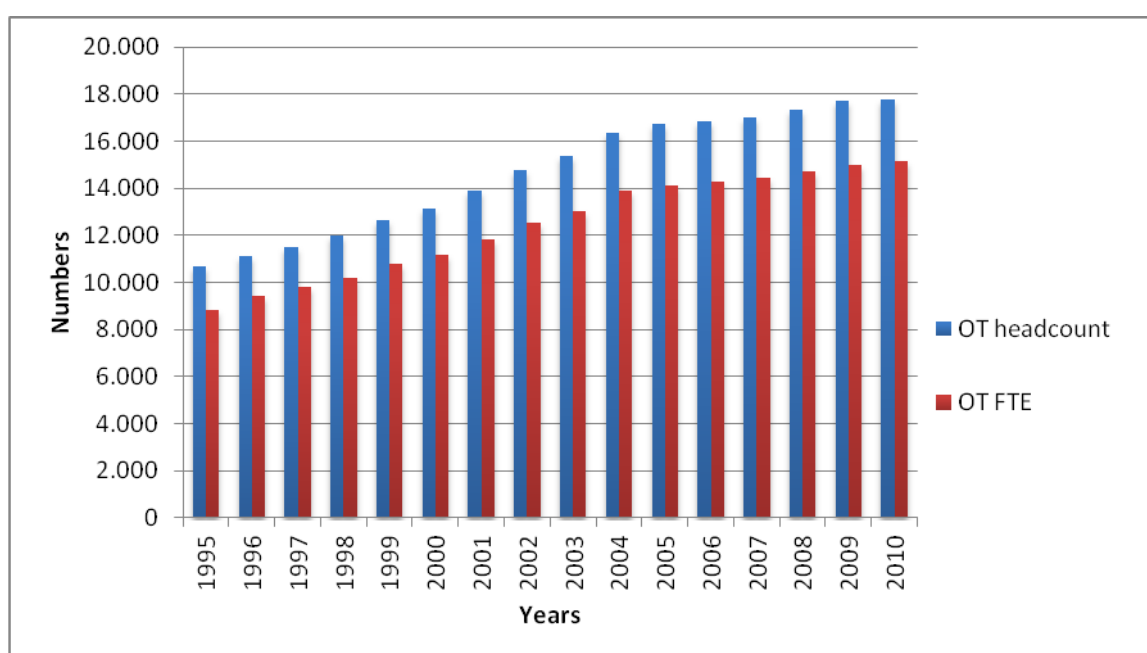
Source - NHS Information Centre, NHS staff numbers

In 2010 17,777 OTs worked for the NHS with almost 60% of them employed by Hospital Trusts and the rest – by PCTs. The labour force distribution by positions presented in Figure 2**Error! Reference source not found.** shows that the majority of practitioners were therapists and only 4% are managers.

Figure 2 Distribution of NHS OTs by positions in 2010
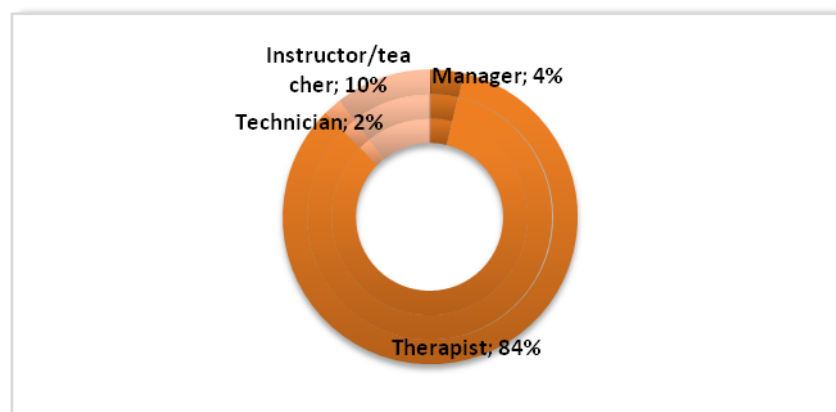
Source - NHS Information Centre, NHS staff numbers

The breakdown of OTs by Strategic Health Authority (SHA) area is presented in Table 1:

Table 1 NHS OT staff by Strategic Health Authority area

Strategic Health Authority area	Number of OT	% to total
North East	1011	6%
North West	2413	14%
Yorkshire and the Humber	1818	10%
East Midlands	1692	10%
West Midlands	1806	10%
East of England	1696	10%
London	2540	14%
South East Coast	1409	8%
South Central	1207	7%
South West	2185	12%
Total	**17777**	**100%**

Source - NHS Information Centre, NHS staff numbers

It can be claimed that on the whole, the OT workforce is uniformly distributed by SHA areas with a slight deviation due to differences in population in the relevant SHA areas.

The age profile of the labour force suggests that 65% of OTs in the NHS in 2010 (Table 2) are aged between 25 and 44, indicating a relatively young workforce.

Table 2 The NHS OT staff by age bands

Age band	Number of staff	% to total
Under 25	920	5%
25 to 29	2349	13%
30 to 34	2973	17%
35 to 39	2888	16%
40 to 44	2574	14%
45 to 49	2591	15%
50 to 54	1805	10%
55 to 59	1151	6%
60 to 64	433	2%
65 & over	93	1%
Total	17777	100%

Source - NHS Information Centre, NHS staff numbers

The number of OTs employed by local authorities has increased by almost 370 employees during the last twelve years.

Figure 3 Number of OTs in social services during 1996-2010 period
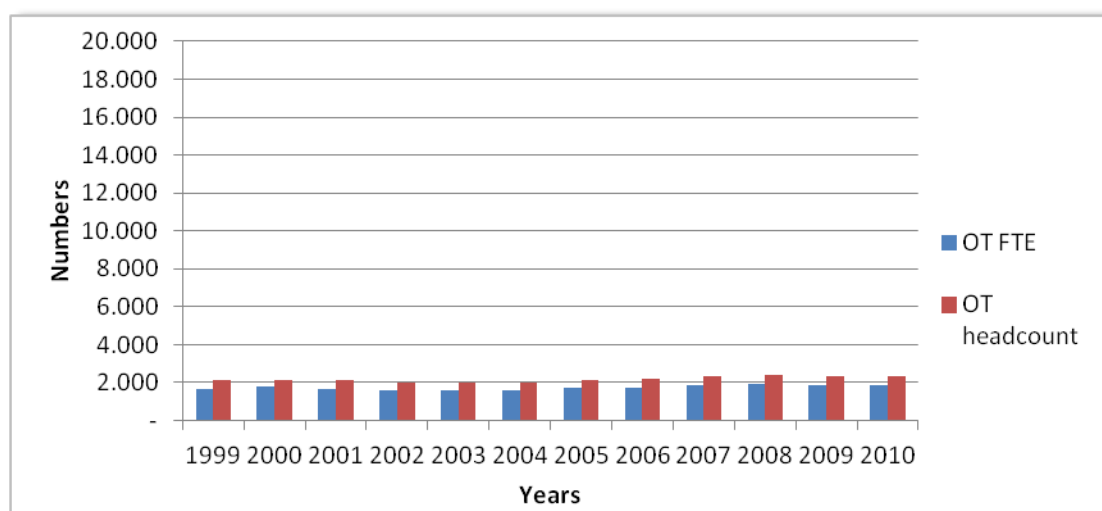
Source - NHS Information Centre, Adult Social care

The statistics indicate that in 2010 out of 2350 OTs working for local authorities the majority of them, 1510 (64%), provided adult social care services, 625 (27%) were involved in general practice and the rest – 215 (9%) were involved in services for children. Occupational therapists comprise only approximately 1.5% of the social care workforce, although they serve almost 25-40% of all referrals (COT 2008).

Likewise of the NHS staff, OTs in social care are predominantly women with a proportion of males of only 9% (NHS Information Centre 2010). Data from previous years shows that historically OTs in social care services were mainly involved in

adult care services. OTs in social services have traditionally focused on recommendations of equipment and adaptations (Riley et al. 2008).

The average participation rate for staff employed within local authorities is proximately 0.8 while for the NHS OTS it is 0.85, which may suggest that the NHS offers less flexibility for their employees. However with the predominantly female OT workforce the trend is increasing flexibility in working conditions and applying a family friendly working policy.

OTs acquire their unique skills and OT techniques through accredited occupational therapy programmes. These programmes are mainly funded by the NHS.

Nowadays after training occupational therapists are commissioned by Primary Care Trusts. According to the report 'Occupational Therapy in Adult Social Care in England' (Riley et al. 2008) in 2007 almost half of local authorities experienced difficulties in recruitment and retention of OTs in certain areas because of high living costs in these areas and higher salaries for the positions with local trusts. However participants of the survey mentioned the stable supply of recent graduates to joining the profession.

The current NHS reforms suggest certain changes which will affect OTs among others. In particular, OTs will be commissioned by consortia of GPs and Local Authorities (COT 2010).

Overall Occupational Therapy's philosophy corresponds to the Government's core ideas of person-centred care and sound health outcomes. The role of Occupational Therapists is becoming even more crucial with the introduction of the government vision of the social and health sector with accent on helping the public to be more independent (*Our health, our care, our say- Partial regulatory impact assessment 2010*).

Therefore, it is very important to estimate the population need for Occupational Therapists' services and to recommend how to respond to public demand in the most efficient way.

2 Literature review

2.1 Theoretical frameworks for workforce planning in healthcare

Workforce planning is the methodical evaluation of future human resources needs and the recommendation of the required actions in order to satisfy these needs (AMWAC 2003).

Healthcare workforce planning is defined as determination of 'the numbers, mix, and distribution of health providers that will be required to meet population health needs at some identified future point in time' (O'Brien-Pallas et al. 2000).

In simple terms, workforce planning assures that there is the right number of health/social care specialists with the right skills and managed in the right way and within the budget who are able to render services offering the best patient care (Skills for Health - Workforce Projects Team).

In general the market for the health care workforce is the meeting point for providers of medical services and patients. A key characteristic of the health care workforce labour market is that it is not self-regulating, but has strong interference from the state sector (Galvan et al. 2006). Both deficit and surplus in the health care market are undesirable. Undersupply of resources would make it impossible to satisfy the need of society for health care services, while oversupply would mean a waste of tax payers' money spent on wages and training of health professionals, as well as a negative social effect on unclaimed professionals. It is also suggested that oversupply of employees in the health care service market may lead to risk of creating demand by the workforce or danger that the labour force will lose its skills because of rare consultations (AMWAC 2003).

In the free market the balance of supply and demand is met at the crossover point of supply and demand. However, in a regulated and segmented market the supply is inelastic in the short term. Since at least the minimum level of medical services has to be provided, centralized planning is essential.

O'Brien-Pallas et al (2000) claims that the health workforce process consists of three phases, namely planning, production and management. According to a framework proposed by AMWAC (2003) the planning process may be divided into three stages:

- description of the current level of supply, the kind of services provided by the particular medical specialists, the recruitment and training process;

- evaluation of the sufficiency of the supply and the regional allocation of specialists based on a number of indicators such as international benchmarks, current trends in health, waiting times;

- prediction of the requirements and workforce supply for a specified period of time under various scenarios and discussion of likely changes in service delivery.

Relevant and accurate planning is only possible under the condition of availability of explicit and up to date information as well as the use of relevant conceptual methodologies and analytic techniques (O'Brien-Pallas et al, 2000). AMWAC (2003) adds to this list some other requisites essential to achieve successful employees planning (including a properly resourced organisational structure to manage the planning and stakeholder participation and their commitment to the planning).

The conducted literature review revealed three main approaches to the planning of healthcare human resources (O'Brien-Pallas et al, 2000; Investigation group of health economics 2007):

- needs-based,

- utilization-based,

- effective demand-based.

The needs-based approach evaluates future demand based on the estimation of undersupply of practitioners and potential coverage of the gap between needs and resources available. The approach is founded on the following assumptions:

- all the demand for health care service may and have to be satisfied;

- cost effective methods of meeting the demand can be detected and applied.

Under utilization-based approach the estimates for workforce supply are based on the current number of employees and population rates. In particular, in order to determine the supply of medical specialists, age and gender ratios for the current workforce are adopted to the size population and its demographic characteristics in

the future assuming that these ratios are appropriate and will remain the same in the future.

The overview of the labour force in health care planning in European countries performed by Bloor et al. (2003) has revealed that the utilization-based approach to planning is the most common one. Study has shown that in such countries as Australia, Germany, Sweden and France the forecast of the medical human resources is based on the current supply of doctors and changes in it including expected retirements and other leavers. As for demand, an estimation of the demand for health care employees is derived from expected demographic changes and the doctor / patient ratio which is assumed to stay the same.

The effective demand-based approach starts with an estimation of the available funding resources that will be allocated to finance the particular area of healthcare.

Apart from the aforementioned concepts a range of reports on health care modelling (AHWAC 2005, Investigation group of health economics 2007) discuss the applicability of Supplier Induced Demand hypothesis to the health care sector. The nature of the hypothesis comes from the economic notion of informational asymmetry: the provider (health professional in our case) has more information about the patient's health and is able to influence the demand for medical services for his own benefit.

2.2 Healthcare workforce supply and demand modelling in practice

The health care workforce market is a specific example of any other labour market which represents an interaction between demand and supply. Various techniques have been developed which can be applied to model demand and supply of healthcare workforce.

Spetz (2007) gives an overview of the demand forecast spreadsheet models. They can be split into three groups:

- ones that use employee-to-population ratios;

- the historical staffing method;

According to this approach for each age range patient days per 1000 inhabitants are calculated; then future patient days are derived from changes in population per age

group. The demand for health care workforce is the multiplication of hours per day by calculated patient days.

- the budgeted vacancies method which is almost the same as the historical staffing method except the fact that the forecasted patient days are multiplied by the budgeted number of specialists per patient day.

All of these methods are relatively easy in terms of calculation; however the assumption that current supply/demand situation will be adequate in the future make them deficient in accuracy. Besides, the drawback of such benchmarks is that it does not take into account the potential technological progress, changes in efficiency of work nor quality of services provided (Galvan et al 2006).

Benchmark approach was also utilized to forecast supply and demand of cardiologists in Spain (Galvan et al 2006). But unlike the aforementioned methods the Spanish study applied international benchmark ratio for their medical parishioners. In particular, in order to model the demand part the ratio established by the Ontario (Canada) planning office – 3.8 cardiologists per 100 thousand of population – was used as a point of reference. Based on this the need for cardiologists for four age groups: 0-14 years, 15-44 years, 45-64 years, ≥65, - was calculated. Furthermore, the need for cardiologists in the future was determined in accordance with forecasts of population decomposition.

A similar approach was used by American scientists to predict workload for surgical oncology; however they combined the demographic and epidemiological factors in their research (Etzioni et. al 2003). The analysts used the survey of inpatient procedures as the base source of data from where they derived the age breakdown of patients who had various cancer surgeries by type of surgery. This enabled them to obtain the incidence rate of the certain surgery per 10000 of population in each age band. Further after these rates were multiplied by population projections within each age band. That resulted in estimation of future utilization of cancer procedures and thus demand in oncological surgeons.

A number of studies in order to forecast demand for health care workforce attempted to turn the factors of demand and supply into numeric values and formulae.

As such Fabbria and Monfardinia (2009) developed an econometric model for forecasting of demand for services of physicians, which is initially based on Grossman equations. The model assumes that individual acts in order to maximize utility for each period of time, where utility being a function of independent variables such as spare time, health. Namely they tried to approach the dilemma which a patient faces when he needs to visit a physician and represented it with an equation:

$y_j = h^j$ (Price, Number of visits, Income; Health status, Waiting time),

where j=GP, Public Physician, Private Physician.

The researchers approached the problem as a regression model and used the data of the survey conducted by the Italian NHS. Among the main findings of the study is that the demand for public services does not depend on the income, and demand for private services does not grow in response to the income increase. Besides, the results showed that the consumers of private health care services are sensitive to waiting time, but rather tolerant to changes in fees.

National Health Workforce Planning and Research Collaboration (Scott et al 2010) also adopted a modelling approach using the notion of utilization.

They split utilization into two types: simple and complex. Demand is modelled as follows: Demand=Activitysimple*a+Activitycomplex*b, where a and b are respectively coefficients linking activity with demand. Actual demand will grow linearly in line with these rates. The supply model is approached as S_t=Sum of (Working hours at age group*Number of males at the age group+ Working hours at age group*Number of females at the age group), where t is a specific year. Change in supply takes into account inflow of graduates and immigrants and outflow of leaver and respective decrease in working hours per each group: male (t, age group)=(1-Proportion of working hours of leavers for male leavers at each age group)*Number of males in the age group + Graduates + Migrants.

However in order to forecast the need for radiography specialists, NHWPRC has simplified the model (Scott et al 2010). They assumed the constant growth rate for demand and supply. Afterwards NHWPRC performed a sensitivity analysis varying demand growth rate, university drop-out rate, exit rates for workforce - in order to estimate how critical they are.

Another best practice modelling was developed by American scientists in order to forecast supply and demand for endocrinologists for the period up to 2020 (Rizza 2003). Several types of modelling demand were proposed. First, an overview of how demand for endocrinologists services changed over the years and the reason for that was acquired from the National Ambulatory Medical Care Survey (NAMCS). Furthermore researchers conducted a survey of the members of the professional body of endocrinologists to enquire about waiting time for a visit and compared it to average waiting time to get an appointment for physicians in general which appeared to be twice as less. Based on this, authors concluded that there was greater demand for endocrinologists.

Afterwards scientists built up the basic equation model of demand and supply. Supply is modelled as follows:

$Supply_t = \sum N_{age,t-1}$ (1-mortality $_{rate\ age,\ t-1}$)*(1-retirement rate $_{age,\ t-1}$)+New joiners $_t$,

where $N_{age,t-1}$ stands for number of endocrinologists at time t-1 of specified age.

The demand model is presented by the following equation:

$Demand_t = Demand_{t-1}$(1+a(Change in managed care penetration rate between current and previous period)+b(Change in supply between current and previous period)+c(Change in per capita income between current and previous period).

where a – ratio connecting change in managed care penetration to change in demand; b – ratio connecting supply of competitive providers to change in demand; c – ratio connecting income per capita to change in demand.

Based on the literature review and estimations, authors of this research determined several potential values for the parameters in the model and drafted the lines of supply and demand based on it. The scenario which more reasonably represented reality was chosen as the baseline for further discussion.

Another feature of health care workforce forecast practice worldwide is scenario modelling.

For example, the Expert Group on Future Skills Needs (FAS 2009) developed a tool for healthcare workforce planning which is currently used in Ireland. The designed supply input-output model is presented in Figure 4:

Figure 4 Medical practitioners flows designed by the Expert Group on Future Skills Needs (FAS 2009)
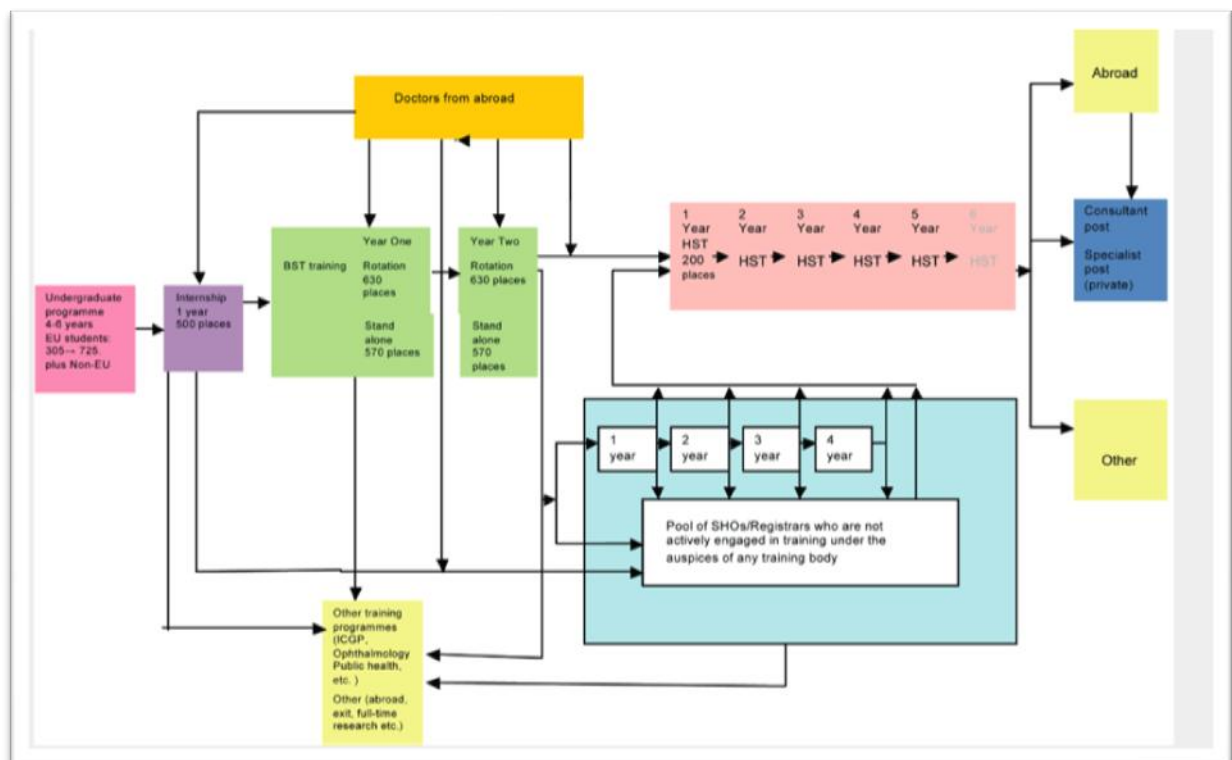
Source - Expert Group on Future Skills Needs (FAS 2009)

The demand modelling takes into account several possible scenarios:

- baseline scenario when the level of services provided by health care specialists stays the same, while the population grows;

- Scenarios when the headcount of medical workforce is increased according with certain proposals;

- Scenarios when it is assumed that more service will need to be provided to certain population groups (e.g. annual number of birth for midwives)

- Scenarios when densities are estimated for the only one area of service provision (e.g. physiotherapists employed in the public sector per total population).

