RESEARCH

Economic Analysis of Obtaining a PharmD Degree and Career as a Pharmacist

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Objective. To evaluate the economic value of pharmacy education/career and the effects of the cost of private or public pharmacy school, the length of degree program, residency training, and pharmacy career path on net career earnings.

Methods. This study involved an economic analysis using Markov modeling. Estimated costs of education including student loans were considered in calculating net career earnings of 4 career paths following high school graduation: (1) immediate employment; (2) employment with bachelor's degree in chemistry or biology; (3) employment as a pharmacist with no residency training; and (4) employment as a pharmacist after completing one or two years of residency training.

Results. Models indicated that throughout their careers (up to age 67), PharmD graduates may accumulate net career earnings of \$5.66 million to \$6.29 million, roughly 3.15 times more than high school graduates and 1.57 to 1.73 times more than those with bachelor's degrees in biology or chemistry. Attending a public pharmacy school after completing 3 years of prepharmacy education generally leads to higher net career earnings. Community pharmacists have the highest net career earnings, and PGY-1 residency-trained hospital pharmacists have greater net career earnings than those who immediately started their careers in a hospital setting.

Conclusion. The economic models presented are based on assumptions described herein; as conditions are subject to variability, these models should not be used to predict future earnings. Nevertheless, the findings demonstrate investment in a pharmacy education yields favorable financial return. Application of results to schools of pharmacy, students, and graduates is discussed.

Keywords: economic analysis, pharmacy career, prepharmacy

INTRODUCTION

In recent years, the US economy, with its increasing challenges, has put traditional investment strategies and positions in question. Moreover, this increased economic uncertainty has been associated with intense scrutiny and critical evaluation of financial decision making from virtually all sectors. Criticism of the financial value of certain careers and the pursuit of particular postsecondary degrees, including health professions, have not been spared. In fact, a survey conducted by Taylor et al found that 57% of Americans believe the higher education system does not provide good value for the money spent on it.¹ Further, financial concerns were the primary impediment to pursuing a college education, especially given that more than 60% of undergraduate students borrowed

money to assist in covering their educational costs, and currently more than 40% of median income is used to pay for college tuition (an increase from less than 25% in 2000).^{2,3} An article published in the *New England Journal of Medicine* indicated that students in health professions graduate with considerable debt-to-average annual income ratios, ranging from slightly more than 30% for orthopedic medicine to greater than 160% for veterinary medicine.⁴ The authors concluded the high cost of health professions education may not be sustainable.

Projected growth for the pharmacy profession is anticipated at 14% between 2012 and 2022, according to the US Bureau of Labor Statistics.⁵ Factors contributing to the proposed projected growth include the aging population, availability of new drug products, and increasing complexity of the health care system. The Bureau of Labor Statistics' projections are corroborated by the US Department of Health and Human Services, which anticipates that national need for pharmacists will increase 1.4% annually through 2030.⁶

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Based on this information, pharmacy seems to be a good career choice. Yet, many have expressed concerns regarding the future employment prospects of pharmacists. For example, Brown noted that a 60% increase in the number of pharmacy schools between 2000 and 2012 and growth of existing pharmacy programs resulted in a considerable influx of new pharmacists into the job market.⁷ As a result of the increased supply of pharmacists, the demand has consequently decreased. According to the Pharmacy Manpower Project's Aggregate Demand Index, national demand for pharmacists has declined somewhat from 3.8 in September 2005 to 3.49 (5.0 indicates highest possible demand and 3.0 indicates balance between demand and supply) in August 2015.⁸ Although this demonstrates there is still greater demand for pharmacists than supply, it also suggests pharmacists may face different challenges than in the past.

