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Title page

Title: Examining pharmacy workforce issues in the United States and the United Kingdom

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Abstract

OBJECTIVE: To examine the currently available data and action surrounding current pharmacy workforce issues in the United States and United Kingdom.

METHODS: Published pharmacy workforce data from the United States and United Kingdom were gathered from various sources, including PUBMED, internet search engines and pharmacy organization websites. A variety of data was collated, including scientific literature, internal documents, news releases and policy positions.

RESULTS: The number of schools/colleges of pharmacy has expanded by approximately 50% in both the United States and United Kingdom over the previous decade. In the United States, continued need within the pharmacy workforce has been previously forecasted, but this is now based on outdated supply figures and on assumptions for economic recovery; no updated mechanisms for workforce planning are known. In the United Kingdom, workforce modelling has predicted a significant future oversupply of pharmacists, and action within the profession has developed to address the situation through educational planning and regulation.

CONCLUSIONS: Workforce planning is an essential task for sustaining a healthy profession. Recent workforce planning mechanisms in the United Kingdom may provide guidance for renewed efforts within the profession in the United States.

Main text

INTRODUCTION:

Healthcare is an environment of constant evolution and growth. In the last several decades, the role of the pharmacist in the United States has shifted from being product-driven to a patient-focused, integrated member of the healthcare system. The profession has recently seen changes in degree and training structures with full transition to the Doctor of Pharmacy (Pharm.D.) degree and increased uptake of postgraduate residency training, as well as growth in need for services with expansion of third-party coverage, community chain pharmacies, and ultimately, prescription volume. Today, pharmacists are confronted with a quickly aging patient population and the advent of healthcare reform integrating into their practice. The past several years have also seen a rapidly expanding market of pharmacy schools/colleges and increased enrollment of students within the profession. Concerns have emerged that this growth may be too expansive, possibly leading to a detrimental effect upon the future workforce and its sustainability within the job market.

This issue is not unique to the United States as similar apprehensions are being recognized in other developed areas of the world – namely within the United Kingdom, which has seen the same evolution in the profession of pharmacy, but now faces similar echoes of concern regarding the expansion of pharmacy enrollment and workforce. However, as the United Kingdom operates within the realm of the National Health Service (NHS), a publicly-funded healthcare system, the scope and approach of the issue is different to that in the United States, and may provide for useful parallel comparison in understanding the issue, and the approaches to address it. Accordingly, the aim of this article is to examine the currently available data and action on current pharmacy workforce issues in the United States and United Kingdom.

METHODS:

Published data relating to the workforce, including supply/demand figures, planning assessments, and policy proposals/statements relevant to the pharmacy profession in the United States and United

Kingdom were informally searched. Data was obtained from various sources, including PUBMED (for scientific literature), internet search engines (for internal documents and news releases) and pharmacy organization websites (for policy and professional materials). Information was collated by country, and supplemented with author analysis and assessment where appropriate.

RESULTS:

United States

The number of pharmacy schools/colleges in the United States has seen significant expansion in recent years – currently at 129 accredited institutions, up from approximately 80 in 2000¹⁻² – and this expansion is primed to provide an increasing number of professionals. The number of students in Pharm.D. programs has also increased dramatically, with growth in enrollment ranging 3.6 to 8.4% per year over the previous decade.² Several commentaries have been published in the *Journal* expressing concern over this increase and its downstream effects upon the pharmacy job market.³⁻⁵ The predominant question is whether this educational expansion will be matched with increased availability of jobs for pharmacists.

The most recent job outlook figures for pharmacists from the Bureau of Labor Statistics (BLS) at the US Department of Labor predict more than 41,000 new positions (a 14% increase) by 2022.⁶ Much of this growth depends on two factors: first, the Affordable Care Act expanding healthcare to millions of currently uninsured Americans, and second, an increased need for services for an aging population with more complex medication needs.⁶ Additionally, there is expectation that the overall industry will expand as the economy recovers, and that pharmacists near retirement who continued working through the recession will exit the job market with an improving economy, specifically expanding the need for newer professionals. While the BLS state that a robust recovery from the recently ended recession is necessary to see industry and job expansion, the Federal Reserve has concluded that no evidence exists indicating the US economy is approaching full health,⁷ and economists state that it will remain below full health through 2014, indicating a slow rather than robust recovery.⁸ The Business