The supply and demand models were applied by the Expert Group on Future Skills Needs to a range of specialists including medical consultants, general practitioner, speech and language therapist, physiotherapist, nurses and others.

A distinct approach to modelling supply and demand of the workforce is using a simulation technique. Unlike mathematical modelling which results in specific

solution, an iteration of simulation produces one of the potential outcomes. Besides simulation is particularly useful to experiment with various 'what if' scenarios (O'Brien-Pallas 2001).

O'Brien-Pallas (2001) describes a simulation model used to predict the demand for physicians in China during the period between 1990 and 2010. The model included three parts, namely population forecast; estimation of need for health care services and efficiency of workforce. The outcome of simulation based on estimated probability distribution was maximum, minimum and most probable value for each variable.

There are examples of health care workforce modelling which uses such an instrument as system dynamics.

Masnick and McDonell (2010) attempted to create a generic map for healthcare that could be transferred into a system dynamic model. The map includes three main elements: the population, which are the potential patients, the employees in healthcare, and the workload; this is presented in the **Figure 5**. Furthermore authors add a subsystem of Facilities and technology and Funds to the whole scheme thus completing the supply part.

Figure 5 Stock flow and population ratio model connecting workforce to requirements and skills mix
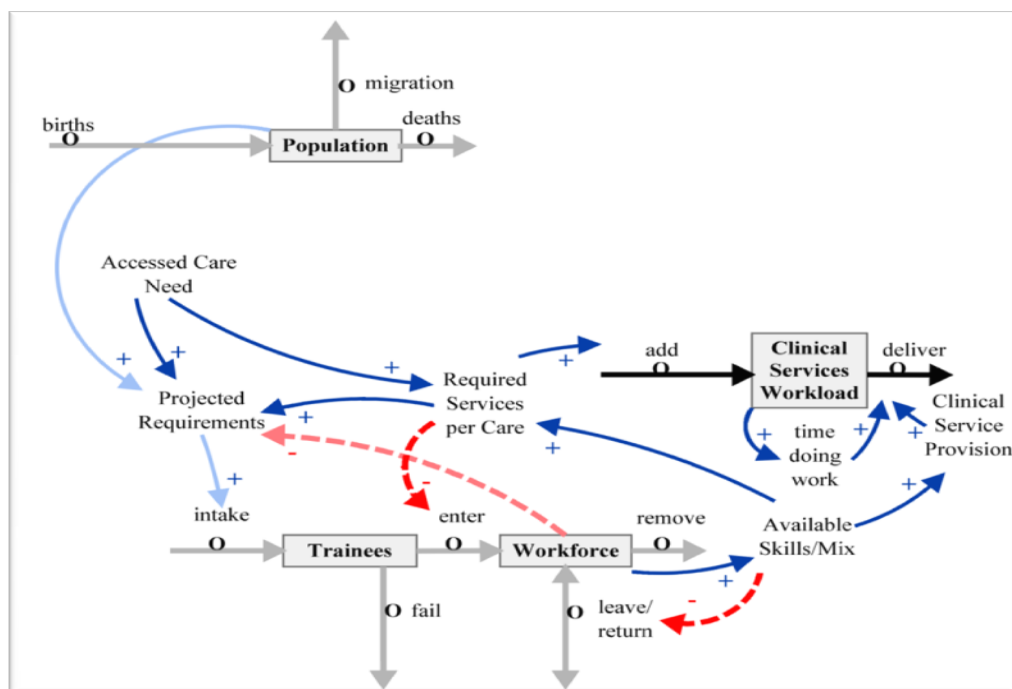
Source - Masnick and McDonell (2010)

In practice the system dynamics modelling is applied in practice to forecast the need for medical specialists in Spain (Galvan et al 2006).

Investigation group of health economics (2007) describes a study whose objectives was to evaluate the supply of services of 43 various types of medical specialists in Spain in 2006 and make a projection for the period up to 2030. Researchers develop the system dynamic model using Powersim Studio 2005 software. The study first designs the system using causal maps which incorporate specific variables and the interrelationship between them.

The map of the specialists supply (

 Figure **6**) starts with actual workforce structure in 2006 including age and gender distribution, and then incorporates recent graduates. After that specialists' demographical changes are determined using incorporation rates, retirement rates, and rates of mortality specific for each gender. Besides, the model incorporates the annual ageing of practitioners.

Figure 6 System dynamics model of supply.
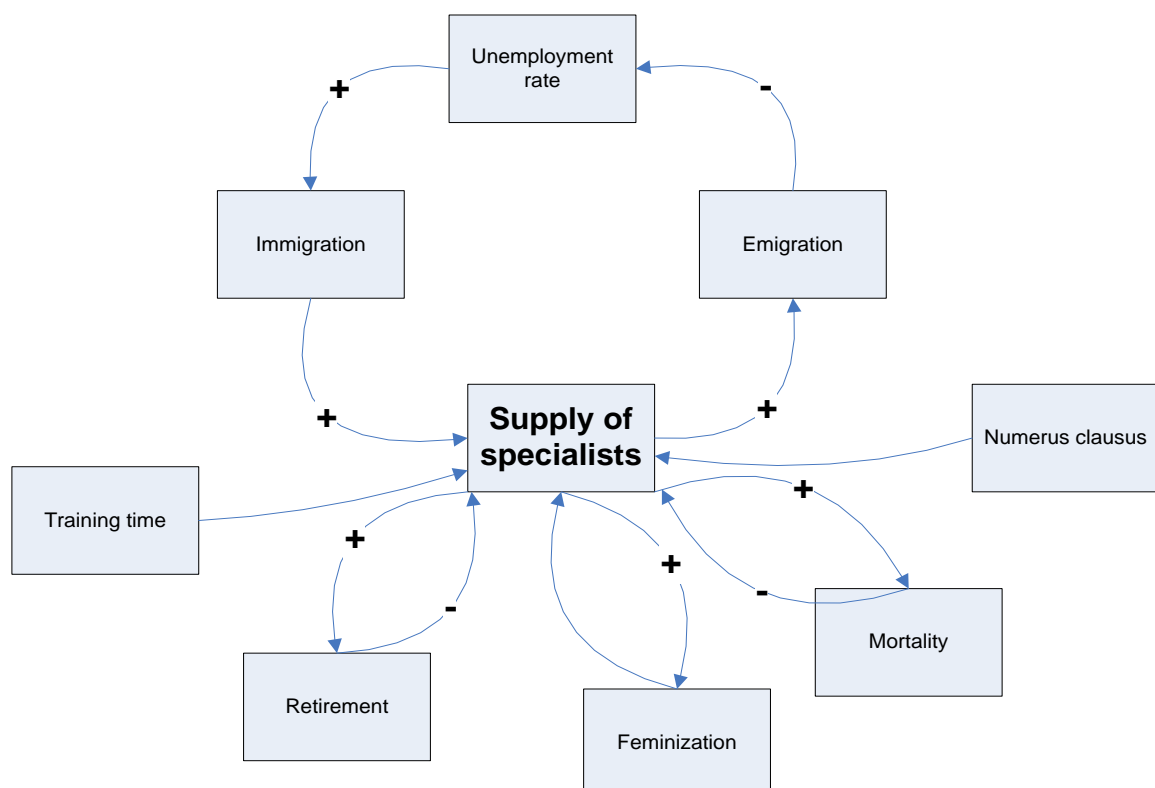
Source - Adopted from Galvan et al. 2006

The main outcomes of the model are calculated rates of medical specialists for 100 thousand inhabitants, proportion of women and percentage of medical specialists older than 51 for each year and speciality.

In terms of the demand model (

Figure **7**) the scientists incorporated different expected growth rates of demand and run the model for two scenarios that differ from each other by immigration assumption.

Figure 7 System dynamics model of demand.
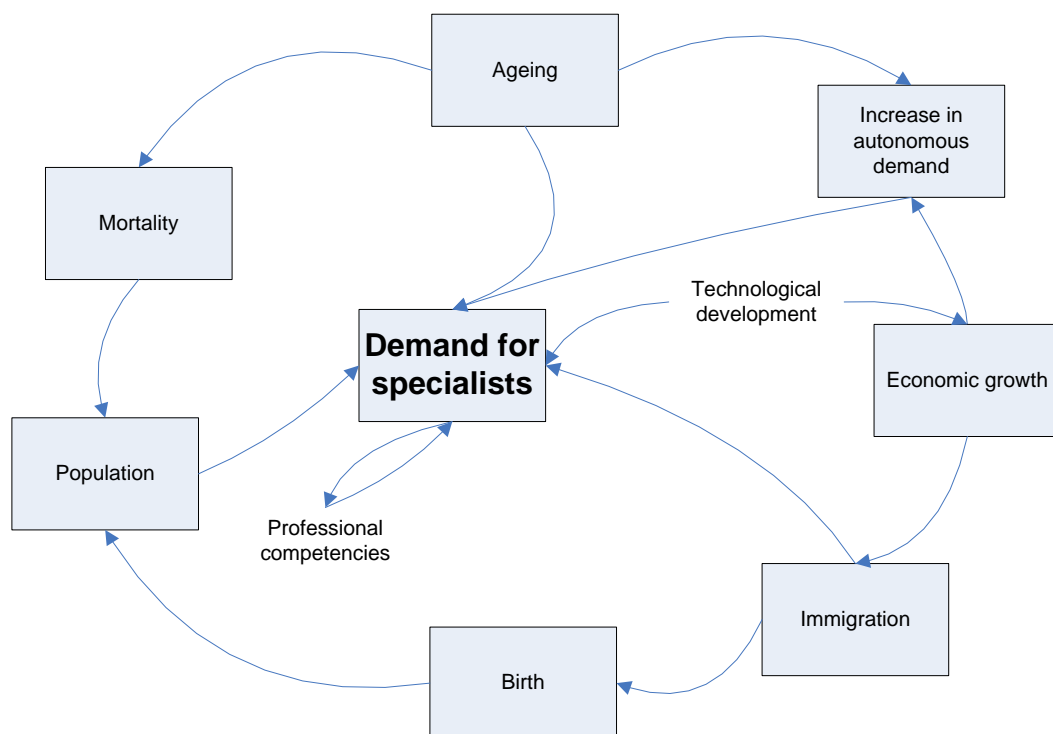
Source - Adopted from Galvan et al. 2006

The gap between predicted supply and demand is the base to project deficit or surplus in healthcare labour force.

As a summary of the review of modelling practices in healthcare certain conclusions have been made:

- all the model approximate reality and their adequacy mostly depend on the quality of data sources used.;

- the greater difficulty most researchers see in modelling the demand;

- the sensitivity analysis and discussion of alternative scenarios proves to be the way of scientific management of uncertainty and is worth performing (Galvan et al. 2006, Bolsworth et al. 2007);

- It is proved to be sensible to determine a margin to define deficit or oversupply in health care labour. For example, Galvan (2006) mentions that in Germany if less than 75% of necessary medical specialists there is deficit and if there is more than 10% of needed workforce there is a surplus. However, it is assumed that for the purposes of workforce planning slight oversupply of specialists, say +5%, would be beneficial. It would create competition in the market and unattractive geographic areas will not experience deficiencies in employing staff.

2.3   Health care workforce planning in the UK

Workforce plans in the UK are developed at various levels starting from the department level where they are built up by a division manager up to the Strategic Health Authorities (SHA) level where the plans presented by Primary Care Trusts (PCTs) and provider organizations are consolidated. The running reforms aim to introduce a new system for labour force planning including integration of planning, training and service (*Liberating the NHS: Developing the Healthcare Workforce*, DH 2010a).

National Workforce Projects developed a six step methodology which is supposed to be a guideline for health care labour planners across the PCTs and SHAs (Bolsworth 2007).

The workforce planning according to this framework is divided into six stages:

- Defining the Plan – including determination of the purpose of the plan, the scope and stakeholders involved;

- Mapping Service - defining current baseline, design of scenarios for service change and goals and estimated benefits of such change;

- Defining the required workforce – including analysis of activities and number of staff needed to complete the tasks

- Understanding workforce availability – includes estimation of current workforce and forecast with various initiatives for changing supply incorporated

- Developing an action plan – including gap analysis and development of further strategy;

- Action plan implementation and review.

Based on this six step methodology, the Centre for Workforce Intelligence has developed a range of demand models and stock and flow models to estimate supply of the workforce for medical and non-medical staff.

In the British modelling practice there are other attempts to build up demand and supply models (Bolsworth 2007):

- The AB model which links demand to the predicted level of activity in different health services and standard medical contact time. This model is based on the Treasury-Walness model that forecasts the level of activity in line with changes in population and epidemiology;

- The model by Southern Derbyshire Acute Trust which links increase in number of employees with service drivers;

- The model designed by Conrage consulting which utilizes productivity ratios from various trusts in order to set up a benchmark which leads to optimum staff numbers;

- The MOR model estimates the demand according to percentage growth of the following factors: growth in current activity (from change in population), supplementary activity to meet waiting time objectives, consequences of National Service Framework changes.

Bolworth (2007) notices that the drawback of these models is that they are not detailed enough to provide assistance for local planning of labour force. However, Bolworth (2007) concludes, they could build up a base for future design of planning tools.

3 Drivers of workforce demand and supply

3.1 Demand drivers

The demand in the occupational therapy services is mainly the need of population in these services. That is why in order to estimate demand it is crucial to understand the main demographic trends in England.

According to the National statistics England's population is predicted to increase by 9.52% by 2018 (Office for National Statistics 2009). Projection of population changes for England is presented in Figure 8.

Figure 8 England population projections.
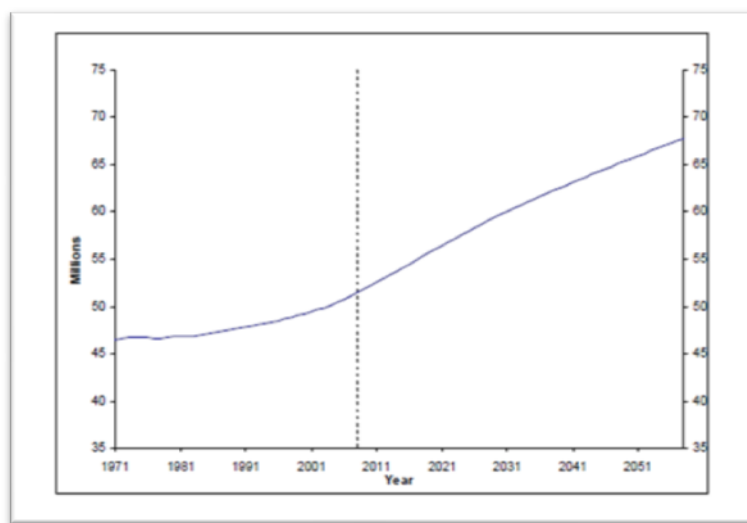
Source - 2008-based National Population Projections Statistical Bulletin - October 2009, Office for National Statistics.

Along with growing in numbers the population is undergoing through qualitative changes becoming more informed and educated. Technological progress affects the demand in the way that having access to information, patients nowadays appear to be more knowledgeable and aware of their rights. Rising expectations make more people request OT services as well as demand higher quality of services delivery. The role expansion requires OTs to work crosswise the boundaries between social care, medicine, physiotherapy and others which make the profession of occupational therapist evolutionary likewise any other.

Technology indirectly affects the supply part as well since technological advances will result in necessity of additional training and change in the way the services are

provided. The forecast for the future is that innovation in health care will continue (AHWAC, AMWAC and AHWOC 2004).

Thanks to technological progress people who have not been treated previously could receive service with the help of new technology.

That is one of the reasons the structure of England's population is foreseen to change: as it can be noted in Figure 9 the proportion of older people is rapidly growing. Ageing population is a wide-spread trend all over the world. The World Health Organisation (WHO 2011) claims that this tendency can be claimed to be a triumph for public health and socioeconomic development from one point of view, but on the other hand the impact of ageing on health may be colossal which challenges countries to adjust their health and social care capacities. In 20 years almost 40 per cent of England's population in comparison to 34 per cent in 2009 will be older than 50 years old while the number of people aged 80 or more will double (The Audit Commission 2008).

Figure 9 Percentage age distribution, England and Wales, 1971-2058.
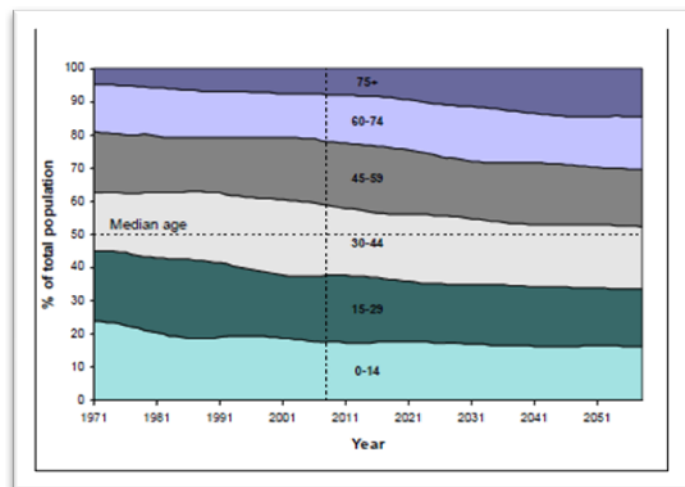
Source - 2008-based National Population Projections Statistical Bulletin - October 2009, Office for National Statistics.

Thus the growing and ageing population is the first sign of rising demand for OTs' services.

Having dealt with demography in general, in order to understand the specifics of demand on OTs it was decided to analyse what is happening in the areas of practice of OTs.

According to the College of Occupational therapists OTs work in the areas listed below.

1. Mental health (including substance misuse and eating disorders, excluding dementia)
2. Dementia care
3. Learning Disabilities
4. Long Term conditions (including HIV, stroke and neurology treatment)
5. Long Term Conditions (including neurology, stroke, HIV, respiratory, rheumatology)
6. Older people, prevention of falls
7. Accidents & Emergencies
8. Disabled Children (include autism, acute hospital admissions etc.)
9. Armed Services rehabilitation
10. Orthopaedics/musculoskeletal
11. Oncology and Palliative Care
12. Prisons
13. Social care (including assessment of equipment and adaptations, reablement, complex housing needs assessments, blue badges)
14. Hand therapy
15. Care Homes
16. Working with the homeless
17. Work rehabilitation; sickness management

The COT provided an approximate breakdown of employees working in each area. Based on this, for major areas a brief overview of legislation, social policies and statistics was performed.

- **Dementia & carers**

Figure 10 suggests that over the next 15 years the number of those who suffer from dementia will significantly increase.

Figure 10 Number of sufferers from dementia in England per age bands.
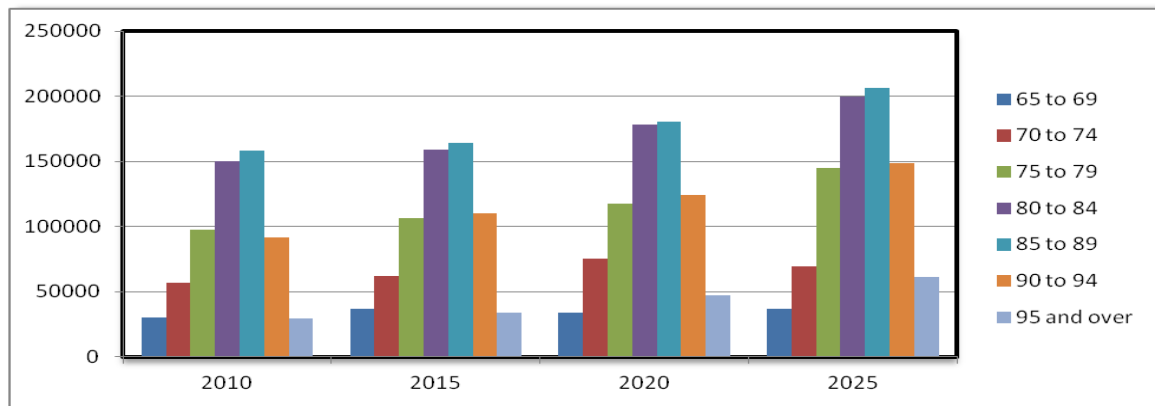
Source - adapted from Gyles Glover, Estimating the future number of cases of dementia in PCTs and upper tier local authorities in England

Living well with dementia - a National Dementia Strategy (DH, 2009) has established an ambition for transforming dementia services aiming to improve awareness of dementia, anticipative diagnosis and quality treatment. Occupational Therapists may be of a great help for people who suffer from dementia: ten sessions of therapy have proven to improve the functioning for more than three months (COT).