Zavadski suggested pharmacy education may be subject to a bubble market, wherein "a good becomes overvalued because buyers are willing to pay higher prices in hopes of selling it for a greater payoff. The bubble deflates when the asset suddenly returns to a more reasonable intrinsic value, leaving buyers from the peak of the boom with something worth far less than what they paid."^{4,9,10} In other words, for many, pharmacy education is worth the investment as long as pharmacist salaries remain high and jobs are available and desirable; thus, should salaries decrease and jobs/desirable employment opportunities become unavailable, the value of pharmacy education declines.

Although commentary exists concerning the value of a pharmacy degree, virtually no studies published in the literature objectively model the estimated long-term economic benefit and return on investment of obtaining a pharmacy degree and working as a pharmacist under current conditions. Hagemeyer and Murawski compared economic outcomes of directly entering community pharmacy practice after earning a doctor of pharmacy (PharmD) vs earning a PhD after earning a PharmD and then entering a career in academia or industry; however, this study did not consider the effects of other educational tracks, residency training, and/or pharmacy career paths such as hospital.¹¹ Objective data like this are not only imperative to those considering pharmacy as a career, but also of interest to stakeholders in the pharmacy profession, including academics. Therefore, the overall purpose of this study was to evaluate the economic value and return on investment of pharmacy education and a pharmacy career, and the effects on long-term earnings of attending a private or public pharmacy school, the length of PharmD program (7-year or 8-year PharmD program), and residency training. Specifically, this study modeled

and compared the career earnings (up to age 67) of graduates of high school, those with a bachelor of science in chemistry or biology, and those with PharmDs, with and without residency training.

METHODS

This study involved an economic analysis of 4 educational and subsequent career paths following graduation from high school: (1) immediate employment; (2) employment after obtaining a bachelor's degree in chemistry or biology; (3) employment as a pharmacist in a hospital or community pharmacy setting after at least 3 years of undergraduate study and obtaining a PharmD (ie, 3+4 programs and 4+4 programs); and (4) employment as a pharmacist in a hospital pharmacy setting after at least 3 years of undergraduate study, obtaining a PharmD, and completing one or two years of postgraduate residency training (PGY-1 and PGY-2). Employment in hospital or community (retail) pharmacy settings were included in the model as they represent the predominant sectors of the pharmacist job market, and salaries in these settings are well-documented.¹² Net career earnings from employment beginning at age 18 and through age 66 were used to determine the overall benefit of each career path. Age 66 was selected as the end age of analysis because age 67 was the official retirement age per the US Social Security Administration, and for study purposes, retirement is assumed to begin promptly on an individual's 67th birthday.¹³ Estimated costs of education (including student loans) and gross salary estimates were used to determine net career earnings, defined as gross cumulative career earnings minus expenditures for postsecondary education. Net career earnings of a high school diploma comprised the base case or option used for main comparisons. All analyses were conducted using TreeAge Pro Healthcare, v2014 (TreeAge Software, Inc., Williamstown, MA), and individual inputs (with supporting references) are listed in Table 1.^{12,14-26}

The economic analysis involved a series of individual Markov cycles for each career option within the branches of the decision tree. For high school graduates, only one Markov cycle was employed, and this singular model spanned all years of the analysis. The models for the branches involving college graduates and beyond were designed around the stage of employment for each career path: in school (or training), early career, and experienced worker. For purposes of model simplification and since reliable data were not available concerning career path changes, individuals were assumed to have remained in the same career path after entering the job market.