Roundtable in a survey of 200 top employers found less than one-third were expecting to increase employment and one-quarter of these employers were instead looking to lay off workers.⁹

A major source of workforce data within the profession is the Pharmacy Manpower Project (PMP; now known as the Pharmacy Workforce Center) initially performed during Autumn 2001.¹⁰ The expert panel was convened to determine the profession's workforce needs through the year 2020; employing data including population demographics, technology, drug use trends, and expansion of the profession into the overall healthcare paradigm, the panel concluded that there would exist a shortfall of 157,000 pharmacists by this time.¹⁰ The increased need for pharmacists would emanate from the expected increase in prescriptions due to the growing percentage of the population over the age of 65 and pharmacist role expansion into a number of areas, such as drug use safety and policy, geriatrics, and long-term care facilities. The panel assumed growth rate in pharmacy education of three new schools/colleges to be created every ten years.¹⁰ Instead, as stated above, the number of schools/colleges has increased by over 50% in just over one decade, and 31 colleges of pharmacy have expanded their class size by more than 50%.²

In 2000, the Department of Health and Human Services (DHHS) produced a report assessing the supply/demand balance within the pharmacy profession; the general consensus of the report was that a shortage was indeed occurring, primarily from increasing demand for pharmaceutical care services and constrained growth in the number of new graduates.¹¹ At the time of the report, there were 81 operating schools/colleges of pharmacy and the number of applicants had dropped off considerably below levels seen in the early 1990s.¹¹ An updated workforce study was issued by the DHHS in 2008 and predicted continued future need for pharmacists with a shortfall of nearly 38,000 by 2030, despite the supply of pharmacists having grown faster than previously projected.¹² However, their updated conclusions were based on growth in schools/colleges leading to 12,000 graduates in 2030 – a number that has been met and surpassed at the current time, nearly 20 years too early.¹² The analysis evaluated several supply- and demand-based scenarios; the most aggressive supply scenario estimated 20% more graduates than baseline assumptions, which at current time best estimates the status quo.¹² When coupled with the most anticipated demand scenario (moderate growth in prescriptions per capita), there would be a resulting slight oversupply of approximately

7,500 pharmacists by 2030; however, based on this increased supply, the range of all demand scenarios varies considerably from an oversupply of 88,900 pharmacists to a shortage of 97,800 pharmacists.¹²

The Aggregate Demand Index (ADI; supported by the PMP) is one data source that provides an up-to-date survey on pharmacist staffing levels.¹³ The most recent ADI indicates that most states (35) have a balanced workforce. A moderate demand exists in 13 states (down from above 40 just a few years ago) and 3 states already acknowledge a surplus of pharmacists; no state has a high demand.¹³ The national ADI has decreased by approximately 25% from 4.31 in August 2006 to 3.27 in March 2014, demonstrating a decreasing demand for pharmacists over time.¹³ Unfortunately, no forward projections are available; time series data from ADI has been utilised to build a descriptive model of the pharmacy workforce, but the ability of said model to forecast has been limited.¹⁴ The American Society for Health-System Pharmacists (ASHP) also conducts an annual survey of staffing levels, albeit limited to those in hospitals and health-systems.¹⁵ The 2013 survey reported a vacancy rate of 2.1% for pharmacists – an eleven-year low from 7.2% in 2002; this was coupled with the lowest turnover rate (5.6%) and lowest mean time to fill vacancies (3.2 months) during the same time-frame.¹⁵ Entry-level frontline pharmacists were perceived to be in excess among 48.1% of pharmacy directors.¹⁵

While there is reasonable expectation that demand within pharmacy may increase, quantifying this effect requires consideration of the overall health of the economy, and growth in prescription rates affected by the aging population and healthcare reform.¹⁶⁻¹⁷ A relatively emerging issue that may also become pertinent is the cost of a pharmacy education, which has increased by 54% on average in the last 8 years, resulting in an estimated average indebtedness among pharmacy students of \$114,422.¹⁸ Although the average pharmacist salary and number of total pharmacist jobs in the United States have steadily increased, from 2008-2012, the rate of increase of average indebtedness greatly outpaced the rate of salary increase (23 vs. 6.6%), decreasing effective salary.¹⁸ Increasing debt could also potentially effect the supply structure for a new generation of pharmacists. No available projection models comprehensively incorporate all of these factors (with up-to-date supply data) to estimate the level of workforce balance.