- **Mental health**

By creating purposeful daily routine and balancing various work and leisure activities OT work across health and social care, paying attention both to physical and psychological health. This comes in line with *Mental health act* 2007 and *No health without mental health* (DH 2007a) framework who establish a vision of government strategy in mental health and set up a goal of achieving equilibrium in treating physical and mental health.

According to the Mental Health Minimum Dataset (MHMDS) the number of occupational therapists contacts from members of the community with mental health problems have increased from k1,042 in 2003/2004 to k1,342, in 2009/2010, which makes up 11.3% of all contacts.

- **Stroke recovery**

Strokes could seriously damage the wellbeing of the individual, distress socializing and mobility; they may lead to the loss of cognitive skills and sight, affecting health in the long term. 85% of strokes happen to people who are older than 65 years old and

stroke is the single greatest reason for adult disability (*National Stroke Strategy*, DH 2007b).

The incidence of stroke has increased over recent years: while in 2004 there were k134 cases across England and Wales (Stroke statistics Resource sheet, 2004), in 2010 there werek82 (DH 2010; Wales Government 2010).

Skills of occupational therapists are crucial to assisting the rehabilitation of those who have suffered from stroke both in hospitals and after transfer to home.

National Stroke Strategy (DH 2007b) along with other goals highlights the importance of appropriate staff levels. It sets as an objective for local areas to plan for and expand stroke-skilled labour force which includes occupational therapy specialists. The framework *Occupational therapy following stroke* (DH 2007c) provides details the role of OT in caring for stroke patients: OTs assisting in acute care (48 hours after attack), during intensive rehabilitation, and further during long term rehabilitation. In particular, researchers claim that there is a need of an OT for 10 patients in acute care; 1 OT for rehabilitation care; for treating patients in the long term – 1 OT for 15 patients. Besides, there should be one OT for each stroke service, for each local authority social services and 1 consultant and 1 clinical specialist for each trust or stroke service.

- **Falls prevention**

According to the World Health Organisation, falls are the second major reason of incidental injury death mainly affecting population aged over 65. The role of OT is centred on both prevention of falls and treating people who have suffered from falls: treatment includes forming safer environments and strengthening bones and muscles. It was proved that intervention of a professional may significantly decrease the incidence rate of falls (Logan et al. 2010).

The National Service Framework for Older People standard 6 (DH 2001) sets a goal of decreasing the number of falls and highlights a special role of OT to assist in this planning to expand the role and increasing the number of staff.

- **Older people**

The fact that the UK has an ageing population and high costs of care and treatment of older people (the NHS spends almost half of its budget of treatment and care for

people who are over 65 years old) have led authorities to assure the quality and efficiency of health and social care services (NHS History). Launched in 2001 *the National Service Framework for Older People* (DH 2001) introduced a strategy for integrated health and social care services for elderly people.

The framework divides the older population into three groups:

- Entering old age – this group consists of people who are between 50 and 70 years old. The objective of health and social care policy here include encouraging an active healthy lifestyle.
- Transitional phase – people who are normally 70-80 and are in transition between active lifestyle and weakness. It is crucial here to identifying appearing problems beforehand and make sure the appropriate measures are taken.
- Frail Older People – the most vulnerable group, those who are in their late old age and may suffer from dementia or stroke. Health and social policy here should be designed in order to solve arising problems and help maintain quality of life and autonomy.

The framework establishes standards that cover such areas as person-centred, hospital and intermediate care, actions to prevent stroke and falls incidence and healthy lifestyle for elderly people. The key theme of the framework is that health and social care services should be provided regardless of age, nationality or ethnicity of the patients based on clinical needs and being equally available to everybody including individuals with mental health problems.

The framework mentions that in order to archive the above stated aims it is crucial to have more skilled staff including allied health professionals, ensure specialised training is provided and take actions to retain staff.

- **Accident & emergency**

From April 2009 to March 2010 there were almost 21 million cases (4% more than the previous year) of attendances at A&E departments (DH 2010a). The role of OT in such departments includes estimation of a patient's mobility and assistance in daily life activities. Their services result in significant savings because of admission avoidance and decreasing time spent in hospital for a patient.

- **Long term conditions**

Better treatment of people with long-term conditions including those who suffer from arthritis, diabetes, dementia, asthma, and depression has been among priorities of the NHS since 1990 (Goodwin et al. 2010). Approximately 17 million people in the UK consider themselves as having long term conditions, which account to more than 60–80% of GP visits (COT). Since the population is ageing, long term conditions will continue to grow.

Assisting individuals to take responsibility of their well-being is a pivotal idea of the White paper *Our health, our care, our say: a new direction for community service* (DH 2006a) and a range of the DH guidelines.

The DH guidance *Transforming Community Services: Ambition, Action, Achievement. Transforming Services for People with Long Term Conditions* (DH 2010b) claims that community services are the base of healthcare and lists ambitious objectives to innovate services and improve health outcomes.

Both *Your Health, Your Way – a guide to long term conditions and self care NHS choices* (DH 2008) and *Supporting People with Long Term Conditions – An NHS and social care model to support local innovation and integration* (DH 2006b) promote the idea of creating an environment where individuals may care for themselves. This may be archived by providing necessary information so that individuals assess their wellbeing, take necessary medicine, and recognize symptoms by themselves. The key person here is a member of staff equipped with skills to teach the principles of self-care.

Allied Health professionals, including OTs, are perfectly located to enrich the wellbeing of individuals with long term conditions, which in sequence makes a positive impact on health and social care expenditure.

- **Learning disabilities**

Research by the University of Lancaster estimated that there are approximately 16,000 adults in England who suffer from profound intellectual and multiple disabilities (Emerson 2009). This number is predicted to grow by 1.8% annually to 2026 (Mansell 2010) and follow the trend shown in Figure 11.

Figure 11 Estimated number of adults in England with profound multiple learning disabilities in 2009-2026
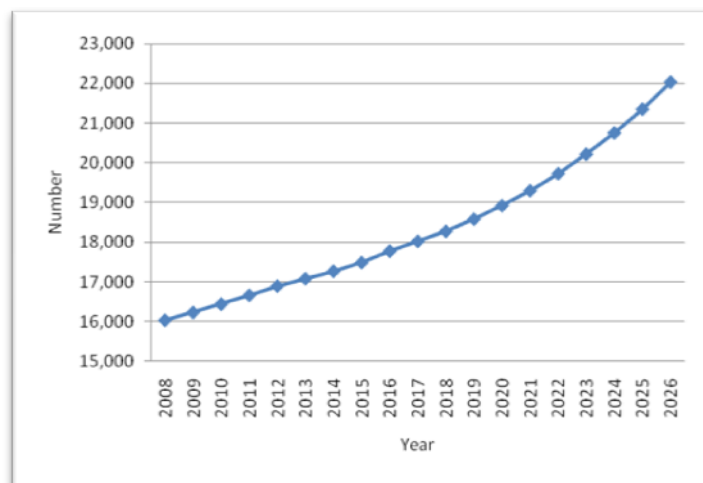
Source - Mansell 2010

Including individuals with learning disabilities in all aspects of community life has been listed as one of the Government's social policy priorities and is highlighted in the White paper *Valuing people now* (DH 2009).

Government policies regarding individuals with learning disabilities have an impact on the occupational therapists. Many of the results of occupational therapy interventions are directly related to the main concerns in those policies.

This is detailed in the research by Lillywhite et al. (2010). The study claims that OTs have a special role and perspective from their education which helps them to estimate the scope of disability and elaborate a long term programme to overcome the difficulties.

- **Disabled children**

National Service Framework Disabled Child Standard, *National Service Framework for Children, Young People and Maternity Services* (DH 2004) establishes a paradigm to support the well-being of children with complex health needs. The standards mention the necessity of OT assessment for such a child as a part of the overall development delay assessment and underlines the importance of OT intervention.

- **Reablement**

In recent years the demand for OT in social services has been significantly high. For instance, during 2007 34% out of all referrals for reablement services make up referrals for OTs (DH, COT, 2008). The DH guidance *Transforming Community Services: Ambition, Action, Achievement Transforming Rehabilitation Services* (DH 2009) lists occupational therapists as an essential element of community rehabilitation services. This fact reaffirms the high demand for OT's reablement services.

The overview of areas of OT's occupation has demonstrated that there is a stable and even gradually rising demand for OT services. The government's social policy in the form of frameworks, guidelines and the White papers makes the public more informed about benefits of OT's intervention, thus stimulating the demand more.

3.2 Supply drivers

The supply of occupational therapists is determined by a range of factors including the cross sector income, potential substitution, and duration of training. The supply of labour force for OT consists of additions-joiners and deductions-leavers. The issues related to human resources supply are summarised below.

The current stock of occupational therapists is the key determinant of future supply. Descriptive analysis performed in Chapter 1 states that the number of 2010 workforce employed by the NHS and local authorities is 20,127 professionals in terms of headcount and 17,032 full-time employees (FTE or WTE). The participation rate demonstrates the connection between available labour force (measured by headcount) and effective labour force (measured as whole-time employees) and is calculated by dividing the number of FTE by the headcount. For OTs working for local authorities the participation rate is 0.85 while for NHS staff it equals to 0.80 in 2010, which gives an average rate of 0.83. The trend for participation rate is declining due to increasing flexibility of working patterns (Tomorrow's workforce: a strategic framework for the future, NHS 2010).

The largest inflow to occupational therapists' workforce consists of recent graduates from programmes which have been mentioned in Chapter 1. Nowadays there are a range of accredited courses of different duration:

- full-time three-year BSc;
- part-time four-year BSc;

- full-time work-based two and a half years BSc;
- a two year Master's degrees or postgraduate diplomas.

The minimum requirement to become an OT is a BSc in Occupational Therapy which is a three year long course and this the most common duration. Thus three years is time lag between the commissioning of posts in universities and the production of therapists.

In order to obtain the figure of the joiners to OT practise, the number of commissioned students is adjusted by the attrition rate and percentage of those employed by the NHS and Local authorities.

Another source for addition to OT labour force is returns to practice. The College of Occupational Therapists issued a special guide for those who want to join the profession after a period of absence (COT 2010). The guide mentions that returners are a valuable resource to the profession as they bring their previous working experience as well as life experience. The guide specifies requirements for those who are willing return to practice with the NHS after more than two years' break: they have to undertake a training course of one or two months in order to update their knowledge.

Another source of new joiners is net immigration. The UK Border Agency lists data on entrants to the UK who work in the health and social care sector, but do not provide any details on particular speciality. The World Federation of Occupational Therapists report (2008) on employment requirement for OT in different countries states that the foreigners who want to be an OT in the UK have to graduate from an institution authorized by WFOT, have at least two years of experience and a good command of English. Review of requirements for OT in other countries mostly include a diploma and sometimes certain years of working experience which enables specialists from the UK to apply their skills working abroad. According to WFOT 612 specialists applied to work in the UK, out of which 265 were authorized to work as an OT (WFOT 2010).

One of the sources of the outflow of workforce is retirees. The age profile of the OT workforce suggests that there is no fixed age for retirement and employees may decide to stay working for a longer period of time. A large proportion of staff in the elder age band is expected to retire by 2012 because of the new pension

arrangement (South East Coast NHS 2010). This alleges a risk of deficit of skilled employees to train new joiners. The number of retirements may be predicted by making an assumption about the average retirement age and applying this to the age profile of the existing and future workforce.

Considering labour supply it was decided that labour substitution is not applicable to the area of occupational therapy due to the specificity of skills required.

Losses from the labour force also include deaths. However, data on the number of deaths is not available.

Another factor to take into account for estimation of the supply is vacancy rates.

Vacancy rate is a ratio calculated by division of listed full-time equivalent vacancies at a certain period of time by the sum of these vacancies and current FTE workforce.

A three-month vacancy is estimated by the division of vacancies which lasted three months by the sum of existing FTE staff and number of 3-month vacancies. Thus the 3-month vacancy ratio indicates the proportion of positions which employers find difficult to fill. Occupational therapists vacancy and 3-month vacancy rates are presented in Table 3 below:

Table 3 Vacancy rates for OTs within NHS in the last 5 years.

Year	3 month-vacancy rate	Total vacancy rate
2005	3.4%	
2006	1.6%	
2007	0.7%	
2008	0.5%	3.6%
2009	0.7%	4.2%
2010	0.5%	2.6%

Source - NHS Vacancies Survey - 2010

Overall the 3-month vacancy rate is decreasing during the last five years due to the freeze of some vacant posts and overall government policy aimed to cut costs (COT).

3.3   Adequacy of supply and demand

An estimation of adequacy of labour force was undertaken in order to find out how supply and demand are currently balanced. For this purpose a set of indicators proposed by AMWAC (2003) was used: for each indicator (in case it is applicable to OTs) its current value was estimated or compared to international benchmarks (Table 4).

Table 4 Summary of indicators of medical workforce shortage and oversupply continued

Indicators	Estimation for Occupational therapists	Source/Comment
Vacant positions	400 at 31 May 2010 (The NHS Information Centre for health and social care Vacancies Survey 31 March 2008 to 2010); 3-month vacancy rate – 0,7%, however it is claimed that vacant posts became frozen.	An indicator of immediate shortage; World Federation of Occupational Therapists (WFOT) has not listed the UK as a country with a shortage of OT (Human resource project, WFOT, 2010), however the report indicated the lack of experienced specialists
Elective surgery waiting time/clearance time;	Non applicable	
Consultation waiting time and patient access;	Many people experience difficulties with accessing an occupational therapist mainly because services are provided to patients with severe health problems	From meeting with an occupational therapist and lecturer in OT at the University of Southampton
Excessive work hours	A British Association of Occupational Therapists UNISON survey in October 2008: 21% of respondents replied that the workload has increased over the last year. BAOT intelligence argues that in 2009 there would be a further increase.	CfWI (2010) Workforce risks and opportunities summary – Occupational therapists (unpublished report)
Price of service/level of co-payment;	Non applicable	
OT/population ratio	4.3 per 10,000 population in 2010 (total practising workforce in terms of headcount)	Almost the same as in the Finland, Norway (WFOT) – countries with a similar health care system.
Service substitution Quality of service provision Views of practitioners in the workforce under review	In some areas of OT work was delegated to specialists without OT qualifications whose approach is not person-centred and checklist-based. OTs nowadays receive less autonomy and face constraints which prevents them from applying a creative and individualistic approach to their patients.	From meeting with an occupational therapist and lecturer in OT at the University of Southampton

The findings have shown that the current demand is not effectively met and there is more need for the services of OTs than existing provision.

4 Supply and demand modelling

4.1   Data sources

The data used for the model is mainly official statistical data. Of particular use were statistics from the NHS Information Centre (NHS IC) which is a central authoritative source of information regarding health and social care information that collects data regarding NHS staff, social care workforce, primary care and hospital care.

Furthermore, a number of meetings were held in order to agree the model assumptions and get an idea on modelling overall and OT workforce specifically.

Certain assumptions were confirmed as a result of the meeting with representatives of the College of Occupational Therapy, and the future trends in the OT practice and training were discussed. The Director of Operations of the College provided a full list of areas of care where OTs are involved for the purposes of demand estimation.

Specialists within the Care Life Cycle Group at the University of Southampton deal with issues of supply and demand in the market of health/social care for the ageing population. The researchers kindly agreed to share some of their experience and provide advice for demand modelling.

Another meeting held was with the lecturer in Occupational Therapy from the University of Southampton, who worked as an Occupational Therapist for 31 years. This meeting provided an opportunity to hear the professional judgement of the current imbalances between society needs in OT and the existing workforce.

The summary of data sources accessed in order to build a supply and demand model is presented in Table 5.

Table 5 Summary of data sources

	NHS Occupational therapists	Occupational therapists working for Local Authorities
Supply		
Headcount and Full-time equivalent staff numbers	NHS Informational centre, 1995-2010; NHS Staff numbers database	NHS Informational centre, 1996-2010; Adult Social care database
Commissioning data	Historic data from CfWI; MPET - NMET Commissions by SHA	
Attrition rate	Agreed with the representative of College of Occupational Therapy	
Percentage of employed graduate by NHS and Local Authorities	Agreed with the representative of College of Occupational Therapy	
Returners to practice	Agreed with the representative of College of Occupational Therapy	
International recruitment	Agreed with the representative of College of Occupational Therapy	
Age profile of OT staff	NHS Informational centre, 2008-2010; NHS Staff numbers database	Not available
Number of retirees during 1996-2008	Historic data from CfWI	Not available
Demand		
Population projections for 2011-2031	Office of National Statistics; 2008-based National Population Projections Statistical Bulletin - October 2009	
3-months vacancy rate	NHS Informational centre; NHS Staff numbers database	
Number of registered OTs	Health Professionals Council	
Additional workforce due to extra funding (154 OT)	College of Occupational Therapy: Half of 152 PCTs and 155 local authority social services organisations will need an additional OT	
Population per Strategic Health Authority	Office of National Statistics; 2008-based National Population Projections Statistical Bulletin - October 2009	
Number of OTs per Strategic Health Authority	NHS Informational centre; NHS Staff numbers database	

Explanation of calculations and sources used for to build the demand model 3 are provided in Appendix 1.

4.2 Assumptions

For the purposes of modelling, certain assumptions were made. Overall the model assumes that the demand and supply of workforce is independent ignoring the supplier-induced demand theory. A summary of other assumptions is presented in Table 6.

Table 6 Summary of the assumptions

Assumption	Validation
Supply modelling	
Attrition rate of 10% will be constant in future years	According to historic data there has not been significant variation in drop-out rates and besides the rate of 10% attrition rate is a goal for the COT
Number of 2011 commissions will experience a) No changes in comparison to 2010 b) 10% reduction in comparison to 2010 c) 20% reduction in comparison to 2010 Number of commissions for years 2011-2031 will not change	There is uncertainty regarding commissioning; these numbers are the best estimations provided by COT based on the information they are aware of. Besides, taking into account all the cuts the NHS is experiencing the assumptions of reduction in bursaries seem reasonable to make.
The number of returners will equal 99 employees per year up to 2030.	The 5 years 2006-2010 average number of OTs returned from a career break is 99 OTs per year. It is assumed that it will remain the same since no significant variation was observed during those 5 years.
There will be no joiners to OT workforce from abroad	Since the OTs were omitted from the UK Border Agency shortage occupation list it is assumed that no foreign specialists in OT will arrive in the UK.
Graduate intake rate assumed to be 88% over the whole period of forecast.	Since 88% of all the OT workforce are employed by NHS and Local Authorities it seems reasonable to assume that university leavers maintain the same distribution. This was agreed with the COT.
Age profile of Local Authorities OTs assumed to resemble the age profile of OTs working for NHS.	Representative from COT confirmed that there is no particular difference in demographic characteristics of LA and NHS staff
Average probability of retirement per age group will remain the same	Taking into account that the NHS workforce is entitled to an NHS pension after 30 years of practice and some mental health officers are allowed to retire from 55, it was decided to maintain the same probability of retirement, accounting that on average people leaving at age 60 or later retire regardless of the reform of changing the state pension age.
Proportion of other leavers/joiners in the entire workforce in 2011-2030 assumed to be average of 2006-2010, (-5.41%)	Since there were no significant variations in the proportion of other joiners/leavers and no other information regarding other leavers/joiners is available, the assumptions seem to be reasonable
Demand modelling	
The productivity of workforce will remain at the same level	The assumptions were made due to the complexity of the factors and unavailability of data.
OTs will go on undertaking the same set of functions	If technological development leads to a decrease in time the OT spent on certain tasks, this would result in less demand for OT. If in the future OTs are to be involved in new areas, the model would underestimate the requirements for the specialists.
Demand 1	
The current OT per population ratio is adequate	So far requirements in OT cannot be assessed accurately, therefore it is assumed that those who were diagnosed correctly and recommended sessions of OT represent patients who indeed need relevant services; and there is a sufficient number of specialists to serve patients in need
The demand will grow in line with population growth rate	A priori there is no reason to assume different since the productivity of a specialist and areas they are involved in are assumed to stay the same

(Table 6 continued)

Assumption	Validation
Demand 2	
Number of registered OTs represent the demand for OT services	The assumption was initially made by the COT.
The demand will grow in line with population growth rate	The same as for Demand 1
Demand 3	
The split of workforce by areas of care will not change significantly	There is no evidence of the opposite
The rate of change for medical conditions will not change significantly	There is no evidence of the opposite
Demand 4	
The SHA with the highest OT/per 10,000 population is a benchmark for others SHA	It is assumed that the lower ratios in other SHAs are due to unmet demand

4.3 Supply modelling

The supply part of the model is built up as a stock-and-flow model where the inflow to workforce consists of joiners, international recruit and returned to practice and the outflow is made up of retirees and others leavers and joiners (Figure 12).