Table 1. Data Inputs Used in Markov Models^{12,14-26}

Variable	Value	References
Income (\$) ^{a,b}		
Pharmacy School Graduates		
Community Pharmacists	102 960	12
Hospital Pharmacists	99 840	12
Pharmacy Residents	42 000 (PGY-1), 50 000 (PGY-2)	22
Residency-Trained Pharmacists	104 000 (PGY-1), 106 080 (PGY-2)	Communication from medical centers, January 2014
Bachelor Degree Graduates		
Chemistry Degree Holder	32 000 (entry), 62 000 (experienced)	16
Biology Degree Holder	31 000 (entry), 56 000 (experienced)	16
High School Graduate	22 464	20
Annual Raise (%)	2.9	16
Cost-of-Living Adjustment (%)	1.5	21
Educational Costs (\$)		
Immediate (Annual) Costs ^c		
Undergraduate ^d	23 066	23
Public Pharmacy School	18 713	25
Private Pharmacy School	32 967	25
Cost of Living	22 287	Communication, University of Tennessee Health Science Center Office of Financial Aid, February 2014
Student Loans		
Public Pharmacy School	103 829	14
Private Pharmacy School	142 849	14
Undergraduate	29 400	24
Interest Rate (%)	4.66 (undergraduate), 6.21 (graduate), 7.21 (PLUS loan)	26
Employment Probabilities		
Pharmacy School Graduate Positions (%)		
Community Job	56.3 (public), 59.4 (private)	14
Hospital Job	24.0 (public), 25.2 (private)	14
PGY-1 Residency	19.7 (public), 15.4 (private)	Calculated from communication with ASHP, January 2014
PGY-2 Residency	16.9 (public), 11.3 (private)	Calculated from communication with ASHP, January 2014
Unemployment Rate (%)		
Pharmacy Degree Holders	3.2	17
Biology Degree Holders	7.7 (entry), 4.6 (experienced)	15,16
Chemistry Degree Holders	6.6 (entry), 4.9 (experienced)	15,16
High School Graduates	8.3	15,16
Length of Unemployment (weeks) ^e		
Doctoral Degree Holders	18.7	18,19
Bachelor's Degree Holders	27.0	18,19
High School Graduates	31	18,19

ASHP=American Society of Health-System Pharmacists

^aValues listed are starting salaries

^bIn the model analysis, chemistry and biology degree holders was assumed to graduate from college and enter the job market at age 22. PharmD holders were assumed to: (1) graduate from 3+4 programs and enter the job market at age 25 (age 26 if completing a PGY-1 residency, age 27 if completing a PGY-2 residency); or (2) graduate from 4+4 programs and enter the job market at age 26 (age 27 if completing a PGY-1 residency, age 28 if completing a PGY-2 residency)

^cRepresents national average

^dIncludes room and board and is the national average across all (public and private) 4-year undergraduate institutions

^eRefers to the average number of weeks between jobs, if an individual loses a job, in a given year (data for specific degree fields were not available)

At base, an individual could either be a high school graduate, college graduate (bachelor's degree in biology or chemistry), or have chosen to attend college, completing either 3 or 4 years of undergraduate study as is required for acceptance by most colleges of pharmacy (according to the American Association of Colleges of Pharmacy [AACPP]), and pharmacy school thereafter at either a public or private institution.²⁷ Biology and chemistry were chosen as they were common undergraduate disciplines/degree pathways studied by pharmacy school matriculates. Chemistry or biology degree holders were assumed to progress within the same job from graduation to retirement, receiving raises and regular salary adjustments each year. For pharmacy school graduates, an additional decision was placed within the model. After pharmacy school graduation, these individuals could have found immediate employment in either a community or hospital setting, completed a PGY-1 residency followed by employment, or completed 2 years of residency (PGY-1 and PGY-2) followed by employment. These decisions were put in place to model the most popular options presented postgraduation.¹⁴ Those who obtained residencies were assumed to find employment in hospital settings because traditionally most positions requiring residency training were in hospitals or clinics, and salary data for this distinction in hospital settings were available, whereas they were not readily available for other settings.

The decision to attend pharmacy school was modeled by allowing for either 3 or 4 years of prepharmacy undergraduate education followed by the choice to attend either a public or private pharmacy school. Within the 4 resulting branches, graduates were then distributed by career choice.^{12,14} The probabilities of enrolling in a PGY-1 residency were calculated using graduation and residency data from 2012 among 4-year public and private pharmacy schools; the odds of a PGY-2 were then calculated among those having completed a PGY-1.²⁸ These data revealed that graduates of public schools of pharmacy had greater probabilities of doing PGY-1 and PGY-2 residencies. These probabilities were included to model the observed differences in career choices made by graduates of public and private pharmacy programs.