Although data is available from multiple sources, the United States has no current and comprehensive effort with regards to pharmacy workforce planning. The last formal assessment was performed by the DHHS in 2008 and while providing useful information, its projections have now shown to be outdated, and no updates are known. In 2010, the American Pharmacists Association (APhA) and ASHP released a joint discussion paper examining the expansion of pharmacy education.¹⁹ Among their key recommendations was the need for a stakeholders' conference on workforce planning, and the establishment of an on-going assessment of workforce needs and response to said needs.¹⁹ However, follow-up action to this recommendation remains to be seen. The de-facto approach by the profession thus far has been a reliance on the free market to self-determine pharmacist supply and demand.

United Kingdom

The number of M.Pharm. (Masters of Pharmacy) programs in the United Kingdom has also increased in recent years. At the time of writing, there are 26 universities fully accredited by the General Pharmaceutical Council (GPhC) and 3 universities with provisional accreditation – this is in contrast to the 16 accredited programs operating in 2003.²⁰ Despite a national increase in first-year university students in all degree programs from 2004-2008 of 15%, the number of students in pharmacy programs increased by 40% during the same time frame.²¹ This increase has led to similar concerns regarding the future balance of the pharmacy workforce.

After completion of the 4-year M.Pharm. degree, graduates apply for pre-registration – a 1-year training period under the supervision of a registered pharmacist at an accredited site, similar to the advanced pharmacy practice experience (APPE) in the US pharmacy education model. Successful completion of these components and subsequent passing of a registration exam enables the graduate to apply to the GPhC for registration (licensing) as a pharmacist. However, unlike APPEs, pre-registration training is a separate experience from the university curriculum and the responsibility of the student to secure. Increased student enrollment puts significant pressure on the number of placements in pre-registration system, not dissimilar to the competitive nature of the ASHP Matching

Program, where 35.7% of applicants in 2014 did not match with a residency.²² However, while residency is an optional experience, poor matching between pharmacy student numbers and pre-registration spots in the United Kingdom would potentially allow students to graduate from a pharmacy program yet be unable to become registered (and work) as a pharmacist.

From 2002-2010, the number of pharmacists on the GPhC register increased by 11.9%.²³ Registrants have become younger, with growth in under 30 year olds outpacing all other age bands – a likely result of the recent increases in pharmacy student numbers.²³ The national pharmacy staffing survey (which surveys NHS-employed pharmacy staff primarily in the hospital sector) indicates an overall net shortage of pharmacists in Great Britain, however vacancy rates dropped between 2010-2012 from 11.9% to 7.5% in England, and from 7.1% to 3.1% in Wales.²⁴ Vacancy rates remain higher in lower band (entry-level) employment – 12.2% in England – but these have also decreased in recent years.²⁴ Data on community pharmacists is less readily available but recent policy changes are likely to change the landscape. In order to open a new community pharmacy and apply for an NHS contract, applicants are required to satisfy a statutory ‘market entry’ test, which is designed to prevent new pharmacies from opening in areas where there is no perceived need for additional services. In 2005, applications in England for pharmacies that would be open at least 100 hours per week were granted an exemption from this rule in an effort to improve public access to pharmacy services. Accordingly, the number of community pharmacies in England (which had remained relatively stable at 9765 in 2000/01 and 9736 in 2005/2006) increased by 15.4% by 2011/12.²⁵⁻²⁶ The growth in the number of pharmacies, particularly those with prolonged operating hours, increased demand for pharmacists and supported the expansion from pharmacy schools and student numbers over the last ten years. However, this exemption was fully repealed in 2012, and the downstream effect this change on growth and job availability for community pharmacists is unknown.