Figure 12 Stock and flow model for Occupational Therapists
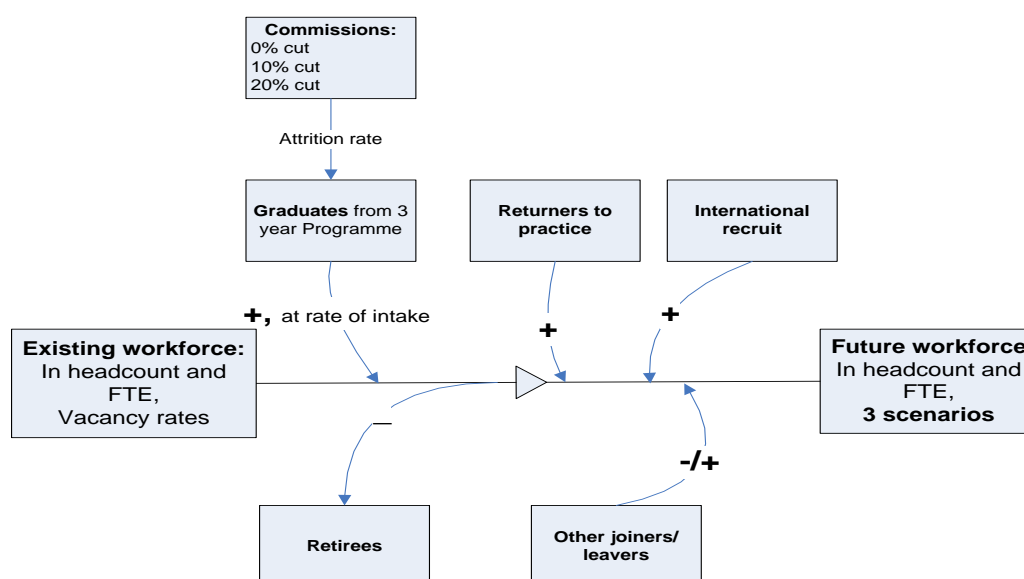
1. Joiners

a. Joiners from universities

The number of historic commissioners for the period 1996-2010 was acquired from the previous OT model built by the CfWI.

There is uncertainty about education commissions for the future periods due to the current NHS reforms. However, the COT expects a 10%-20% cut in the number of

commissions for 2011/2012. The literature review has indicated that in the presence of uncertainty the best option is to introduce various scenarios to the model (FAS 2009):

1. The number of commissions for 2011/2012 will be the same as in 2010 and will stay the same up to 2030;

2. The number of commissions for 2011/2012 will be 10% less than in 2010 and will stay the same up to 2030;

3. The number of commissions for 2011/2012 will be 20% less than in 2010 and will stay the same up to 2030;

However, it is acknowledged that due to possible contractual agreements between the COT and Higher Educational Institutions the possible cuts would be implemented in two-three years, but for the purposes of modelling it is implemented from the next year.

The number of graduated students is calculated as follows: the number of commissions multiplied by the attrition rate in the respective year which is 10% as estimated by COT. It is assumed that this will remain constant up to 2030. Another point is that if the number of commissions is to be cut, meaning that better students will be offered places in the universities, it is possible that the attrition rate will decrease. For example, if the attrition rate turns out to be 5% in scenario 2 than there will be the same number of joiners from universities in both scenarios 1 and 2. However, it may not be that straightforward, as provided the number of commissions is decreased, some of the courses may be closed or combined, which would result in the same or even lower time spent per student and thus the same or even lower drop-out rates. Thus, after this reflection it was decided to leave the attrition rate at 10%.

Afterwards, the number of those who actually joined the practice is calculated by applying the rate of those people employed by the NHS and local authorities – 88%, also provided by COT.

b. International recruits

The number of OTs from abroad practising in the UK is available for 2007-2010, and for the next years it is assumed to be equal to zero.

c. Returners to practice

The number of returners for 2006-2010 was provided by COT, and for the following years it is assumed to be equal to the average of these 5 years – 99.

2. Leavers
a. Retirees

The number of retirees from the NHS for the period 1996-2008 is historic data obtained from the previous CfWI model. For the time period from 2010 to 2031 the number of retirees was estimated using the age profile.

Since the age profile is not available for staff from Local Authorities (LA), it was assumed that they follow the same age distribution as their colleagues from the NHS. Thus the age profile for both the NHS and LA for 2010 was calculated and taken as a baseline.

Starting from 2010 the retirement age for women will be increased from 60 to 65 years, the same as for men (DirectGov 2010). It was assumed that starting from age 65 the difference between the number of employees who are aged X and those who are aged (X+1) the next year is due to retirement. Such a difference is calculated for employees in each age group for the years 2008-2010 for which the data is available. Furthermore, the percentage of leavers in each age group in the years 2008-2010 is calculated, and then - a three years average. It is assumed that this average rate of leave per age will remain the same in the future for both NHS and LA staff; therefore it is used to calculate retirees in each age group for 2010 and relevant headcount in 2011, then time series data is extrapolated up to the year of 2030. The sum of all leavers aged more than 55 annually is assumed to be the number of retirees.

3. Other joiners and leavers

One could stipulate that the headcount in year X will equal to the headcount in year (X-1) plus joiners and minus leavers. However, there are other leavers and joiners, presented in the Figure 13[1].

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[1] However, it is acknowledged that such a calculation is quite approximate because it does not take into account those who joined and left in the same year

Figure 13 Other leavers and joiners over 1999-2010 period
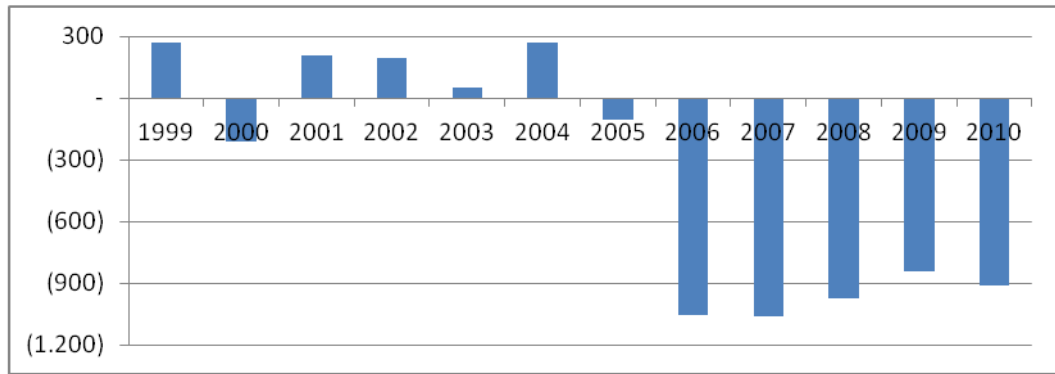
Source - from the modelling results

In the two last years other leavers made up approximately 4% of the total workforce and it was assumed that this rate will remain unchanged over the period of forecast.

The number of other leavers for the next years was calculated as 4% of the respective headcount excluding other leavers (Headcount of previous year + Joiners-Leavers).

Having made all the necessary assumptions the model extrapolates the numbers of joiners and leavers, thus providing an estimation of the future workforce in terms of headcount and full time equivalent (Figure 14).

Figure 14 Historic data and projections of supply of OTs
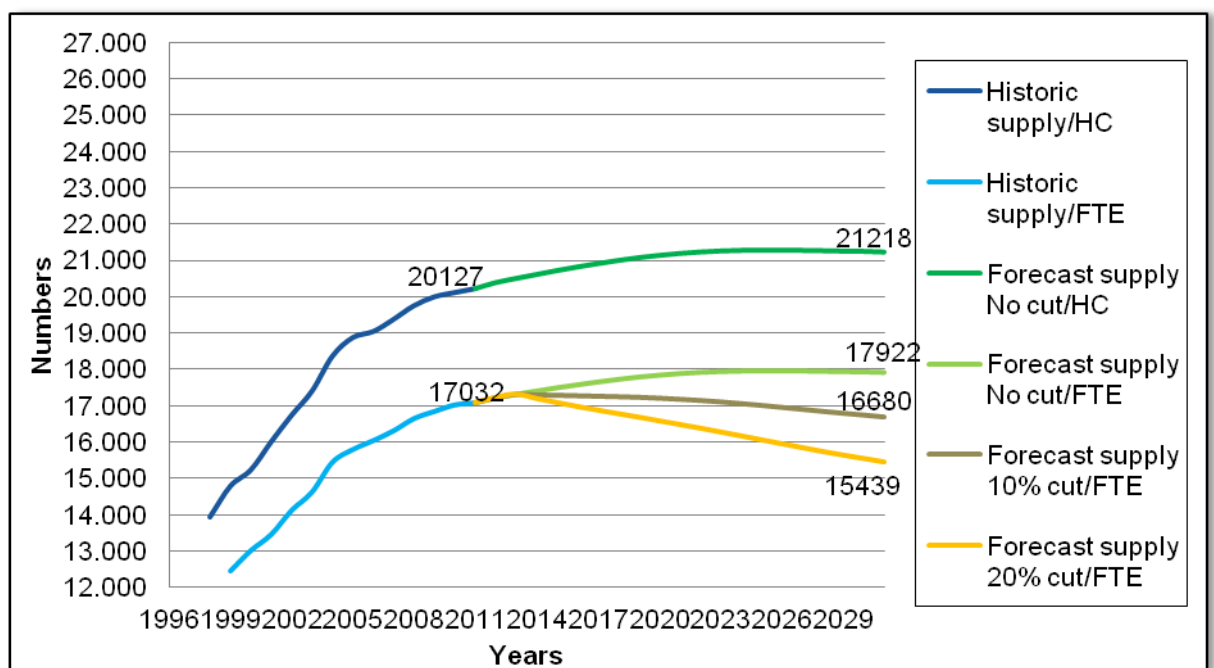
Source – from the modelling results

The graph shows that according to scenario 1 the supply of specialists will increase by only 5% in 20 years time reaching the value of 17,922 (FTE). In the scenarios where there are cuts in commissioning (10% and 20% cut) the supply will decrease by 2% and 9% respectively.

4.4 Demand modelling

The modelling of the demand part appeared to be rather complex in this project. A range of forecasts of future requirements for OTs have been developed, based on the various assumptions and professional judgements of specialists who were interviewed.

Before starting modelling it is important to distinguish the concepts of demand and need for health and social care services.

The need for health care may be described as the number of services necessary to make the population as healthy as possible at this level of medical science development (AHWAC, AMWAC 2005).

The demand represents the average recognized benefit for a user of the health care system from marginal units of service.

A summary of relationship between concepts of need and demand is presented in Figure 15.

Figure 15 Relationship between need and demand for health care services.

What the person feels	What the person does	Need exists	Individual demand exists	Professional demand exists
The person feels unwell	Does not wish for intervention	Maybe	No	No
	Does wish intervention, asks for service, health professional says NO to intervention	Maybe	Yes	No
	Does wish intervention, asks for service, health professional says YES to intervention	Yes	Yes	Yes
Health professional says there is need	Individual perceives need	Yes	Yes	Yes
	Individual sees no need, but accepts the service	Yes	No	Yes
	Individual sees no need, and does not accept the service	Yes	No	Yes
Society sees need	Compulsory	Maybe	No	No

Source - Adapted from Vetter (2010)

It was discovered that there is a great need for occupational therapy. For example, the lecturer in Occupational Therapy at the University of Southampton claimed that there are many people who experience difficulties in accessing specialists. However, for the purposes of this research it was decided to provide estimations of demand, not need for therapy. That is why the baseline for the demand estimations was based on the existing registered/practicing workforce. This approach is commonly used in international practice of workforce projections (Galvan et al. 2006, Scott et al. 2010, Bloor et al. 2003).

The College of Occupational Therapy suggests that the number of registered OTs with the Health Professionals Council (which is obligatory for all practising OTs) reflects requirements in OT services and is the starting point for predicting demand.

The previous CfWI model implied the following approach: the requirement for OT was estimated at 18,545, 78% of all registered OTs in May 2010, and it was assumed to be constant up to 2010 and would thereafter grow at the same rate as population growth, i.e. 0.7%.

The Government has recently released £232 million as a reablement scheme for patients discharged from hospital, with the Secretary of State's statement of intention to support long term investment in occupational therapists (Cooper 2011). Occupational therapists are key professionals in health and social care involved in assisting people to leave hospital and ensure that the equipment and services are in place to support discharge. The College of Occupational Therapists claims that this would be the key factor of growth for 2011. COT proposes that half of the existing authorities (out of 152 Primary Care Trust and 155 local authorities) will need an additional OT to meet current requirements, which will result in 154 more OTs for 2011.

1. Demand model version 1

The most simplified demand forecast is based on the average staff per population ratio and population projections. Applying this approach we assume that the current workforce meets the population's demand for occupational therapy. For OTs the average number of NHS and LA staff per 10,000 of population over the past 2 years is equal to 0.39. Extrapolating this on population estimations from the Office for

National Statistics the following illustration of demand and supply has been drawn. The graph comprising all scenarios is presented in Figure 16**.**

Figure 16 Projection of future supply (including all scenarios of commissions cuts) and demand (modelled based on OT per population ratio)
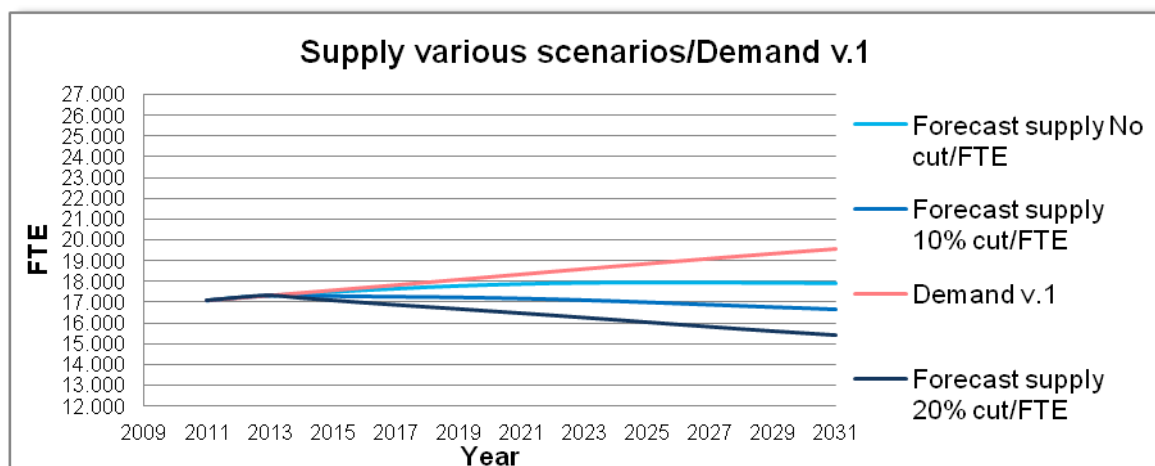
It can be noted that there is a gap between demand and supply of OTs in all of the scenarios; however in the case when the number of commissions remains at the 2010 level the gap is smallest: for the first 10 years, the supply and demand lines almost coincide. The graph for this scenario including historic data is displayed in Figure 17.

Figure 17 Projection of future supply (scenarios with no commissions cuts) and demand (modelled based on OT per population ratio)
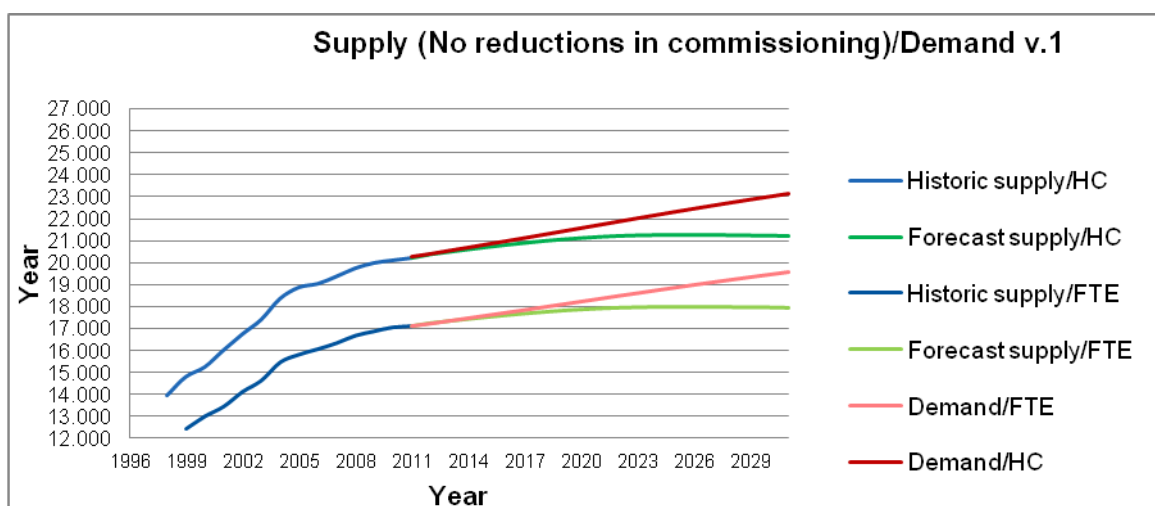
2. Demand model version 2

For the second demand model the same principle was used as in the previous CfWI OT model: requirements for 2010 were estimated as 88% of all registered OTs in

2010 (HPC, February 2011) (since we compare with supply from NHS and LA which make up 88% of all OTs), i.e. 24,970*0.88 = 21,974. For 2011 the COT recommendation regarding additional 154 specialists was taken into account together with the annual England population growth rate (0.7%). For the future years the figures were increased in line with the population growth rate. The resulting graph presenting the comparison of projected demand and supply (3 scenarios) appears below (Figure 18):

Figure 18 Projection of future supply (including all scenarios of commissions cuts) and demand (modelled based on current registered OTs)
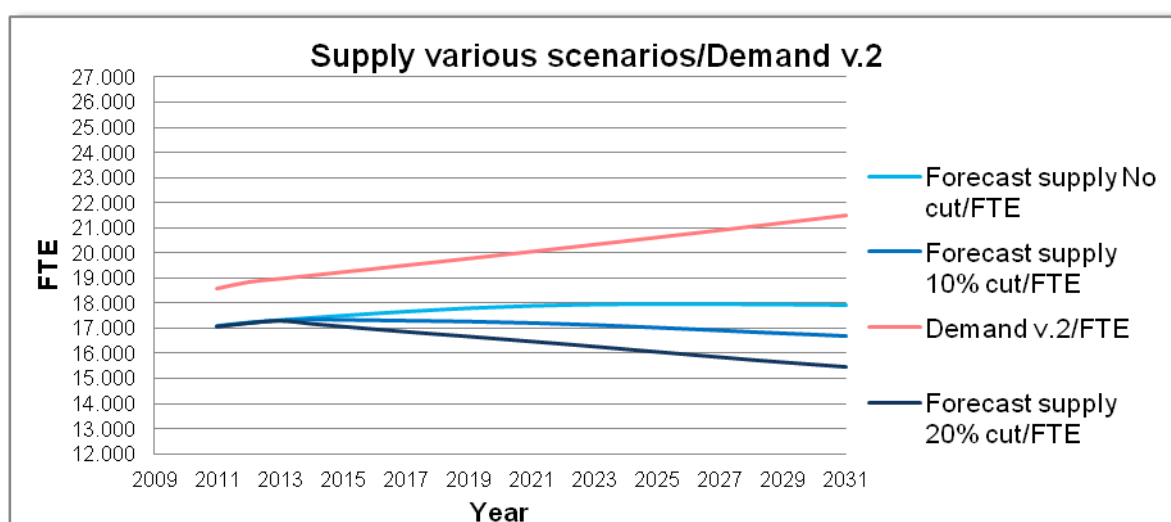
3. Demand model version 3

The next model is based on the estimations of breakdown of OTs involved in areas of care provided by the COT. The approach is partly inspired by the Care Life Cycle Group and the study by Etzioni (2003) on workforce projections for surgical oncology.

The following steps were performed:

1. For each area of care the estimated number of OTs involved was calculated: Total headcount*Percentage provided;
2. For areas in total covered by 92% of the workforce the number of potential patients of an OT in 2010 and 2020 was found by research and analysis of statistics. The details are in Table 7.

**Table 7 Main areas of care OTs are involved in with projected patients**

Areas where OTs are involved	Proportion of entire workforce time spent on each area	Workforce employed	Type of sufferers	Number of sufferers 2010	Number of sufferers 2020
Dementia care	4%	4,912.66	Actual	607,249	755,953
Older people, prevention of Falls	23%	4,545	Potential	8,584,992	10,576,723
Mental health including substance misuse including eating disorders	24%	734	Actual	8,326,984.8	9,148,091
Learning Disabilities	4%	727	Actual	16,442.00	18,925
Long Term conditions excluding stroke	10%	2,001	Actual	15,829,854.3	17,351,255
Stroke	7%	1,382	Actual	118,204	126,817
Accidents & Emergencies	1%	151	Potential	52,234,000	56,039,881
Orthopaedics/musculoskeletal	8%	1,687	Potential	52,234,000	56,039,881
Social care	11%	2,332	Potential	52,234,000	56,039,881
Total	**92%**				

For details of the calculations in the table please refer to Appendix 1.

3. The estimated number of future OTs was calculated: Increase in patients $_{area\ i}$* Current workforce $_{area\ i}$.

Taking into account the increase in demand in the aforementioned areas and the current demand estimation (derived from the COT estimation as 88% of registered OTs) an annual increase in demand was extrapolated for the period of 2010-2030 (Figure 19). The assumption was made that the growth rate in demand will remain the same.