The benefits of attending college and pharmacy school were summarized by cumulative incomes across each career path prior to age 67. For high school graduates, gross annual salary began to cycle at age 18.²⁰ For those obtaining 4-year college degrees only, gross annual salary began to cycle starting with the first year after graduation. Gross salary data (Table 1) for chemistry and biology degree holders allowed for the imputing of mean starting salaries as well as salaries for experienced workers (>5 years of work experience).¹⁶ For the first

5 years after graduation, the model gave these employees the national average salary increase of 2.9% annually; after 5 years, salaries were increased to the average "experienced" level and thereafter received the national average salary increase annually.¹⁶ After 10 years of work, salaries were capped and only national average cost of living increases of 1.5% annually were factored into income data to account for inflation.^{16,21}

Pharmacy graduates were allotted starting gross salaries according to data from the Bureau of Labor Statistics for hospital pharmacy and community pharmacy, and gross salaries of pharmacists who were PGY-1 and PGY-2 trained were obtained from several hospitals.¹² Salaries for residents were accounted for in the model.²² Salaries for all pharmacy positions were allowed to increase using national average raises of 2.9% annually for the first 10 years of initial employment, but were only given a cost of living increase of 1.5% annually for subsequent years prior to age 67.^{16,21}

All cycles were probability weighted based on unemployment rate for each branch.¹⁵⁻¹⁷ Within each employment cycle, an individual was defined as either "employed" or "unemployed" to weight each year's income with the odds of having been unemployed during the year. Both cost and income values for unemployed individuals were adjusted based on mean length of unemployment (weeks) for Americans with high school, undergraduate, or doctoral degrees.^{18,19} During times of unemployment, it was also assumed that unemployment benefits would be sought and no student loan payments would be made. When available, rates of unemployment were adjusted to reflect reductions in these odds as a result of accrued work experience.¹⁶ Unemployment benefits were assumed to be received by workers of all educational levels according to the benefit schedule by quarterly income or the maximum benefit when reached. Benefits were adjusted annually to keep pace with inflation.^{18,19} To determine income during periods of unemployment, the weekly rate was multiplied by the average number of weeks of unemployment for each level of education; income for the remaining weeks returned to regular, full-time levels for each year.

To calculate the net benefits of higher education, all costs of attendance were incorporated into the models for both undergraduate and pharmacy schools. National average amounts from 2012 for college tuition and room and board were used to establish the total cost of undergraduate attendance based on the number of years enrolled in a post-secondary institution (Table 1).²³ The immediate (annual) cost of undergraduate attendance (\$15 716) was determined by the difference between the total cost of attendance for each year (\$23 066) and the average

amount borrowed (\$29 400) and divided by 4,²⁴ thus, a negative net benefit of education defined the years spent in college. For students completing only 3 years of college prior to beginning pharmacy school, the total cost and amount borrowed were reduced by 25%.

National average tuition amounts as well as average student loan amounts for public and private pharmacy schools were provided by AACP.^{14,25} Cost of living was included in the total cost of attendance. Similar to undergraduate costs, the difference between the average amount borrowed and the total cost of attendance was assumed to be immediately absorbed by the student and was imputed as net negative benefits for the years spent in pharmacy school.