In response to these data and increasing concern within the profession, the Department of Health (the ministerial branch of government supporting healthcare in England) commissioned a third-party comprehensive assessment of supply and demand in the pharmacy workforce, performed by the Centre for Workforce Intelligence (CfWI). The assessment used a robust approach with a horizon scanning workshop among stakeholders to identify impacting forces within the profession, followed by

scenario generation of possible influences and finally, modeling of supply/demand structure for pharmacists.²⁷ Factors considered included the demographic structure of the workforce, training schemes and enrollment figures, reform proposals, technological advancements in the profession, and changes in pharmacist roles.²⁷ The models were accompanied by sensitivity analyses and formal assessment of data quality for input variables.²⁷ The results were published in 2013, and among four main models considered, all resulted in a predicted oversupply by 2040 ranging from 11,000 to 19,000 pharmacists (compared to the approximately 50,000 pharmacists currently registered in Great Britain). The consensus determined that no active intervention for the increasing number of students “would almost certainly lead to unemployment... in the short-to-medium term.”²⁷

Prior to the release of the workforce assessment, it was recommended that a cap be placed on the number of students studying pharmacy at universities in England.²⁸ University placements for medicine and dentistry have been subject to such regulation for several years as part of a formal and on-going assessment of future workforce requirements.²⁹ This type of intervention appears to have good professional support as well. A recent risk analysis from the Royal Pharmaceutical Society (RPS; the professional leadership body for pharmacists in Great Britain) identified controlling university admissions as the most likely means of controlling entry to the pharmacy profession, while minimizing consequences for both patients and the profession.³⁰ Integral to this option was the need to plan and match student numbers to market demand, and the mandate that all pharmacy school graduates would be guaranteed a pre-registration placement.³⁰

In formal response the CfWI report, the Higher Education Funding Council for England (HEFCE) and Health Education England (HEE) released a consultation in September 2013 seeking advice on how to manage the projected oversupply of pharmacists.³¹ Three potential options were presented for discussion, including (1) continuing to let the free market determine student enrollment, (2) employing a control on student numbers, or (3) altering the M.Pharm. program structure to allow for two educational paths: one leading to a general science (non-professional) qualification, and one leading to pre-registration.³¹ A variety of stakeholders have published their responses in favor of option (2), including the RPS,³² British Pharmaceutical Students' Association (the official student organization of the RPS),³³ the Pharmacy Schools Council (a non-regulatory body representing schools of pharmacy

in the United Kingdom),³⁴ and the Pharmaceutical Services Negotiating Committee (which promotes and supports interests of all NHS community pharmacies in England).³⁵ The full results of this consultation from HEFCE-HEE are expected in 2014.

DISCUSSION:

Data available at this time suggests that the supply of pharmacists is rapidly increasing in both the United States and the United Kingdom as a function of educational expansion. Current projections from the United Kingdom demonstrate a future job market that will likely be unable to meet this growth, and policy action has been initiated within the profession to address the problem. Available workforce projections from the United States, although highly active in the past, are now outdated and have not been considered within the new context of healthcare reform and the current state of the economy.

The availability of a stable and competent workforce is central to a functional and advancing healthcare system. A shift in focus toward enhanced patient care and interdisciplinary collaboration has increased the number of professional opportunities for pharmacists in recent years. However, the needs of healthcare are dynamic, and a recent International Pharmaceutical Federation (FIP) report recommends that countries proactively model their future workforce needs and develop planning strategies to secure the future provision of services and education within the profession.³⁶ The FIP report notes that national healthcare systems are diverse with varying needs, and therefore a “one size fits all” approach may not be fully optimal for workforce planning.³⁶ This is certainly the case with the United States and the United Kingdom and their potential approaches to the situation.