Figure 19 Projection of future supply (including all scenarios of commissions cuts) and demand (modelled based on main areas of occupation growth)
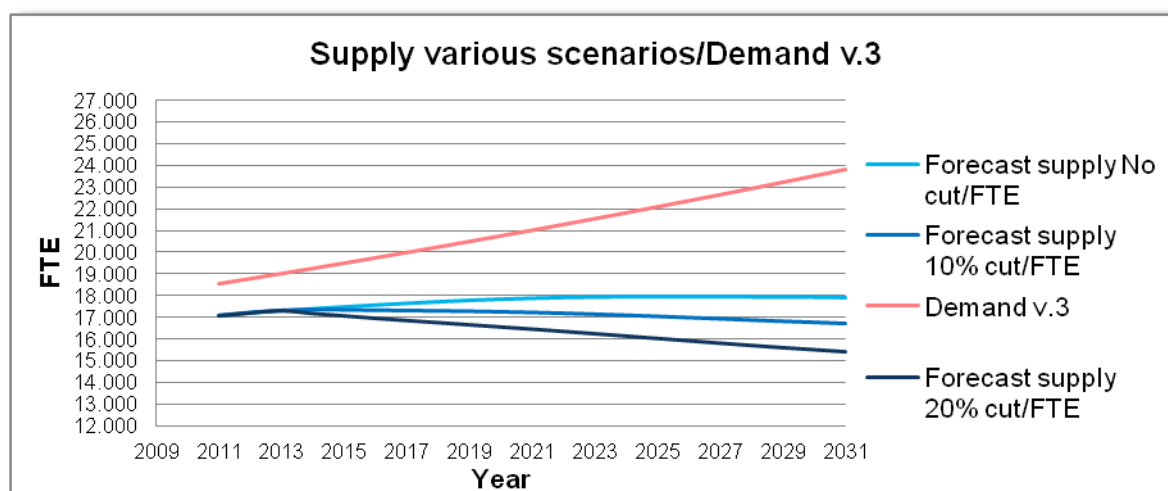
According to this model the demand is growing more rapidly than in models 1 and 2 reaching almost 24,000 (FTE) in 2030.

4. Demand model version 4

The fourth way of modelling the demand has applied the benchmark approach implemented by Galvan (2006). However, unlike the study mentioned above where an international established benchmark, the number of cardiologists in Canada per 1,000 of population, was used, here the highest ratio of OT per 10,000 people by SHA was used as a reference point. This represents an attempt to include the unmet demand. It is assumed that the unmet demand in underserved SHAs will be equal to the number of services which would be utilized if these areas had the same level of supply as areas with the highest supply of specialists per 10,000 of population (Schofield 2008).

The details of data are presented in Table 8 In our case the ratio in the South West which is 4.85 OT per 10,000 of population is the highest. Therefore the number of OTs was adjusted taking into account the 4.85 ratio, which resulted in 25,356 OTs in England.

Table 8 Distribution of OTs and population by SHA, 2010.

Strategic Health Authority area	Number of NHS OTs	Number of Local Government OTs	Population distribution by SHA in 2010	Ratio OT/per 10000 population	Assuming South West ratio as a benchmark
North East	1011	80	2,606,600	4.19	1,265
North West	2413	240	6,935,700	3.83	3,367
Yorkshire and the Humber	1818	180	5,301,300	3.77	2,573
East Midlands	1692	330	4,481,400	4.51	2,175
West Midlands	1806	195	5,455,200	3.67	2,648
East of England	1696	110	5,831,800	3.10	2,831
London	2540	295	7,825,200	3.62	3,799
South East Coast	1409	255	4,385,400	3.79	2,129
South Central	1207	250	4,137,700	3.52	2,009
South West	2185	375	5,273,700	4.85	2,560
Total	**17777**	**2310[2]**	**52,234,000**	**3.85**	**25,356**

Source – NHS Information centre, NHS staff database, Adult social care

Figure 20 represents the graph of demand according to model 4 and supply of various scenarios.

Figure 20 Projection of future supply (including all scenarios of commissions cuts) and demand (including unmet demand)
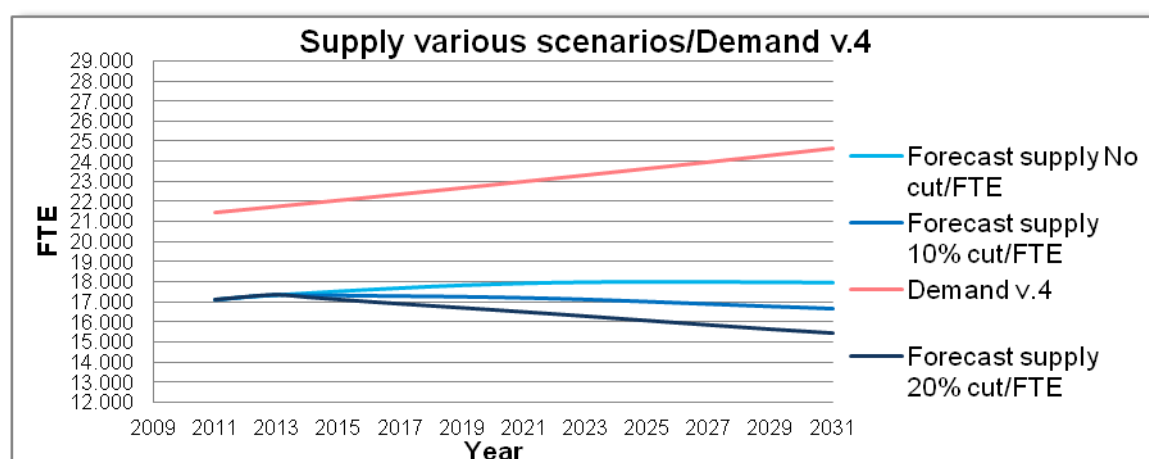
The difference of almost 3,000 between 21,500 and approximately 18,500 employees used as a starting point in previous models is assumed to be unmet demand in occupational therapy.

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[2] According to the data of distribution of OT per Local authorities from IC NHS the total number of OTs working for Local authorities is 2,310, however the historic data of LA OT headcount in 2010 indicates 2,350.

5 Discussions and recommendations

The models built represent a very simplified real situation; however they allow to estimate a scope of gap between demand and supply.

All the models of supply/demand are compiled in Figure 21.

Figure 21 Supply and demand models
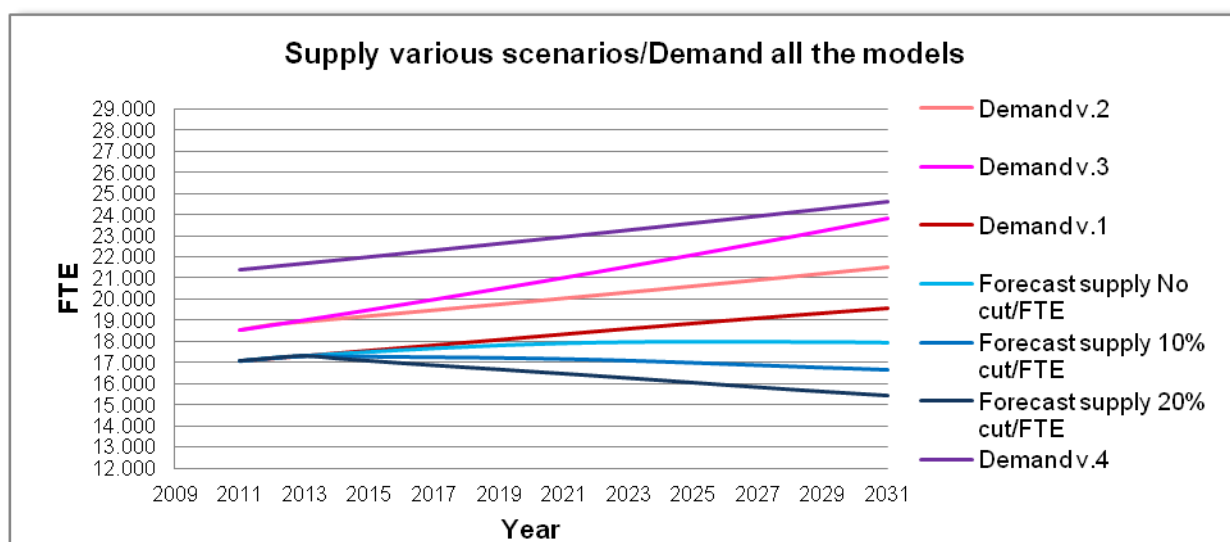
Demand graphs 1, 2 and 4 are parallel with a constant gap of 154 extra OTs added in scenario 2 and 3,000 (FTE) of OTs covering unmet demand in scenario 4. Demand line 3 representing the growth in areas of care is surging more rapidly than others. Therefore, according to model 1 the approximate number of OTs needed in two decades time will be 19,000 (FTE), model 2- 21,500 and approximately 24,000(FTE) in scenario 3 and 4, which is 12%, 26% and 41% respectively increase in comparison to existing FTE employees. For comparison, during the previous 15 years only the number of NHS staff has increased by 5,300 (FTE) or 43%.

The graph illustrates that there is a gap between supply and demand in all the scenarios. It is the least in case of no cut in commissioning.

Number wise, the gap between supply (No cut scenario) and demand (all scenarios) is compiled in Table 9.

Table 9 Gap between supply and demand

Supply/ demand gap	2010	2011	2012	2013	2014	2015	2016	2017	2018	2019	2020
Demand v. 1	(72)	(127)	(113)	(141)	(175)	(210)	(254)	(305)	(361)	(426)	(504)
Demand v. 2	(1,528)	(1,730)	(1,725)	(1,762)	(1,805)	(1,851)	(1,905)	(1,965)	(2,030)	(2,105)	(2,193)
Demand v. 3	(1,528)	(1,702)	(1,801)	(1,943)	(2,094)	(2,249)	(2,415)	(2,588)	(2,770)	(2,963)	(3,171)
Demand v. 4	(4,385)	(4,477)	(4,491)	(4,547)	(4,610)	(4,675)	(4,749)	(4,829)	(4,914)	(5,009)	(5,118)
	2021	**2022**	**2023**	**2024**	**2025**	**2026**	**2027**	**2028**	**2029**	**2030**	
Demand v. 1	(589)	(683)	(787)	(899)	(1,016)	(1,137)	(1,261)	(1,385)	(1,507)	(1,625)	
Demand v. 2	(2,290)	(2,397)	(2,517)	(2,648)	(2,786)	(2,931)	(3,082)	(3,238)	(3,395)	(3,551)	
Demand v. 3	(3,391)	(3,624)	(3,871)	(4,131)	(4,402)	(4,681)	(4,970)	(5,265)	(5,564)	(5,865)	
Demand v. 4	(5,235)	(5,363)	(5,504)	(5,655)	(5,815)	(5,981)	(6,153)	(6,331)	(6,509)	(6,687)	

Source – from the modelling results

The gap between supply and demand (model 1) starts from less than 100 specialists (FTE) in 2010 and increases up to almost 1,600 employees (FTE; model 1) in 2030 accounting to 8% of overall demand estimation. The gap in scenario 2, 3 and 4 will reach 3,500, 6,000 and 6,700 respectively in 20 years time. This means that a significant number of patients may not receive the necessary services.

In attempt to cover the gap a range of 'what if' scenarios are applied and the outcome is estimated. It is thought that out of all variables in the supply and demand models international recruitment and number of commissioners are the ones which the Department of Health may actually influence. Besides, LA and NHS services providers could change their HR policy in order to retain more specialists at the age of retirement. Thus variation of their values allows to find the approximate balance between supply and demand.

Before starting experimenting with changing variables it is decided to establish an 'ideal' situation of balance between supply and demand. For example, Galvan (2006) mentions that if less than 75% of necessary medical specialists there is deficit and if there is more than 10% of needed workforce there is a surplus. However, it is assumed that for the purposes of workforce planning a slight oversupply of specialists, say +5%, would be beneficial. It would create competition in the market and unattractive geographic areas would not experience deficiencies in employing staff.

The 'what if' scenarios are implemented for the scenario of supply with no cuts in commissioning, which represents the least gap with demand, and 1 and 4 demand models since they represent the minimum and maximum estimation of demand, and other models are in between.

Supply – Demand v.1

1. **Increase of international recruitment – putting the OT back to shortage list**

In case each year during the period of 2010-2030 there will be 100 specialists from abroad, the gap between demand and supply (in case no cuts in commissioning) will not be more than 1% on average with a slight oversupply in the second decade (Figure 22).

**Figure 22 Supply (no cuts and 100 OTs from abroad) and demand v.1**
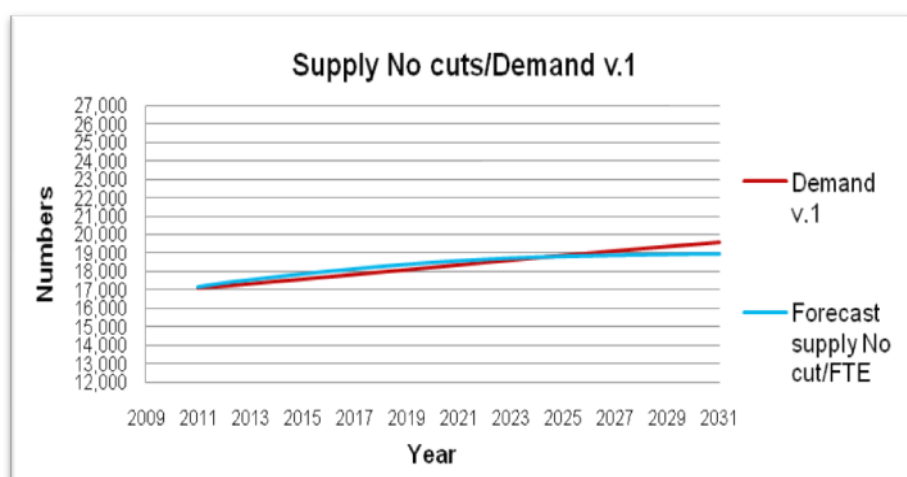
2. **Increase in commissioning**

It is not easy to balance the gap between supply and demand by introducing changes in commissioning since there is a three year gap till this adjustment could influence the workforce. The optimal change will be 1% of the annual increase in commissioning throughout the period 2011-2030 (Figure 23).

**Figure 23 Supply (1% increase in commissioning) and demand v.1**
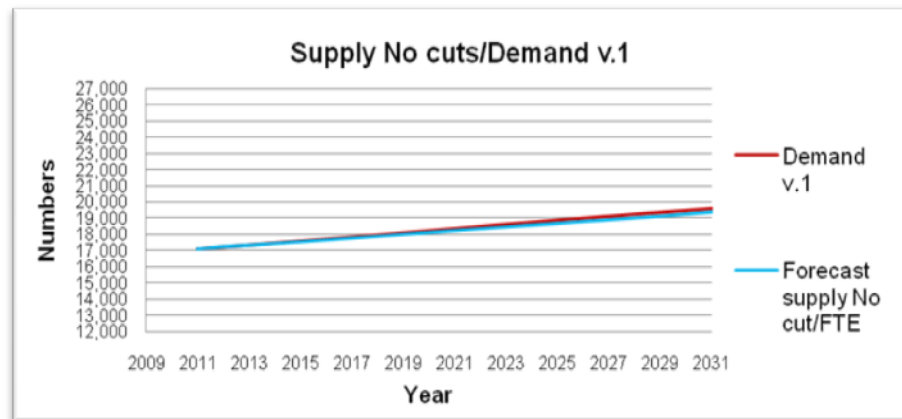
In this case the gap between supply and demand would not surpass (-1)% on average.

3. Investment in retaining staff at their retirement age

If the NHS and Local authorities invested in retaining more staff at their retirement age then the estimation of leavers would change. For example, the graph in Figure 24 shows the decreased gap if the staff were encouraged to retire later.

Figure 24 Supply (Retention of staff at retirement age) and demand v.1
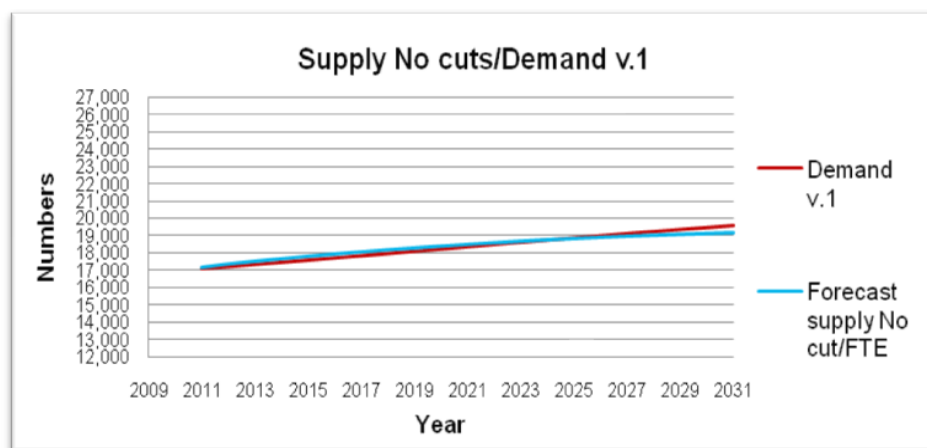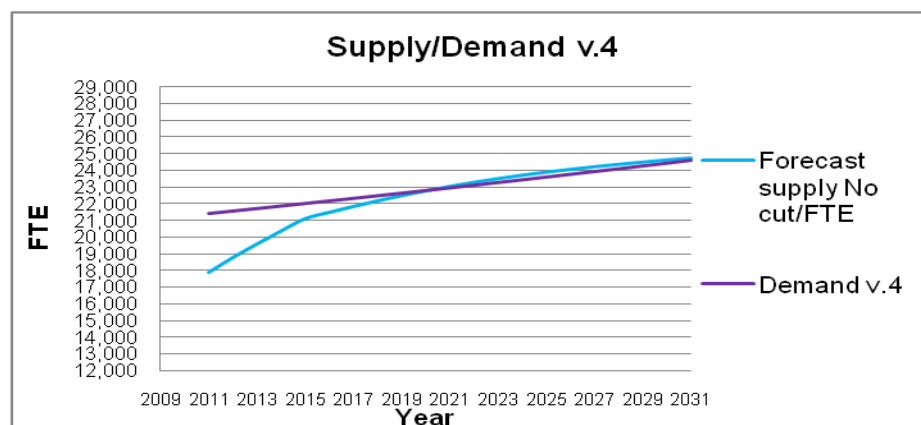

Supply – Demand v.4

1. Increase of international recruitment

The initial gap between supply and demand in model 4 is vast, so it is attempted to cover by international recruits – starting for the first 5 years by attracting 1000 specialists from abroad, and then for the following 15 years – 600 employing 800 foreign OTs.

Figure 25 Supply (no cuts and 1000 and 600 OTs from abroad) and demand v.4

2. Increase in commissioning

In case the commissions are increased by 15% during the first five years and then kept at that level, it would balance supply and demand (Figure 26).

Figure 26 Supply (10% increase in commissioning till 2015) and demand v.4
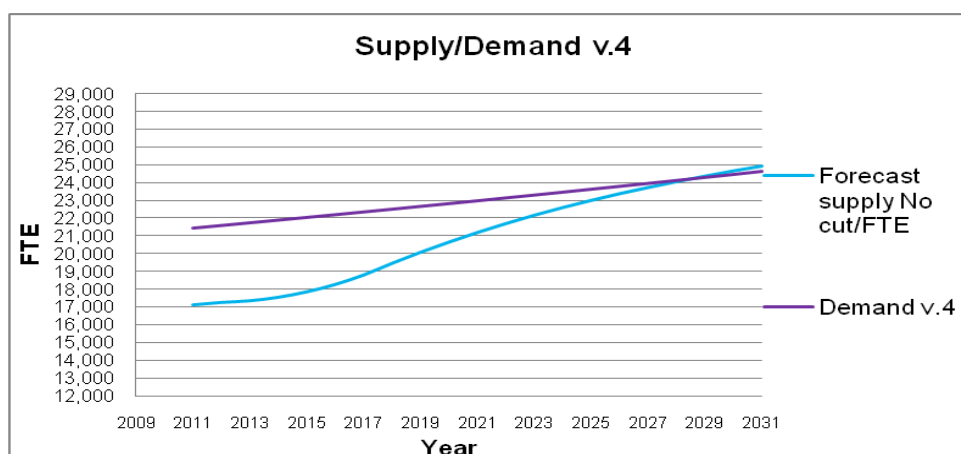
Further 'what if' scenarios are applied to Demand model 3.

Supply – Demand v.3

1. Decrease in prevalence of diseases

In case the social policy and government investment succeed and result in reducing the prevalence of medical conditions OTs are working with (including areas where the group or whole population is taken as group of potential patients), for example up to 10% less in 2020, then the gap between supply and demand would decrease to an average of (-11%) throughout the period of 20 years (Figure 27).