To account for the long-term costs of education, student loan repayment was factored into the determination of net benefits. Cost of education was modeled as the sum of subsidized loans for undergraduate studies (at maximum amounts of \$13 500 for 3 years of pre-pharmacy and \$19 000 for 4 years of prepharmacy), unsubsidized loans for undergraduate studies (in the amounts of \$8550 for 3 years of prepharmacy and \$10 400 for 4 years of pre-pharmacy, which supplemented subsidized loans to the mean amount borrowed per year), unsubsidized loans for pharmacy school (maximum amount allowed which was \$20 500 per year), and PLUS loans for pharmacy school (in the amounts of \$21 828 for public pharmacy school and \$60 848 for private pharmacy school, which supplemented unsubsidized loans to the mean amount borrowed).²⁶ Undergraduate loans, both subsidized and unsubsidized, had interest rates of 4.66%, while graduate unsubsidized loans had an interest rate of 6.21% and graduate PLUS loans had an interest rate of 7.21%.²⁶ Biology and chemistry degree holders were assumed to begin repayment immediately upon graduation and complete payments after 10 years using the standard repayment schedule.²⁹ Among pharmacy graduates, the total amount borrowed during either 7 or 8 years of postsecondary education was used to determine the monthly payment, with repayment over 25 years.²⁹ For pharmacy graduates who pursued residency training, loans were assumed to be in forbearance with interest accruing at the aforementioned interest rates for the 1 or 2 years spent in residency training.

RESULTS

The final economic model spanned 49 years, representing net career earnings from age 18 until age of retirement (67 years). The base case analysis was net career earnings for those with a high school diploma, determined to be approximately \$1.80 million. For those earning a bachelor's degree in biology or chemistry, estimated

net career earnings were \$3.26 million and \$3.60 million, respectively. Earning a PharmD resulted in net career earnings ranging from \$5.66 million to \$6.29 million, depending on years of prepharmacy education, type of school (public or private), and subsequent pharmacy career choice/path (community, hospital/no residency, hospital/PGY-1, or hospital/PGY-2; Figure 1).

When weighted by the distribution of respective graduates, those with a PharmD may expect to earn, on average and after educational expenses, roughly 3.15 times that accrued by a high school graduate. A college graduate would be expected to earn approximately 1.8 to 2 times that of an individual with a high school diploma (Figure 2).

Differences in net career earnings were observed between graduates of pharmacy schools and those with undergraduate degrees alone. As presented in Table 2, probability-weighted comparisons showed that incremental (defined as the cost difference between alternatives) net earnings over career resulting from a PharmD vs a bachelor's degree were, on average, between \$2.06 million and \$3.03 million; differences were dependent on the type of pharmacy school attended, years of prepharmacy education, and the comparative field of study (biology or chemistry). When factored over the years of gainful employment, pharmacy school graduates would net approximately \$65 000 more per year, on average, than those with bachelor's degrees in biology or chemistry.

Weighted analysis indicated that among the 4 educational tracks, attending a public pharmacy school after completing 3 years of prepharmacy education led to higher net career earnings than the other educational tracks. Graduates of public 3+4 programs would earn additional incomes of at least \$168 642 (vs 3+4 private pharmacy schools), \$240 407 (vs 4+4 public pharmacy schools), and \$408 753 (vs 4+4 private pharmacy schools) over the course of their careers. Differences were also observed between public and private pharmacy schools whose graduates had completed 4 years of prepharmacy preparation: public school graduates were expected to earn approximately \$177 000 more over their career, on average, than private school graduates.

When examining specific career paths, the extra year of employment afforded public pharmacy school graduates with only 3 years of prepharmacy work (compared to 4 years of prepharmacy work) resulted in higher net career earnings regardless of pharmacy school type or career path (Table 3). Among like schools and the same career path, the choice to do only 3 years of prepharmacy education resulted in approximately \$240 000-\$249 000 of extra net income. For example, hospital pharmacists who completed 3 years of undergraduate (prepharmacy)

Disclaimer: the economic models presented in this study are based on assumptions described herein; as conditions are subject to variability, these models should not be used to predict future earnings.
 *High school diploma. **Bachelor's degree in biology or chemistry. ***Public pharmacy school with three years of undergraduate education. +Private pharmacy school with three years of undergraduate education. ±Public pharmacy school with four years of undergraduate education. ¶Private pharmacy school with four years of undergraduate education.