The publicly funded structure of education and healthcare enables governmental intervention on a high level in the United Kingdom. However, administrative powers are ‘devolved’ (meaning they are handled separately by constituent areas of England, Wales, Scotland and Northern Ireland), and there is no single central body with coordinated powers in education or healthcare in the whole of the United Kingdom. As a student can obtain their degree in one part of the country, and do their pre-registration training or obtain employment in another part, there is potential for issues to arise from

fragmented workforce planning. At current time, the HEFCE/HEE consultation has focused solely in England; how it will fall into place within the rest of the United Kingdom remains to be seen. In the United States, the privatised nature of healthcare and administrative structure of professional education mean that caps on enrollment are practically impossible (and arguably, illegal) to impose. However, the United States comparatively has similar issues with devolution in that administrative oversight of pharmacy and education are delegated to the individual states with little federal control that could reconcile varying interpretations and degrees of professional supervision. Although the United Kingdom has nationalised healthcare, regulation in the profession of pharmacy is similar to the United States. The GPhC (in the United Kingdom) and the Accreditation Council for Pharmacy Education (ACPE; in the United States) operate in similar fashion, serving purely as assessors of quality control in developing standards for pharmacy education, and not as educational regulators for supply/demand in the profession. Community pharmacists (which constitute the large majority of the profession) in the United Kingdom are not NHS employees, but rather are privately employed by third-party companies that contract pharmacy services with the NHS; these companies operate in a business market with similar regard to profit as in the United States. Therefore, an oversupply within the profession is likely to result in similar effects in the job market in either country.

Recent actions in the United Kingdom may not be directly applicable to the United States; however, much can be learned from the comparison. The United Kingdom has provided an admirable example for professional grassroots action stimulating formal and comprehensive workforce assessment, which has involved input from a variety of pharmacy stakeholders and external experts in workforce planning, and has included consultation to the public and profession regarding preference among possible solutions. In the United States, in order to provide the number of necessary pharmacists while maintaining the highest professional standards in education as well as the workforce, an unprecedented collaboration of profession, industry, government and education needs to be formed with these goals as their primary, if not sole, achievement. This type of national, collaborative and on-going process is unquestionably needed at current time, and should be fulfilled as previously recommended.¹⁹ Solutions and how they would be implemented within the United States would depend on the specific issues would be identified through such a process, but consideration potentially needs to be given to the following items:

- (1) Investigating, learning from and coordinating with approaches utilised by other professions, such as medicine and dentistry³⁷⁻³⁸
- (2) Implementation of scenario-based assessments in workforce planning to accommodate for a volatile healthcare environment³⁸
- (3) Active discouragement of academic expansion that does not fill a pre-identified need as a matter of professional responsibility rather than regulation⁴
- (4) Advocating for establishment of new pharmacist roles to meet already increasing professional supply⁴
- (5) Continuing focus on sustaining quality in pharmacy education within the rapidly expanding market of pharmacy schools/colleges³⁹

CONCLUSION:

As described in a recent statement in the *Journal*, “making projections and monitoring data trends are necessary but not sufficient... [we] need to use the projections and data trends as tools to identify and embrace those actions that will lead the profession forward in uncertain times.”⁴⁰ Prudent workforce planning should emerge and be seen as a responsibility within the profession to ensure a future workforce that is secure, trained and able to meet the demand of the dynamic healthcare environment; instrumental to this is a better alignment of healthcare policy within the government to form a unified profession.⁴¹

Despite different healthcare delivery models, pharmacists in the United States and United Kingdom are facing similar rapid expansions within the profession. In the United States, the number of new schools/colleges and expanded class sizes has extended beyond the expected scope foreseen by previous estimates. There is suggestion that the pharmacist shortage may be ending, yet no major coordinated response strategies are on the horizon. In the United Kingdom, the reality of a future oversupply of pharmacists has been identified and accepted by the profession and the government. Policy efforts are being focused on how to best address the situation, which will undoubtedly require a large scale coordinated effort to keep the profession in balance. The approach in the United Kingdom

can serve as a good example prompting the need for formal workforce assessment and the planning in the United States.

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REFERENCES:

1. Routson J. Pharmacists face challenges of oversupply, changing roles. *Pharmacy Times*. November 2, 2010.
2. American Association of Colleges of Pharmacy. Academic pharmacy's vital statistics. <http://www.aacp.org/about/Pages/Vitalstats.aspx>. Accessed April 9, 2014.
3. Brown D. From shortage to surplus: the hazards of uncontrolled academic growth. *Am J Pharm Educ*. 2010;74(10):185.
4. Brown DL. A looming joblessness crisis for new pharmacy graduates and the implications it holds for the academy. *Am J Pharm Educ*. 2013;77(5):90.
5. Rennie T and Anderson C. Oversupply and under-resourced: the global context of pharmacy education. *Am J Pharm Educ*. 2013;77(6):111.
6. US Department of Labor: Bureau of Labor Statistics. Occupational outlook handbook 2012-13 edition: pharmacists. <http://www.bls.gov/ooh/healthcare/pharmacists.htm>. Accessed April 9, 2014.
7. Crutsinger M. Fed keeps easy money flowing. Associated Press. September 19, 2013.
8. Rugaber CS. Survey foresees sluggish recovery. Associated Press. September 18, 2013.
9. Pisani J. CEOs less optimistic about US economy. Associated Press. September 19, 2013.
10. Knapp DA. Professionally determined need for pharmacy services in 2020. *Am J Pharm Educ*. 2002;66(4):421-429.
11. Department of Health and Human Services. The pharmacist workforce: a study of the supply and demand for pharmacists. <http://bhpr.hrsa.gov/healthworkforce/reports/pharmaciststudy.pdf>. Accessed April 9, 2014.
12. Department of Health and Human Services. The adequacy of pharmacist supply: 2004 to 2030. <http://bhpr.hrsa.gov/healthworkforce/reports/pharmsupply20042030.pdf>. Accessed April 9, 2014.
13. Pharmacy Manpower Project Inc. National Pharmacist Demand by State – March 2014. <http://www.pharmacymanpower.com/usstatemap.jsp>. Accessed May 23, 2014.
14. Taylor TN, Knapp KK, Barnett MJ, et al. Factors affecting the unmet demand for pharmacists: state-level analysis. *J Am Pharm Assoc*. 2013;53(4):373-381.

15. American Society of Health-System Pharmacists. 2013 ASHP pharmacy staffing survey results. <http://www.ashp.org/DocLibrary/MemberCenter/SPPM/2013-ASHP-Staffing-Survey.pdf>. Accessed May 23, 2014.
16. Knapp KK, Cultice JM. New pharmacist supply projections: lower separation rates and increased graduates boost supply estimates. *J Am Pharm Assoc.* 2007;47(4):463-470.
17. Knapp KK, Shah BM, Barnett MJ. The pharmacist Aggregate Demand Index to explain changing pharmacist demand over a ten-year period. *Am J Pharm Educ.* 2010;74(10):189.
18. Cain J, Campbell T, Congdon HB, et al. Pharmacy student debt and return on investment of a pharmacy education. *Am J Pharm Educ.* 2014;78(1):5.
19. American Pharmacists Association and American Society of Health-System Pharmacists. Concerns about the accelerating expansion of pharmacy education: time for reconsideration. <http://www.ashp.org/DocLibrary/News/Accelerating-Expansion-of-Pharmacy-Education.aspx>. Accessed May 23, 2014.
20. Sosabowski MH, Ingram MJ. 21st century issues in pharmacy education in the United Kingdom. *Am J Pharm Educ.* 2003;67(4):122.
21. British Pharmaceutical Students' Association. The imbalance between pre-registration training and undergraduate pharmacy student numbers: A BPSA discussion paper. http://www.pharmacyworkforcenw.nhs.uk/uploads/88a4241d8573ea95677c257cd08af98a/BPSA_Student_Numbers_Discussion_Paper_-_17th_July_2012.pdf?download=true. Accessed April 9, 2014.
22. National Matching Services. Summary results of the match for positions beginning in 2014. <https://www.natmatch.com/ashprmp/stats/2014applstats.html>. Accessed March 24, 2014.
23. Hassell K. Centre for Pharmacy Workforce Studies (CPWS) briefing paper: GPhC register analysis 2011. <http://www.pharmacyregulation.org/sites/default/files/Analysis%20of%20GPhC%20Pharmacy%20Register%202011.pdf>. Accessed April 9, 2014.
24. NHS Pharmacy Education & Development Committee. National NHS pharmacy staffing establishment and vacancy survey 2012. <http://www.nhs.uk/DocLibrary/MemberCenter/SPPM/2013-ASHP-Staffing-Survey.pdf>. Accessed April 9, 2014.