Figure 27 Supply/demand v.3 in case of 10% decrease in the number of potential patients
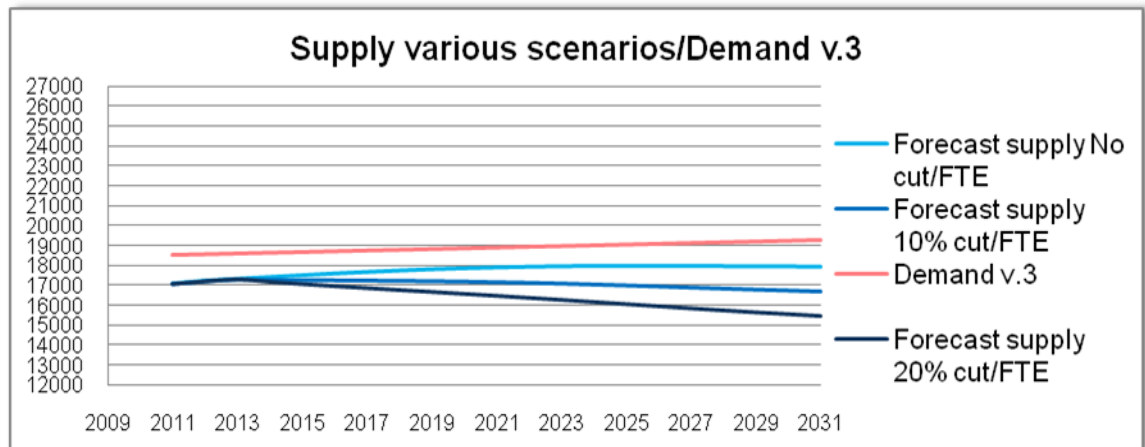
2. Change in areas of care

There has been a range of evidence in the history of medical practice when the task or entire area certain specialists are in charge of becomes a responsibility of other professionals. That happened to blood tests: primarily GPs had taken blood tests, then it became responsibility of nurses. There is also such an example in Occupational therapy: a few years ago van drivers who delivered OT equipment were trained to show the patients how it worked thus reducing the OTs' time. Such shifts are difficult to forecast, but it is seen beneficial if OT assistant staff could take upon themselves some of OTs' tasks.

In order to implement the scenarios described above various incentives can be used. For example, scholarships and bursaries to attract more students, increase in salary or additional flexibility in hours of service to retain existing staff. There can be also non-monetary incentives like facilitating the visa process for international OT graduates. In the long term perspective adjusting the number of workforce in training is beneficial, while in the short term migration may help to deal with temporary regional disproportions.

Various factors influence the balance of supply and demand in the health care market which requires defining health and social workforce policy. From this point of view health planning plays a critical part since it is a direct measure to adjust market discrepancy (Zurn 2004).

Economists such as Segal (2009) specified some challenges of health and social workforce forecasting including changes in productivity, in public expectations, and disease profile.

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6 Conclusion

No system will achieve a perfect balance of skills and patients' needs at all times, but a systematic approach to planning (…) will mitigate the risks for patients, for services and for staff.

Liberating the NHS: Developing the workforce (DH 2010)

Delivering care to the ageing population suffering from long term conditions and disabilities is a challenge for many countries that have to handle the problem of skilled workforce shortage and adapt the health and social care system to cope with the XXI century.

The current study is dedicated to exploring risks and opportunities facing the profession of Occupational therapy in England.

In an attempt to estimate the occupational therapy workforce over the next 20 years, this study has discussed the characteristics of the current workforce, current imbalances in the labour market, factors contributing to supply and demand and approximate supply and demand for OT services in the future.

The work was performed in close contact with major stakeholders of the projects: the College of Occupational Therapy, the representative of the profession, the Centre for Workforce Intelligence, - what has added to believability and accuracy of the model.

The work's main outcomes are spreadsheet models of supply and demand and a report describing major issues in the profession and the modelling. The forecast of health and social care workforce, taking into account all the ambiguity due to current reforms, has resulted in several possible scenarios of supply of workforce. The modelling of demand resulted in 4 outcomes depending on the selected approach. The models built represent an attempt to quantify reality and are grounded on a number of assumptions. They are not technically sophisticated, but enable to get a quantitative estimation of supply and demand and simulate various 'what if' scenarios.

The major findings of the research and modelling are the following:

- At the current level of commissioning the level of supply will continue to grow until it reaches a plateau by 2020;

- In case there will be 10—20% cuts in commissions the level of supply will decrease, reaching the level in twenty years which is lower than the level of the existing workforce;
- There will be at least 1,500 employees (FTE) of gap between supply and demand in 2030;
- According to all the models built to estimate the requirements of OT workforce the demand is growing more rapidly than supply.
- Demand model 3 (areas of care) and model 4 (unmet demand) could be the base for future modelling since they are an attempt to more closely approach reality. In order to improve modelling of the unmet demand which was attempted in Model 4, the participation of stakeholders, mainly representatives of 'underserved' and 'benchmark' areas is believed to be helpful. Besides, more accurate estimation of time spent on areas of care is considered beneficial for the improvement of the modelling.

The research performed has revealed certain issues to be considered for the purposes of further research and modelling:

- Breakdown of time dedicated to care for each age group is considered to be useful information to collect so that disaggregated growth rates for each age band are used for precise extrapolation;
- Establishment of what is considered as a balance between supply and demand of workforce or an 'ideal' situation (for example, in terms of percentage – 5% of oversupply) proves to be beneficial in order to implement 'what if' scenarios;
- Area for further research could be related to gathering information on career progression in Occupational Therapy so to split the total supply in bands and estimate the risk of shortage in each band.

AMWAC (2003) states that health workforce planning is a dynamic process. That means that permanent update of the model, and review of factors of supply/demand and assumptions have to be performed.

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Appendix I Data for demand model 3

Breakdown of OT workforce distribution among areas of care

Source – Received from the Director of Operations of the College of Occupational Therapists

Areas where OTs are involved		Estimate of numbers of occupational therapists Working in these areas	Proportion of workforce distribution among areas of care
Mental health including substance misuse including eating disorders		5404	24%
Dementia care		807	4%
Learning Disabilities		800	4%
Long Term conditions total excluding stroke		2201	10%
	Neurology	650	
	Others (including Respiratory, Rheumatology)	1535	
	HIV	16	
Stroke		1520	7%
Older people, prevention of Falls		5,000	23%
Accidents & Emergencies		152	1%
Disabled Children include Autism, DCD, ADHD, acute hospital admissions		1216	5%
Armed Services rehabilitation		50	0%
Orthopaedics/musculoskeletal		1,700	8%
Oncology and Palliative Care		300	1%
Prisons		20	0%
Social care which includes: Assessment of equipment and adaptations, Reablement, Complex Housing needs assessments moving and handling, blue badges		2450	11%
Hand therapy		150	1%
Care Homes		100	0%
Working with the homeless		20	0%
Work rehabilitation; sickness management		250	1%
Total		**22,140**	**100%**

Details of calculations for Demand model 3.

Areas where OTs are involved	Number of sufferers		Initial data for 2010	Base for 2020 calculation	Source
	2010	**2020**			
Dementia care	607,249	755,953	Both figures from Mental Health Observatory Brief 3 - Estimating the Future Numbers of Dementia; Table 2; http://www.nepho.org.uk/mho/briefs		
Older people, prevention of Falls	8,584,992	10,576,723	Population projections by the Office for National Statistics; number of people older than 65 years; http://www.statistics.gov.uk/statbase/Product.asp?vlnk=15106;		
Mental health including substance misuse including eating disorders	8,326,985	9,148,091	The number of people with various kind of mental disorder excluding dementia in 2007 - k8070; in 2026 – k9740; assuming the constant growth rate – it is 1.0105. **2010**: k8070*1.0105^3=8,326,984	**2020**: Number in 2010*Growth rate^9=8,326,984*1.0105^9=9,148,091	Paul McCrone, Sujith Dhanasiri, Anita Patel, Martin Knapp, Simon Lawton-Smith. Paying the price. The cost of mental health care in England to 2026; King's Fund 2008; www.kingsfund.org.uk/document.rm?id=7665
Learning Disabilities	16,442	18,786	Table 3 – estimations of number of people with Profound Multiple Learning Disabilities in 2010 and for 2020		Eric Emerson (2009) Estimating future numbers of adults with profound multiple learning disabilities in England., Centre for Disability Research (CeDR), University of Lancaster; http://www.dh.gov.uk/en/Publications andstatistics/Publications/Publication sPolicyAndGuidance/DH_103201
Long Term conditions total	15829854	17351256	Assuming the growth rate constant – it is equal (18/15.4)^(1/17)=1.009219 **2010**: 15*1.009219^3=15.829854 million	15*1.009219^13=17.35 1256 million	Department of Health (2008) Raising the Profile of Long Term Conditions Care: A Compendium of Information; http://www.dh.gov.uk/en/Publications andstatistics/Publications/Publication sPolicyAndGuidance/DH_082069 p.13 – increase to 18 million by 2025, p. 10 – 15.4 million people with long term conditions in 2007.
Stroke	118,204	126,817	Estimated incidence of Transient Ischaemic Attacks per 1000 of population – 0.51; number of stroke cases in 2007 in England– 110,000 -> incidence of stroke – 2.15 per 1000. Total incidence 2.26 multiplied by population projections in 2010. **Number** in 2010 – 118,204	Incidence multiplied by population projections in 2020. **Number** in 2020 – 126,817	National Institute of Health and Excellence (2008) Costing template for stroke. 2008. www.nice.org.uk

Appendix II Management report submitted to the CfWI

DEVELOPING AN INTEGRATED MODEL OF HEALTH AND SOCIAL CARE SECTOR ON THE EXAMPLE OF OCCUPATIONAL THERAPISTS

The Centre for Workforce Intelligence

Oksana Pchelenkova (University of Southampton)

9th September 2011

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Abstract

The current project is devoted to building of a supply and demand model spanning health and social care using Occupational Therapists as an exemplar. The methodology used for modelling is based on the review of relevant academic papers, meeting with the stakeholders and existing practice of the Centre for Workforce Intelligence, project's sponsor. The supply model, designed using stock-and-flow approach, resulted in three possible scenarios depending on the changes in the education commissioning. The demand modelling appeared to be most challenging part of the project since there is no uniform model which can be applied to all the specialities and it is not clear what can be taken as current demand. The work related to demand of Occupation Therapy resulted in four models which represent very simplified real situation, however enable to estimate a kind of gap between demand and supply. The analysis of predictions for demand and supply has indicated that at the existing level of education commissioning growing demand for Occupational Therapy services could not be fully satisfied. The final part of the report suggests possible lines of action in order to overcome the gap between supply and demand as proposals for further discussion.

Key words: *Occupational Therapy. Workforce planning. Supply. Demand.*

Executive summary

Currently the NHS in England is planning a set of reforms, the aim of which is 'make the NHS the envy of the world' (David Cameron, Equity and excellence: Liberating the NHS). In order to improve efficiency and overcome current financial challenges of the NHS the White paper *Liberating the NHS: developing the workforce* establishes a set of objectives to achieve for workforce planning and education.

The current project is directly related to such objectives as securing supply and meeting demand, aiming to build an example supply and demand model spanning health and social care. It was decided that Occupational Therapists (OT) could be a good example of specialist who work across these two sectors.

In order to gain insight of the existing modelling practice various methods were reviewed for forecasting demand and supply of healthcare staff including econometrics, system dynamics, stock-and-flow modelling and others. The review of general frameworks in modelling enabled us to structure our work and built it in accordance with well-established principles.

It was important to understand the issues the existing OT workforce is facing as well as meet stakeholders including experienced Occupational Therapists and representatives of the professional body for all occupational therapy staff in the United Kingdom. Our findings have shown that the current supply is not effectively met and there is more need in the services of OTs than existing provision.

In order to build our models of supply the factors which could influence supply and demand were listed.

As for the future supply the key determinant of it is the current stock of Occupational Therapists. We incorporated in the model the data on NHS and Local Authorities intake from the universities, education commissioning, attrition rates, international immigration number, specialists retuning to practice after a career break and the retirement forecast. Since there is uncertainty about education commissions for the future periods due to proposed reforms, three possible scenarios were introduced, namely no cuts, 10% cut and 20% cut in education commissioning in 2011. This resulted in three supply projections.

In order to estimate demand it is crucial to understand the main demographic trends in England, the influence of technological progress, as well as analyse what is happening in the areas of practice of Occupational Therapists. Together with the College of Occupational Therapists it was agreed on the list of areas of care covering all activities of OTs, and for each of the areas analysis covering prevalence of diseases and introduction of government policies was performed. The analysis has indicated growing demand for OT services.

Our work related to demand of Occupation Therapy resulted in four models.

- The first model is based on the staff per population ratio and population projections.

- The second model uses the current number of registered Occupational Therapists who work for NHS and Local Authorities and adds additional specialist in 2011 due to extra fund from the Government, and then utilizes population growth rate.
- The third model is based on the changes in the areas of care. The growth factor for each area and workforce involved in the area needed to serve the increased number of patients was estimated.
- The fourth model represents an attempt to include the unmet demand. First, the ratio of Occupational Therapist per thousand of population in each Strategic Health Authority was calculated. Then it was assumed that low rates are due to underserved population, so the highest rate was taken a benchmark and multiplied by SHA population. Then the population growth rate was used for future projections.

The main findings of the modelling are as follows:

- At the current level of commissioning the level of supply will continue to grow until it reaches a plateau by 2020. In case of 10-20% cuts in commissions the level of supply will go down, reaching a level in twenty years which is lower than the level of existing workforce;
- The demand according to the first model for the first 10 years almost coincides with the supply line, but in 20 years time results in a gap of more than 1 thousand specialists (FTE);
- The unmet demand according to the fourth model is about 3.5 thousand;
- The third demand model representing the growth in areas of care is increasing more rapidly than the others. It predicts an increase in demand by 5 thousand FTE specialists;
- The third model of demand (areas of care) and fourth model (unmet demand) could be the base for future modelling since they are an attempt to more closely approach reality.

As an action line to overcome shortage in Occupational Therapy workforce the following measures are proposed and their implementation analysed:

- Increase of international recruitment – putting the Occupational Therapists back to shortage list;
- Increase in commissioning;
- Investment in retaining staff at their retirement age and actions to reduce exit rates before retirement;
- Decrease in prevalence of diseases;
- Change in areas of care.

The research performed has revealed certain issues to be considered for the purposes of further research and modelling:

- Breakdown of time dedicated to care each age group is considered to be useful information to collect, so that disaggregated growth rates can be used for each age band for precise extrapolation;
- Establishment of what is considered as a balance between supply and demand of workforce or 'ideal' situation proves to be beneficial in order to implement 'what if' scenarios;
- Area for further research could be related to gathering information on career progression in Occupational Therapy so to split the total supply in bands and estimate the risk of shortage in each band.

1   Introduction

Currently England NHS plans a set of reforms, the aim of which is mentioned in the epigraph to the chapter. Financial difficulties of the present system, bad health statistics and reported inefficiencies have led the Government to plan a major restructuring of the NHS and social care services.

One of the inefficiencies of the current system is a lack in balance in the supply and demand of labour force. In the White paper *Equity and excellence: Liberating the NHS* (2010) the Department of Health admits that the existing top-down management approach is not effective in the case of workforce planning and argues the necessity of greater autonomy for the employers and reducing its own role in trainees forecasting. With an objective of efficiency improvement and overcoming current financial challenges of NHS the White paper *Liberating the NHS: developing the workforce (*2010*)* establishes objectives for workforce planning and education, for example securing of supply, provision of quality training, adaptation to public demand and altering service models and widening cooperation of public (Figure 28).
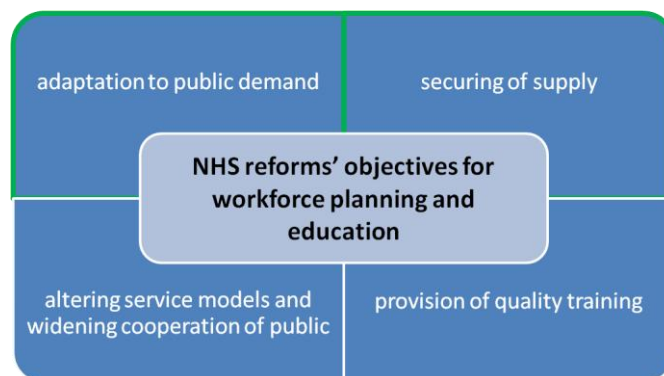

Figure 28 Objectives of NHS reforms for workforce planning and education. Adapted from DH (2010) Liberating the NHS: developing the workforce

For this to be effective, the DH recognises that it is essential to supply local authorities with appropriate tools and has assigned the role of information and intelligence source to the Centre for Workforce Intelligence (CfWI), the sponsor of the current project.

2   Objectives of the project

This project links to the overall activity of the CfWI to supply intelligence and analytical models. The aim of this particular project is an elaboration of an example supply and demand model spanning health and social care for Occupational Therapists and further assessment of the modelling results.

Among priorities for the future the CfWI establishes improvement of workforce modelling including building up a supply and demand model for utilize across health and social care and performing research on developing joined-up workforce strategies. Thus the occurrence of the current project and its objectives are dictated by the CfWI strategy and are in line with the CfWI business plan for 2011.

The main objectives of the current project are:

- Literature review of existing models and data sources;

- Production of an example supply and demand model spanning health and social care for Occupational Therapists;
- An assessment of the impact of the modelling results on the Occupational Therapy workforce.

3 Overview of health care workforce modelling practice: conclusions

In simple terms, workforce planning assures that there is the right number of health and social care specialists with the right skills and managed in the right way and within the budget who are able to render services offering best patient care (Skills for Health - Workforce Projects Team).

According to the framework proposed by the Australian Medical Workforce Advisory Committee the planning process may be divided into three stages (AMWAC 2003):

- description of the current level of supply, the kind of services provided by the particular medical specialists, the recruitment and training process;

- evaluation of the sufficiency of the supply and the regional allocation of specialists based on the number of indicators such as international benchmarks, current trends in health, waiting times;

- prediction of the requirements and workforce supply for a specified period of time under various scenarios and discussion of likely changes in service delivery.

There have been developed various techniques which can be applied to model demand and supply of the healthcare workforce. As a part of the literature review the following types of models were reviewed:

- **The stock and flow models**

One of the example of such methodology is the study by Galvan et al (2006) aimed to forecast supply and demand of cardiologists in Spain. Researches approached supply as a sum of current workforce, new joiners and leavers. To predict demand they used international benchmark ratio for their medical practitioners split by age groups.

An overview of supply stock-and-flow model for nurses was provided by Spetz (2007). The inflow in the model are graduates from local and international nursing programmes as well as those who moved from inactive to active license status. The outflow consists of emigration, death and retirement.

In the supply model by Scott et al. (2010) change in supply takes into account inflow of graduates and immigrants and outflow of leaver and respective decrease in working hours by each group. In order to forecast the demand for radiography specialists researchers assumed the constant growth rate for demand and supply. Afterwards they performed a sensitivity analysis varying demand growth rate, university drop-out rate and exit rates for workforce in order to estimate how critical they are.

- **Econometric**

A number of studies in order to forecast demand for health care workforce attempted to turn the factors of demand and supply into numeric values and formulas. As such Fabbria and Monfardinia (2009) developed an econometric model for forecasting of demand for services of physicians, which is initially based on Grossman equations. The model assumes that individual acts in order to maximize utility for each period of time, where utility being a function of independent variables such as spare time and health. The researchers approached the problem with the help of the regression model and used the data of the survey conducted by Italian NHS.

Another best practice modelling was developed by American scientists in order to forecast supply and demand for endocrinologists for the period up to 2020 (Rizza 2003). The scientists built up the basic equation model of the supply, including such parameters as mortality rate, new joiners, retirement rate and age profile. Based on the literature review and estimations, authors of this research determined several potential values for the parameters in the model and drafted the lines of supply and demand based on them. The scenario, which more reasonably represents reality, was chosen as the baseline for further discussion.

The study by Spetz (2007) proposes to model supply using multivariate regression including such parameters as federal migration policy, demographics, graduation, wages and stock market performance. However, the study concludes that most forecasts do not use this model.

- **System dynamic**

There are examples of health care workforce modelling which uses such an instrument as system dynamics. Masnick and McDonell (2010) attempted to create a generic map for healthcare that could be transferred into system dynamic model. The map includes three main elements: the population, which are the potential patients, the employees in healthcare, and the workload.

In practice the system dynamics modelling is applied in practice to forecast the need for medical specialists in Spain (Gonzalez Lopez-Valcarcel et al. 2007). The study first designs the system using causal maps which incorporate specific variables and interrelationship between them and then developed the system dynamic model using Powersim Studio 2005 software. The map of the specialists supply starts with actual workforce structure including age and gender distribution, and then incorporates recent graduates. After that specialists' demographical changes are determined using incorporation rates, retirement rates, rates of mortality specific for each gender. Besides, the model incorporates annual ageing of practitioners. The main outcomes of the model are calculated rates of medical specialists for 100 thousand inhabitants, proportion of women and percentage of medical specialists older than 51 for each year and speciality.

As a summary of the review of modelling practices in healthcare certain conclusions have been done:

- all the models approximate reality and their adequacy majorly depend on the quality of data sources used;

- the greater difficulty most researches see in modelling the demand;

- the sensitivity analysis (the change of one of the assumptions and assessment how this has influenced the rest of the model thus determining which ones are the most sensitive) and discussion of alternative scenarios proves to be reasonable as the way of scientific management of uncertainty;

- It is proved to be sensible to determine a margin to define deficit or oversupply in health care labour. For example, Galvan (2006) mentions that in Germany if less than 75% of necessary medical specialists there is deficit and if there is more than 10% of needed workforce there is a surplus. However, it is assumed that for the purposes of workforce planning slight oversupply of specialists, say +5%, would be beneficial. It would create competition in the market and unattractive geographic areas will not experience deficiencies in employing staff.