Figure 1. Net career earnings for degree holders by educational track, length of pre-pharmacy education (3 or 4 years), and type of pharmacy school (public or private).

study and attended a public pharmacy school would have extra net income of \$240 407 compared to hospital pharmacists who completed 4 years of undergraduate study and attended a public pharmacy school. Differences were most dramatic for students choosing this 7-year route when entering community pharmacy where, compared to any form of hospital-based career, between \$273 000 and \$626 000 in extra earnings might be garnered regardless of type of pharmacy school.

The choice to attend a private vs public pharmacy school also came with distinct differences in net career earnings potential based on chosen career path. Regardless of years spent completing prerequisites, graduates of public schools were observed to earn approximately \$168 000 to \$192 000 more than their private school peers who had chosen the same pharmacy career (Table 4).

The choice to pursue one or 2 years of postgraduate training led to inconsistent differences in net career

Figure 2. Net career earnings ratios of post-secondary degree holders compared to high school graduates.

Table 2. Incremental Pharmacy Net Career Earnings Compared to Bachelor's Degree Holders

School	Prepharmacy	Track	Bachelor's Degree	
			Biology	Chemistry
Public Pharmacy School	3 Years	Community	3 034 018	2 691 848
		Hospital	2 831 809	2 489 639
		PGY-1	2 906 240	2 564 070
		PGY-2	2 847 601	2 505 431
	4 Years	Community	2 787 099	2 444 929
		Hospital	2 591 402	2 249 232
		PGY-1	2 659 257	2 317 087
		PGY-2	2 598 950	2 256 780
Private Pharmacy School	3 Years	Community	2 865 376	2 523 206
		Hospital	2 663 167	2 320 997
		PGY-1	2 726 626	2 384 456
		PGY-2	2 655 532	2 313 362
	4 Years	Community	2 618 753	2 276 583
		Hospital	2 423 056	2 080 886
		PGY-1	2 480 183	2 138 013
		PGY-2	2 407 177	2 065 007

Earnings are net the immediate and long-term (student loan) costs of education and represent the additional income (up to age 67) accumulated by choosing a particular pharmacy career versus a position leveraging a bachelor's degree in biology or chemistry

earnings when compared to other pharmacy career paths. As depicted in Table 5, residency-trained pharmacists earned less than community pharmacists over the course of their careers, regardless of prepharmacy education and choice of pharmacy school. For example, PGY-2-trained pharmacists who graduated from 3+4 public pharmacy programs would earn \$186 417 less than community pharmacists who graduated from 3+4 public pharmacy programs. However, over the course of their careers, PGY-1 residency-trained pharmacists were observed to make more in net career earnings than pharmacists who immediately started their careers in a hospital setting. For these

PGY-1 residency-trained pharmacists, incremental income ranged from \$57 127 to \$74 431. On the other hand, among PGY-2 residency-trained pharmacists, only those who graduated from public pharmacy programs were able to surpass the earnings of hospital pharmacists who began their careers immediately following pharmacy school graduation.

Pharmacists with PGY-1 residency training who completed 7 years of total postsecondary education were able to make up the gap in incomes earliest, catching their hospital-based peers by age 48. Other PGY-1 trained pharmacists (ie, those who attended private schools of

Table 3. Incremental Pharmacy Net Career Earnings of 3 Years vs 4 Years of Prepharmacy Education

Prepharmacy		4 Years							
	Career	Public				Private			
		Community	Hospital	PGY-1	PGY-2	Community	Hospital	PGY-1	PGY-2
3 Years	Public	Community	246 919	442 616	374 761	435 068	415 265	610 962	553 835
		Hospital	44 710	240 407	172 552	232 859	213 056	408 753	351 626
		PGY-1	119 141	314 838	246 983	307 290	287 487	483 184	426 057
		PGY-2	60 502	256 199	188 344	248 651	228 848	424 545	367 418
	Private	Community	78 277	273 974	206 119	266 426	246 623	442 320	385 193
		Hospital	-123 932	71 765	3910	64 217	44 414	240 111	182 984
		PGY-1	-60 473	135 224	67 369	127 676	107 873	303 570	246 443
		PGY-2	-131 567	64 130	-3725	56 582	36 779	232 476	175 349