25. The NHS Information Centre, Prescribing Support Unit. General pharmaceutical services in England 2000-01 to 2009-10. <https://catalogue.ic.nhs.uk/publications/primary-care/pharmacy/gene-phar-serv-eng-2000-2010/gene-phar-serv-eng-2000-2010-rep.pdf>. Accessed April 9, 2014.
26. Health and Social Care Information Centre, Prescribing and Primary Care Team. General pharmaceutical services in England 2002-03 to 2011-12. http://www.gpcwm.org.uk/wp-content/uploads/file/PHARMACEUTICAL%20SERVICES/General_pharmaceutical_services_in_england_2002_03_to_2011_12_22nov2012.pdf. Accessed April 9, 2014.
27. Centre for Workforce Intelligence. A strategic review of the future pharmacist workforce: informing pharmacist student intakes. <http://www.cfwl.org.uk/publications/a-strategic-review-of-the-future-pharmacist-workforce/@@publication-detail>. Accessed April 9, 2014.
28. Gibney E. Ministers put the cap on pharmacy student numbers. Times Higher Education. December 30, 2012.
29. Department of Health and the Higher Education Funding Council for England. The Health and Education National Strategic Exchange (HENSE): review of medical and dental school intakes in England. https://www.gov.uk/government/uploads/system/uploads/attachment_data/file/127339/medical-and-dental-school-intakes.pdf. Accessed April 9, 2014.
30. Royal Pharmaceutical Society. Options for controlling entry to the pharmacy profession. <http://www.rpharms.com/workforce-and-education/workforce-planning-and-development.asp>. Accessed April 9, 2014.
31. Higher Education Funding Council for England. Ensuring a sustainable supply of pharmacy graduates: proposals for consultation (first stage). <http://www.hefce.ac.uk/pubs/year/2013/201319/#d.en.83034>. Accessed September 20, 2013.
32. Royal Pharmaceutical Society. Enabling a sustainable supply of pharmacy graduates: proposals for consultation (first stage) (HEFCE 2013/19) response. <http://www.rpharms.com/news-story-downloads/hefce-2013-19-annex-b-response-form-rps-final.pdf>. Accessed April 9, 2014.
33. British Pharmaceutical Students' Association. Consultation response: ensuring a sustainable supply of pharmacy graduates.

- <http://www.bpsa.co.uk/images/BPSA%20Response%20to%20HEFCE%20%20HEE%20Consultation%20Paper.pdf>. Accessed April 9, 2014.
34. Pharmacy Schools Council. Pharmacy Schools Council responses to joint HEFCE-HEE consultation on managed student numbers.
<http://www.pharmacyschoolscouncil.ac.uk/Blog/Post/5/Pharmacy-Schools-Council-responds-to-joint-HEFCE-HEE-consultation-on-managed-student-numbers>. Accessed April 9, 2014.
35. Pharmaceutical Services Negotiating Committee. Ensuring a sustainable supply of pharmacy graduates: response to the proposals for consultation (first stage). <http://psnc.org.uk/wp-content/uploads/2013/08/PSNC-response-to-HEFCE-consultation.pdf>. Accessed April 9, 2014.
36. International Pharmaceutical Federation. 2012 FIP Global Pharmacy Workforce Report. <https://www.fip.org/humanresources>. Accessed April 9, 2014.
37. Knapp KK. Pharmacy and medicine: different workforce strategies driving expansion in educational systems. *J Am Pharm Assoc.* 2005;45(4):430-2.
38. Deloitte Center for Health Solutions. The complexities of national health care workforce planning: a review of current data and methodologies and recommendations for future studies.
<http://bipartisanpolicy.org/sites/default/files/BPC%20DCHS%20Workforce%20Supply%20Paper%20Feb%202013%20final.pdf>. Accessed May 30, 2014.
39. Cohen JL. Pharmacy education in the United States: what lies ahead? *J Med Sci.* 2008;28(3):103-110.
40. Knapp K, Schommer JC. Finding a path through times of change. *Am J Pharm Educ.* 2013;77(5):91.
41. Maine LL, Knapp, KK, Scheckelhoff DJ. Pharmacists and technicians can enhance patient care even more once national health policies, practices, and priorities are aligned. *Health Affairs.* 2013;32(11):1956-1962.