4   Current workforce

4.1 Descriptive analysis

Currently there are 25,395 registered occupational therapists in England (Health Professions Council, August 2011).

The Occupational Therapy (OT) workforce is distributed between those who work for the NHS, which is the major employer – more than half of currently registered OTs are employed by the NHS, – for local councils and other organisations.

The majority of OT staff working for the NHS in 2010 is female: almost 90% against 10% males.

During last five years of previous century and first five years in the current century there was on average an annual increase of 600 employees of the NHS OTs (

Figure 1). Since then the grow rate has slowed down – up to 200 employees a year.

*Figure 29 Number of NHS OTs (FTE and headcount) during 1995-2010 period*
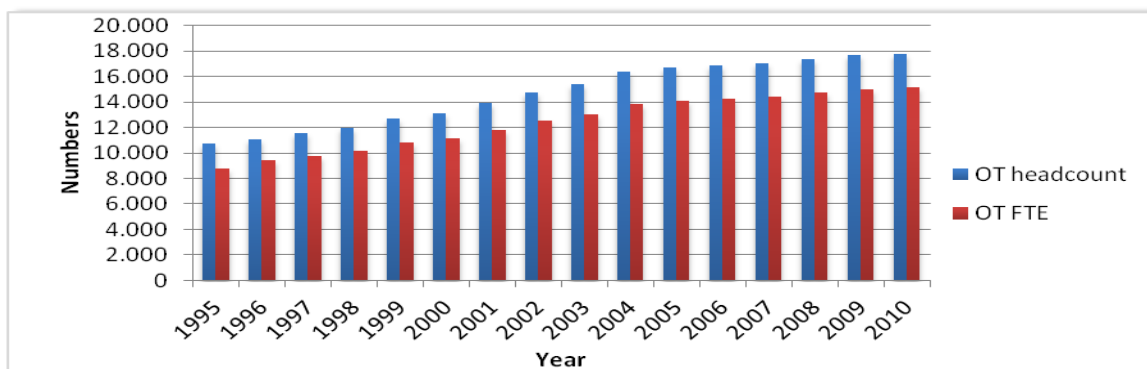
In 2010 17,777 OTs worked for the NHS with almost 60% of them employed by Hospital Trusts and the rest – by Primary Care Trusts.

The labour force distribution by positions presented in **Error! Reference source not found.** shows that majority of practitioners were therapists and only 4% are managers:

Figure 30 Distribution of NHS OTs by positions in 2010
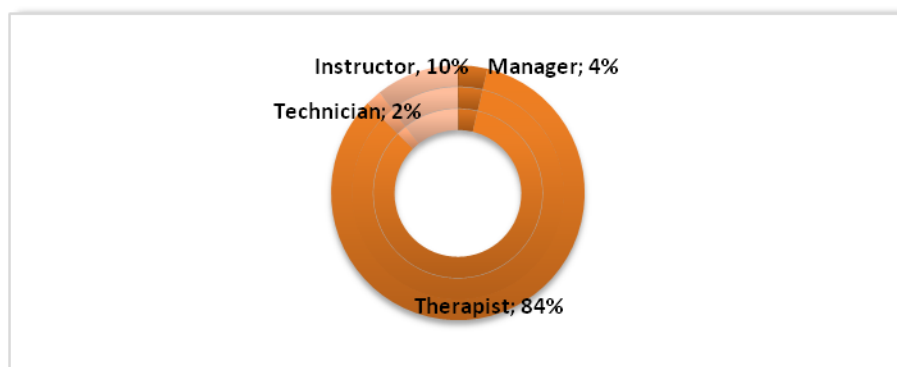
Age profile of labour force suggests that 65% of OTs in NHS in 2010 is aged between 25 and 44, indicating relatively young workforce.

The number of OTs employed by local authorities has experienced an increased by almost 370 employees during last twelve years.

Figure 31 Number of OTs in social services during 1996-2010 period
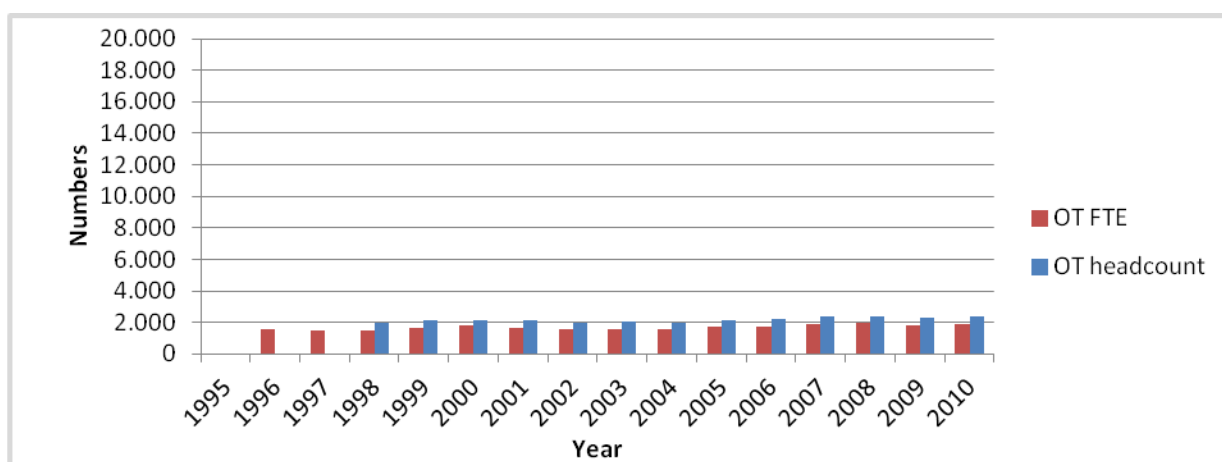
Source - NHS Information Centre, Adult Social care

The unique skills and OT techniques the specialists learn through accredited occupational therapy programmes. These programmes are majorly funded by NHS.

4.2 Adequacy of workforce supply and demand

An estimation of adequacy of labour force was undertaken in order find out how supply and demand are currently balanced. For this purpose a set of indicators proposed by Australian Medical Workforce Advisory Committee was used: for each indicator (in case it is applicable to OTs) its current value was estimated or compared to international benchmarks (AMWAC 2003).

Table 10 Summary of indicators of medical workforce shortage and oversupply continued

Indicators	Estimation for Occupational therapists	Source/Comment
Vacant positions	400 vacant posts at 31 May 2010; 3-months vacancy rate – 0.7%, however it is claimed that vacant posts became frozen. **World Federation of Occupational Therapy (WFOT)**: • UK not in the list of countries with shortage of OT • Lack in experienced and specialists	The NHS Information Centre; WFOT has not listed UK as country with shortage of OT (Human resource project, WFOT, 2010, www.wfot.org),
Consultation waiting time and patient access	Many people experience difficulties with accessing an occupational therapist mainly because services are provided to patients with severe health problems	From meeting with an occupational therapist and lecturer in OT in the University of Southampton
Excessive work hours	A British Association of Occupational Therapists (UNISON survey in October 2008): Workload increase according to 21% of respondents	CfWI (2010) Workforce risks and opportunities summary – Occupational therapists (unpublished report)

| OT/population ratio	4.3 per 10,000 population in 2010 (total practicing workforce in terms of headcount)	Almost the same as in the Finland, Norway (WFOT) – countries with similar health care system.
Service substitution	• Decrease in autonomy in work	From meeting with an occupational therapist and lecturer in OT in the University of Southampton
Quality of service provision	• Less person-centred and more checklist-based approach	
Views of practitioners in the workforce under review		

The findings have shown that the current supply is not effectively met and there is more need in the services of OTs than existing provision.

5 Workforce supply

The supply of occupational therapists is determined by a range of factors professionals cross sector income differences, potential substitution, duration of and others. The literature review has show that the most common approach for modelling is stock-and-flow modelling (Spetz 2007, Galvan 2006, FAS 2009). and on data availability it is decided to build up the supply forecast for OTs as a flow model where the inflow to workforce is joiners, international recruit and practice and the outflow made up of retirees and others leavers and joiners (

Figure 32).

Figure 32 Stock and flow model for Occupational Therapists
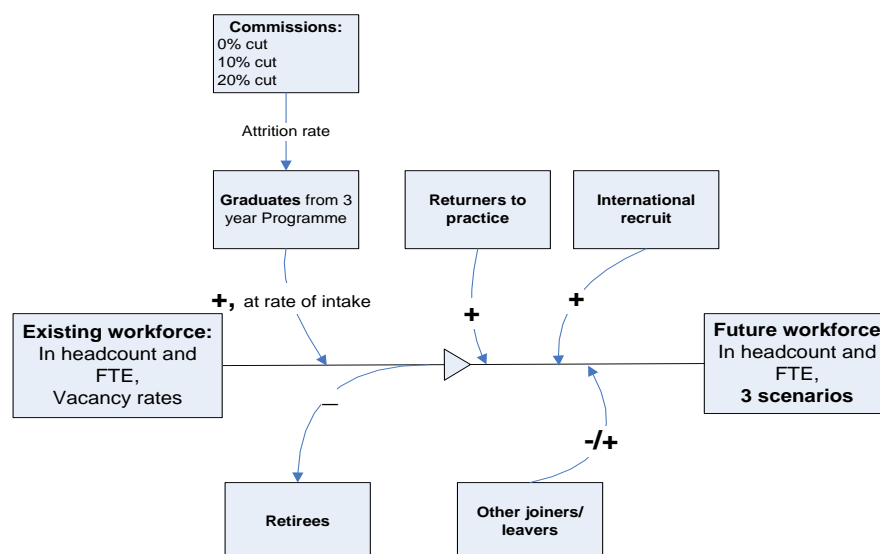
The current stock of occupational therapists is the key determinant of future supply which comes in line with the *Next Stage* report by Lord Darzi (2008). Descriptive analysis performed in chapter 1 includes the number of 2010 workforce employed by NHS and local

authorities, which 20,127 professionals in terms of headcount and 17,032 full-time employees (FTE).

5.1 Joiners

The biggest inflow to occupational therapists' workforce consists of recent graduates from regulated programmes. Nowadays there are a range of accredited courses of different duration:

- full-time three-year BSc;
- part-time four-year BSc;
- full-time work-based two and a half years BSc;
- two-year master's degrees or postgraduate diplomas.

The minimum requirement to become an OT is BSc in Occupational Therapy which is three years long course and this is the most common duration of the course. Thus three years is time lag between the commissioning of posts in universities and the production of therapists.

There is uncertainty about education commissions for the future periods due to all running reforms. However, COT expects 10%-20% cut in number of commissions for 2011/2012 year. The literature review has indicated that in case of uncertainty the best option is to introduce various scenarios to the model (FAS 2009) like:

1. Number of commissions for 2011/2012 will be the same as in 2010 and will stay the same up to 2030;
2. Number of commissions for 2011/2012 will be 10% less than in 2010 and will stay the same up to 2030;
3. Number of commissions for 2011/2012 will be 20% less than in 2010 and will stay the same up to 2030;

However, it is acknowledged that due possible contractual agreements between the COT and Higher educational institutions the possible cuts would be implemented in a couple of years, but for the purposes of modelling it is implemented from the next year.

Number of graduated students is calculated as the number of commissioners multiplied by the attrition rate in the respective year which is 10% as estimated by COT. Afterwards, the number of those who actually joined the practice is computed by applying the rate of employed by NHS and local authorities –88%, also provided by COT.

In order to get the figure of the joiners to practice the number of commissioned students is adjusted by the attrition rate and percentage of those employed by NHS and Local authorities.

Another source for addition to OT labour force is returns to practice. Number of returners for 2006-2010 was provided by COT, further after it assumed to be equal to average of these 5 years – 99.

Number of OTs from abroad practicing in the UK is available for 2007-2010, further after it is assumed to be equal zero.

5.2 Leavers

One of the workforce outflows of is retirees. Age profile of OT workforce suggests that there is no fixed age for retirement and employees may decide to stay working longer. A large proportion of staff in elder age band is expected to retire by 2012 because of the new pension arrangement (South East Coast NHS 2010). This alleges a risk of deficit of skilled employees to train new joiners.

The number of retirees in the NHS for the period 1996-2008 is historic data obtained from previous CfWI model. For time period from 2010 to 2031 the number of retirees was estimated using age profile for 2007-2010 workforce and assuming probability to retire for the each age group will not change.

5.3 Other joiners and leavers

Over two ultimate years other leavers make up approximately 4% of total workforce and it was assumed that this rate will remain unchanged over the period of forecast (.

Figure 13).

Figure 33 Other leavers and joiners over 1999-2010 period
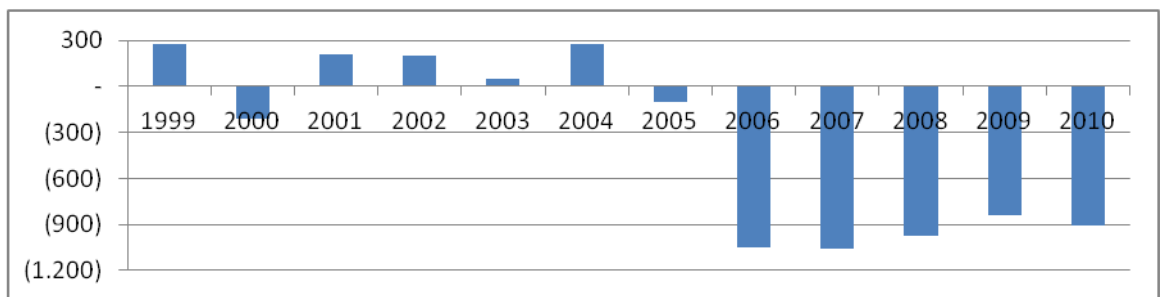
Having made all the necessary assumptions the model extrapolates the number joiners and leavers thus providing an estimation of future workforce in terms of headcount and assuming the participation rate constant we got full time equivalent figures (

Figure *34*).

Figure 34 Historic supply and forecast for OT workforce
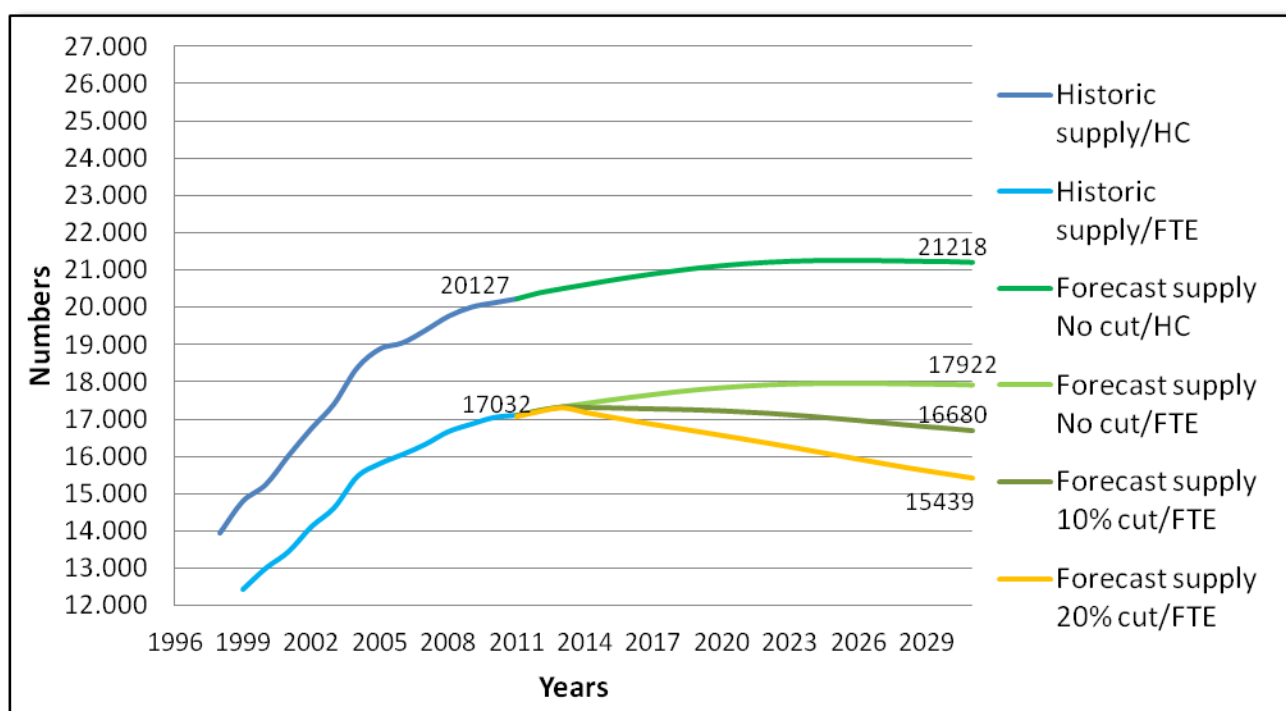
5.4 Vacancy rates

Another factor to take into account for estimation of the supply is vacancy rates. Vacancy rate is a ratio calculated by division of listed full-time equivalent vacancies at a certain period of time by the sum of this vacancies and current FTE workforce.

A three-month vacancy is estimated by division of vacancies which lasted three month by sum of existing FTE staff and number of 3-months vacancies. Thus 3-months vacancy ratio indicates proportion of position which employers find difficult to fill in. For occupational therapists vacancy and 3-month vacancy rates are presented in the **Table 3** below:

Table 11 Vacancy rates for OTs within NHS in the recent 5 years. NHS Vacancies Survey - 2010

Year	2005	2006	2007	2008	2009	2010
3 month-vacancy rate	3.4%	1.6%	0.7%	0.5%	0.7%	0.5%
Total vacancy rate				3.6%	4.2%	2.6%

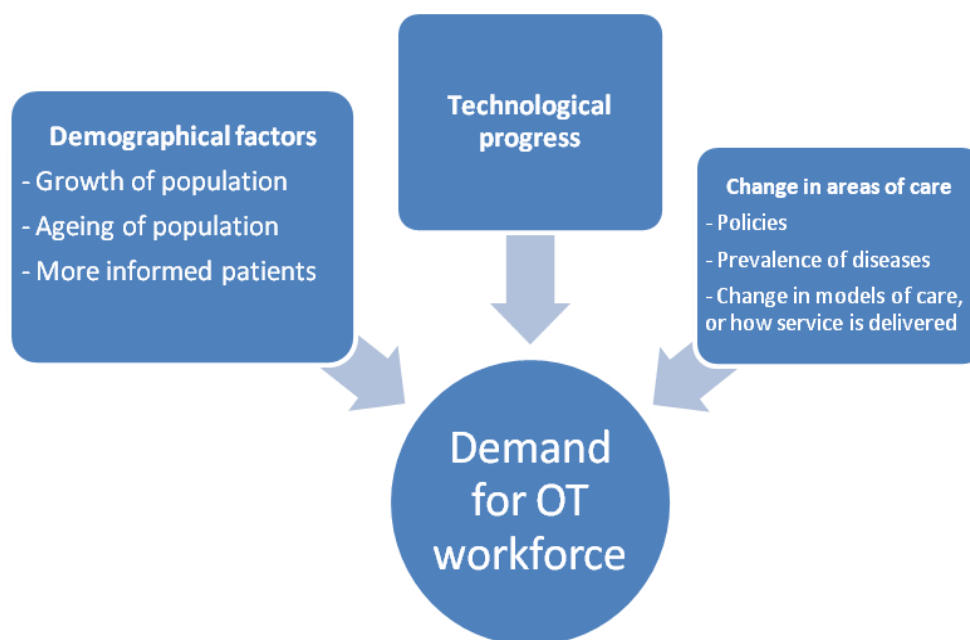*Source – NHS Information Centre, NHS and GPs vacancies*

Overall the 3-months vacancy rate is falling back during the last five years due to freeze of some vacant posts and overall government policy (COT).

6 Demand drivers and modelling

The factors of demand are summarised in the

Figure 35.

Figure 35 Drivers of demand for OT workforce

Source – Adapted from Demand for Health Services and the Health Workforce - Information Paper, Health Workforce Information (2005) Australian Health Workforce Advisory Committee, Australian Medical Workforce Advisory Committee and Australian Health Workforce Officials' Committee, Paper 3, Sydney.

6.1 Demographic factors

The demand on the occupational therapy services is mainly the need of population in these services. That is why in order to estimate demand it is crucial to understand the main demographic trends in England. According to the National statistics England population is predicted to increase by 9.52% by 2018 (Office of National Statistics 2009). Besides, the proportion of older people is rapidly growing which challenges to adjust health and social care capacities - the NHS spends almost half of its budget of treatment and care of people who are over 65 years old (NHS History). In 20 years almost 40 per cent of England's population in comparison to 34 per cent in 2009 will be older than 50 years old while the number of people aged 80 or more will double (The Audit Commission 2008).

Along with growing in numbers the population is overcoming qualitative changes becoming more informed and educated. Rising expectations make more people request for OT services as well as demand higher quality of services delivery.

Thus the growing and ageing population is the first sign of rising demand for OTs' services.

6.2 Technological progress

Technological progress affects the demand in the way that having access to information patients nowadays is becoming more knowledgeable and aware of their rights. Rising

expectations make more people request for OT services as well as demand higher quality of services delivery. The role expansion requires OTs to work crosswise the boundaries between social care, medicine, physiotherapy and others which make the profession of occupational therapist likewise any other evolutionary. The forecast for the future is that innovation in health care will continue (AHWAC, AMWAC and AHWOC 2004).

6.3   Changes in areas of care

Having dealt with demography in general, in order to understand the specifics of demand on OTs it was decided to analyse what is happening in the areas of practice for OTs.

According to College of Occupational therapists OTs are practicing in the areas listed below (Table 12).

Table 12 Areas of care for Occupational therapists

Areas where OTs are involved	Proportion of entire workforce time spent on each area	Character of sufferers : Actual – health statistics, Potential – whole population	Number of sufferers 2010	Number of sufferers 2020
Dementia care	4%	Actual	607,249	755,953
Older people, prevention of falls	23%	Potential	8,584,992	10,576,723
Mental health excluding dementia	24%	Actual	8,326,984.8	9,148,091
Learning Disabilities	4%	Actual	16,442.00	18,925
Long Term conditions excluding stroke	10%	Actual	15,829,854.3	17,351,255
Stroke	7%	Actual	118,204	126,817
Accidents & Emergencies	1%	Potential	52,234,000	56,039,881
Orthopaedics/musculoskeletal	8%	Potential	52,234,000	56,039,881
Social care	11%	Potential	52,234,000	56,039,881
Total	92%			

Source – The College of Occupational Therapy

For each of the areas the COT provided an approximate breakdown of employees working in this area. Based statistical databases and research papers the number of people suffering from these medical conditions was found and predictions of growth for these numbers. For some areas these are real numbers of patients (Actual in the table 3), for example the total number of people who have mental health problems. But for some areas the whole population was estimated as potential patients (Potential in the table 3). That was only done for the purposes of estimation growth rate for these areas – so growth rate of England population was used for calculations. Our analysis covers 92% of all activity of OTs.

DH publications, National frameworks including Valuing people now (DH 2009), Supporting People with Long Term Conditions – An NHS and social care model to support local innovation and integration (DH 2006), the National Service Framework (NSF) for Older People (DH 2001), National Stroke Strategy (DH 2007) and others promote the idea of creating an environment where individuals may self-care. The government's social policy in the form of such frameworks, guidelines and white papers makes the public more informed about benefits of OT's intervention, thus stimulating more the demand.

The overview of areas of OTs' activity has demonstrated that there is a stable and even gradually rising demand for the services of OT.

6.4 Demand modelling

There have been developed a range of forecasts of future requirements for OTs based on the professional judgements of specialists met and various assumptions. The models are classifies and described in *Figure 9*.

Figure 36 Demand modelling
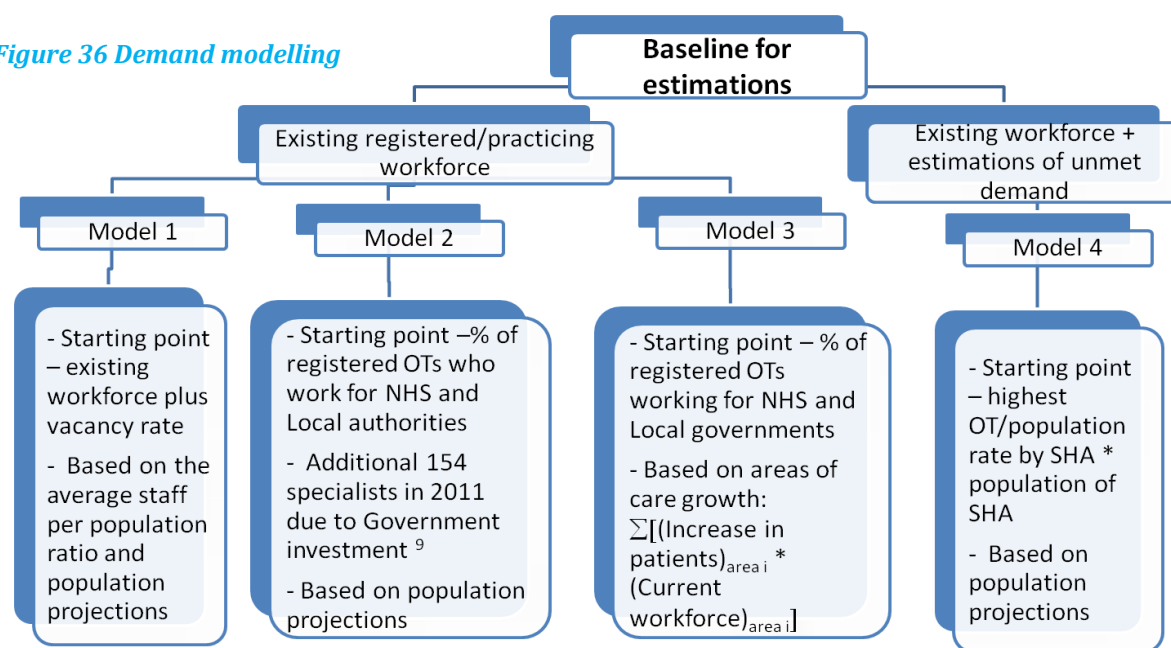
The first three models use existing registered or practicing workforce as a baseline.

The first model is most simplified. It uses the staff per population ratio and population projections and extrapolates this for the next 20 years.

The second model is based on the recommendations of the College of OTs. It is based on the registered OTs who work for NHS and LA, plus it adds additional specialist in 2011 due to extra funding from the Government, and then utilizes population growth rate.

The third model, partly inspired by Care Life Cycle Group and the study by Etzioni (2003) on workforce projections for surgical oncology, is based on the changes in the areas of care. Having the growth factor for each area and workforce involved in the area we estimated the workforce needed to serve the increased number of patients.

The forth way of modelling the demand has aroused as a combination of the benchmark approach implemented in research by Galvan (2006) and an attempt of quantifying unmet demand by Schofield (2008). The fourth model represents an attempt to include the unmet demand. Based on the breakdown of OT by Strategic Health Authority (SHA) ratio of OT per thousand of population in each SHA is calculated. It was assumed that low rates are due to underserved population. So the highest rate was taken as a benchmark and multiplied by England population.

The demand modelling results are presented in

Figure 37.

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[3] An OT for half of 152 PCTs and 155 local authority social services organisations

Figure 37 Demand for the workforce
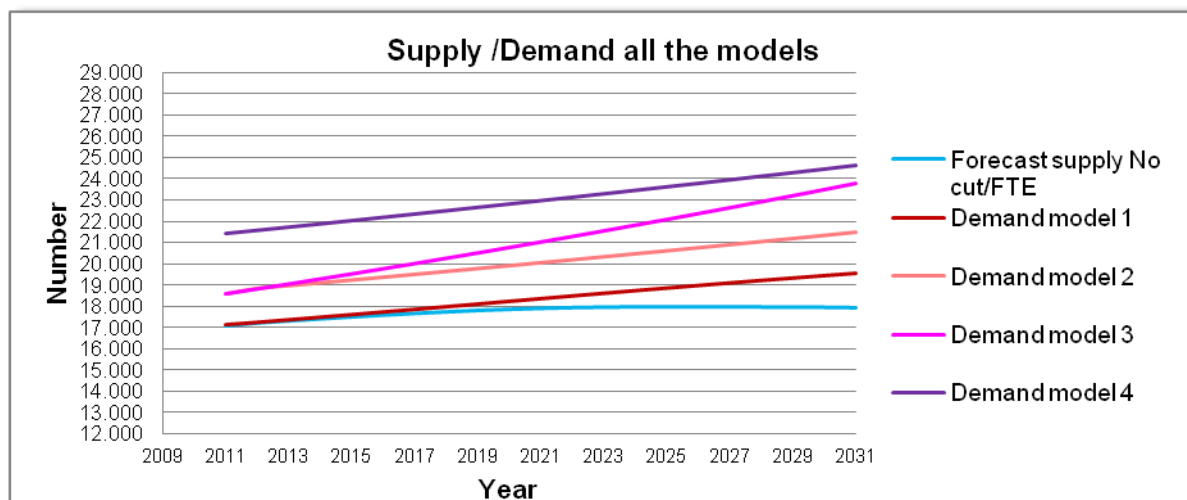
The 1, 2 and 4 demand graphs are parallel with a constant gap supposing being 154 extra OTs added in 2 scenario and 5,000 (FTE) of OTs covering unmet demand in scenario 4. The 3 demand curve representing the growth in areas of care is surging more rapidly than others. So, according to models 1 and 2 the approximate number of needed OTs in two decades time will be 21,500 (FTE) and around 24,000 (FTE) in scenario 3 and 28,000 in scenario 4, which is 13%, 26% and 45% respectively increase in comparison to existing FTE employees. For comparison, during the previous 11 years only NHS staff has increased by 5,300 (FTE) or 43%.

7 Supply/demand gap analysis

7.1 Analysis

The models built represent very simplified real situation, however enable to estimate a kind of gap between supply and demand.

The graph (*Figure 38*) illustrates that there is a gap between supply and demand in all the scenarios. It is the least in case of no cut in commissioning.

Figure 38 Supply and demand forecast for Occupational Therapy workforce
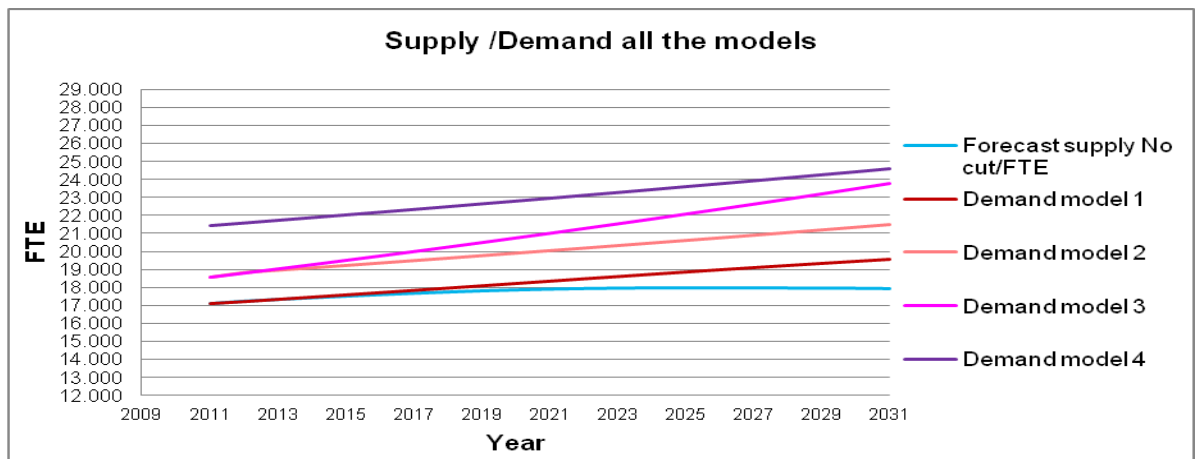
The gap between supply and demand (model 1) in 2010 starts from less than 100 specialists (FTE) in 2010 and increases up to almost k1.6 employees (FTE; model 1) in 2030 accounting to 8% of overall demand estimation. The gap in model 2, 3 and 4 will reach k3.5, k6 and k6.7 respectively in 20 years time. This means that a significant number of patients may not receive the necessary services.

7.2 Addressing the gap

As measures to cover the gap and meet unmet demand in Occupational therapy the following measures could be considered:
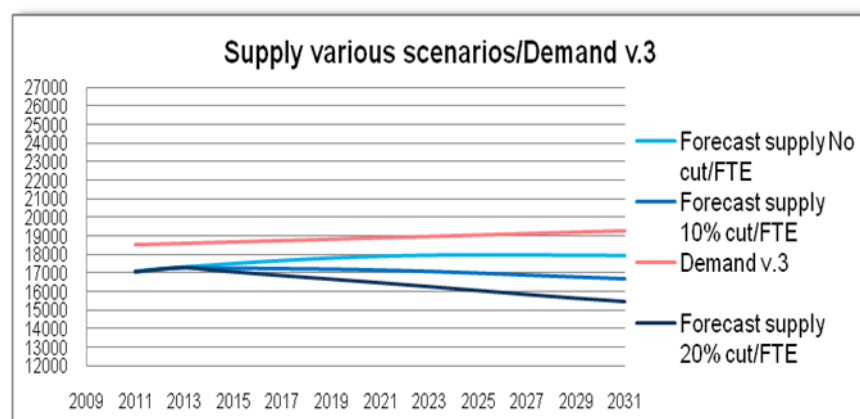
- Increase of international recruitment – putting the OT back to shortage list (Galvan 2006)

- Increase in education commissioning (this line of action was also implemented in the researches by Galvan (2006), Scott (2010))

- Investment in retaining staff at their retirement age and reducing losses from the workforce (exit rates) (Scott 2010)

- Changes to models of care and changes to skills mix

There has been a range of evidence in the history of medical practice when the task or entire area certain specialists were in charge of turns to be a responsibility of other professionals. There is already such an example in Occupational therapy practice: few years ago van drivers who delivered OT equipment were trained to show the patients how it worked thus releasing the OTs' time (from University of Southampton MSc dissertation). This measure of dealing with gap between supply and demand is also proposed in the study by Galvan (2006) who describes of possibility to incorporate noncardiologists to overcome deficit in cardiologists.

- Decrease in prevalence of diseases

In case the social policy and government investment succeed and result in reducing the prevalence of medical conditions OTs are working with (including areas where the group or whole population is taken as group of potential patients) up to 10% less in 2020 then the gap between supply and demand will decrease to an average of undersupply of 11% throughout the period of 20 years (*Figure 39*). However, it was concluded like in the study regarding cardiologists in Spain by Galvan (2006) that in the society with growing life expectancy the demand for OTs is not likely to go down.

In attempt to find a balance between supply and demand and give an approximate quantitative estimation of measures 'what if' scenarios were applied Demand model 1 and Supply model with No cuts.

1. Increase of international recruitment – putting the OT back to shortage list

In case the overall each year during the period of 2010-2030 there will be 100 specialists from abroad the gap between demand and supply (in case no cuts in commissioning) will not be more than 1% on average with slight oversupply in second decade (Figure 22).

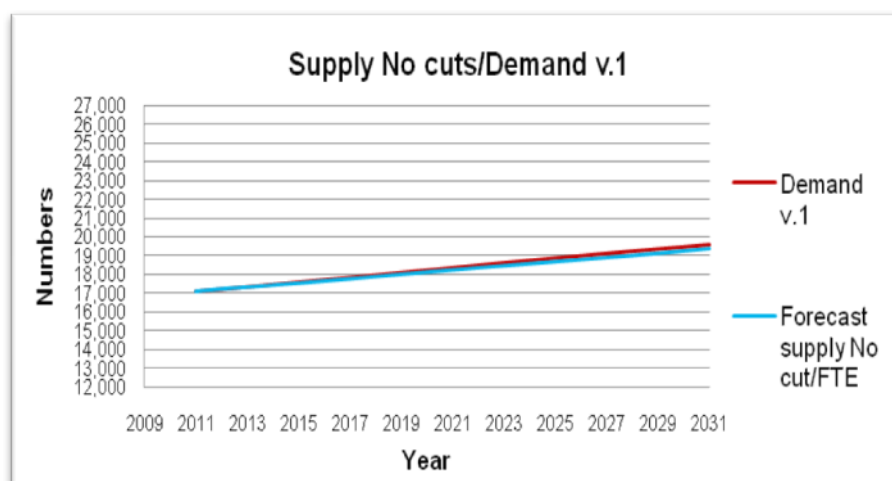*Figure 40 Supply (no cuts and 100 OTs from abroad) and demand v.1*
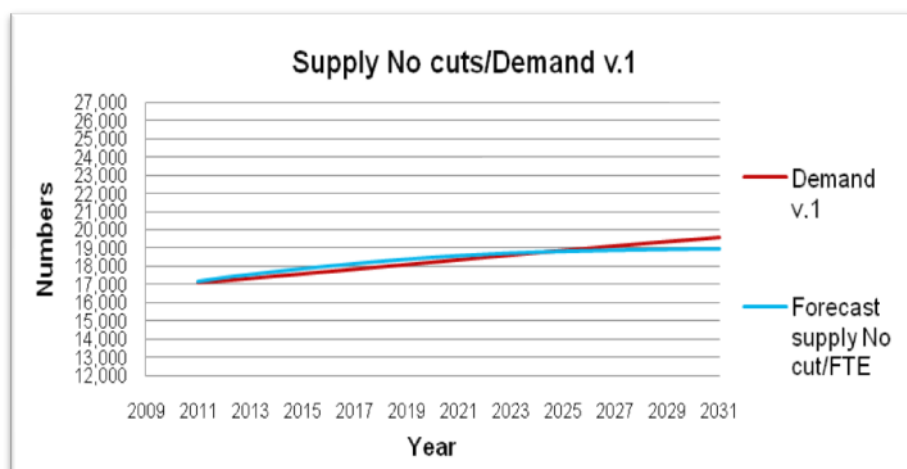
2. Increase in commissioning

The optimal change will be 1% of annual increase in education commissioning throughout the period 2011-2030 and then keeping this number stable (

Figure 23).

*Figure 41 Supply (1% increase in education commissioning) and demand model 1*

In this case the gap between supply and demand would not surpass (-1) % on average.

3. Investment in retaining staff at their retirement age

If NHS and Local authorities invested in retaining more staff at their retirement age then the estimation of leavers would change. For example, the graph in Figure 24 shows the decreased gap if the staff is encouraged to retire later.

Figure 42 Supply (Retention of staff at retirement age) and demand v.1
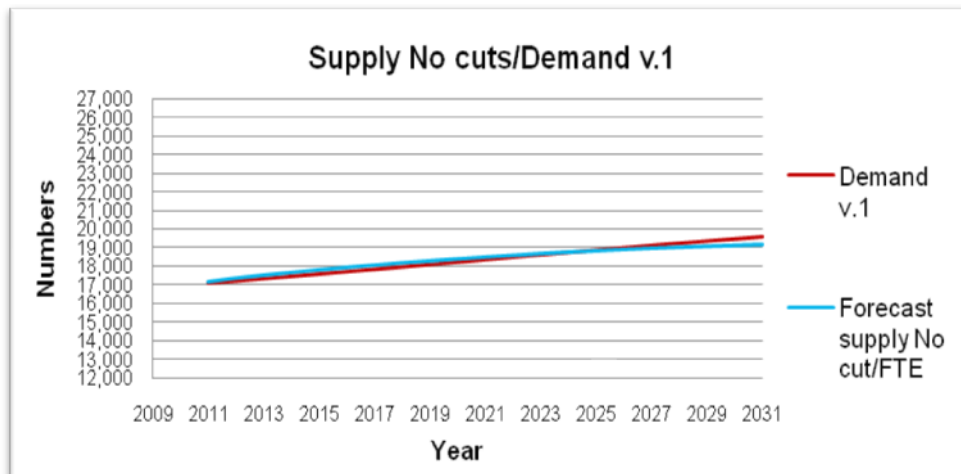
In order to implement the scenarios described above the essential component is availability of funding, for example, to finance scholarships and bursaries to attract more students or increase in salary to retain existing staff. There can be also non-monetary incentives like facilitating visa process for international OT graduates or additional flexibility in hours of service. In long term perspective adjusting number of workforce in training is beneficial while in short term migration may help to deal with temporary disproportions.

8 Conclusion and recommendations

Delivering care to ageing population suffering from long term conditions and disabilities is challenge for many countries that have to handle the problem of skilled workforce shortage and adapt the health and social care system to cope with XXI century.

In an attempt to estimate occupational therapy workforce in future 20 years, this study has discussed the characteristics of the current workforce, imbalances in the labour market now, factors contributing to supply and demand and approximate supply and demand in OT services in future.

The work was performed in close contact with major stakeholders of the projects: the College of Occupational Therapy, the representative of the profession, the Centre for Workforce Intelligence, - what has added to believability and accuracy of the model.

The forecast of health and social care workforce taking into account all the ambiguity due to current reforms has resulted in several possible scenarios of supply of workforce. The modelling of demand resulted in 4 outcomes depending on selected approach.

The major findings of the research and modelling are the following:

- At the current level of commissioning the level of supply will continue to grow till it reaches a plateau by 2020;
- In case there will be 10-20% cuts in commissions the level of supply will go down, reaching the level in twenty years which is lower than the level of existing workforce;
- There is at least 2,000 employees (FTE) of gap between supply and demand;
- According to all the models built to estimate the requirements of OT workforce the demand is growing more rapidly than supply;
- Demand model 3 (areas of care) and model 4 (unmet demand) could be base for future modelling since they are attempt to more closely approach reality
    a. Estimation of unmet demand which was attempted in Model 4 is considered to be performed with participation of stakeholders, mainly representatives of 'underserved' and 'benchmark' areas;
    b. More accurate estimation of time spent on areas of care is considered beneficial for the improvement of modelling;
- Breakdown of time dedicated to care each age group is considered to be useful information to collect so that to not to use general population growth rate, but disaggregated growth rates for each age band for precise extrapolation;
- Establishment of what is considered as a balance between supply and demand of workforce or 'ideal' situation (for example, in terms of percentage – 5% of oversupply) proves to be beneficial in order to implement 'what if' scenarios;
- Area for further research could be related to gathering information on career progression in Occupational Therapy so to split the total supply in bands and estimate the risk of shortage in each band.

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I declare that this dissertation is my own work, and that where material is obtained from published or unpublished works, this has been fully acknowledged in the references.

Signed: Date:

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Oksana Pchelenkova (24433306)