Values represent the difference in net career earnings (up to age 67) by completing 3 or 4 years of pre-pharmacy, having attended either public or private pharmacy school, and working in a particular sector of pharmacy. Completion of 3 years of pre-pharmacy is the comparator. Examples of how to interpret the table are as follows: Community pharmacists who had 3 years of pre-pharmacy study and graduated from a public pharmacy school would have net earnings of \$415 265 more than community pharmacists who had 4 years of pre-pharmacy study and graduated from a private pharmacy school. A PGY-1-trained hospital pharmacist who had 3 years of pre-pharmacy study and graduated from a public pharmacy school would have net earnings of \$246 983 more than a PGY-1-trained hospital pharmacist who had 4 years of pre-pharmacy study and graduated from a public pharmacy school.

Table 4. Incremental Net Career Earnings of Public vs Private Pharmacy School Graduates by Prepharmacy Education and Career Track

Pharmacy School	Prepharmacy	Career	Private			
			Community	Hospital	PGY-1	PGY-2
Public	3 Years	Community	168 642	370 851	307 392	378 486
		Hospital	-33 567	168 642	105 183	176 277
		PGY-1	40 864	243 073	179 614	250 708
		PGY-2	-17 775	184 434	120 975	192 069
	4 Years	Community	168 346	364 043	306 916	379 922
		Hospital	-27 351	168 346	111 219	184 225
		PGY-1	40 504	236 201	179 074	252 080
		PGY-2	-19 803	175 894	118 767	191 773

Values represent the differences in net career earnings (up to age 67) by attending a public or private pharmacy school given 3 or 4 years of prepharmacy work and compared across pharmacy career tracks. Attending a public pharmacy school is the comparator. Examples of how to interpret the table are as follows: community pharmacists who attended a public pharmacy school after 3 years of prepharmacy study would have net earnings of \$168 642 more than the net career earnings of community pharmacists who attended a private pharmacy school after 3 years of prepharmacy study. Likewise, hospital pharmacists who attended a public pharmacy school after 4 years of prepharmacy study would have net career earnings of \$168 346 more than the net career earnings of hospital pharmacists who attended private pharmacy school after 4 years of prepharmacy study

pharmacy and/or were in 4+4 program) did so by age 55 at the latest. Pharmacists with PGY-2 residency training who graduated from 4+4 public pharmacy programs made up the gap in earnings by approximately age 65. Pharmacists with PGY-2 residency training who graduated from private schools were unable to make up the gap in earnings throughout their careers.

DISCUSSION

According to the August 2014 issue of *Money Magazine*, consumers have a high degree of stress concerning college education, both in terms of financing and post-graduation employment prospects.³⁰ Therefore, as with any financial investment, adequate return on investment of postsecondary education must be assessed. To better

understand the long-term economic impact of pursuing a pharmacy degree and a career in pharmacy, the current analysis compared the lifetime projected earnings of those with a high school degree, a bachelor's degree in biology or chemistry, or a pharmacy degree (including parameters for length of education, public or private university, residency training, and pharmacy career path). Net career earnings of pharmacists were approximately 3.15 times more than high school graduates and 1.57 to 1.73 times more than bachelor's degree holders. Thus, substantive economic differences existed favoring a career in pharmacy compared to the alternatives investigated in this study.

In evaluating economic return of a career, salary is not the only consideration. Employment rate must also be

Table 5. Impact of Residency Training on Net Career Earnings of Hospital Pharmacists Compared to Other Employment Options

Track	Public		Private	
	Community	Hospital	Community	Hospital
3 Years Prepharmacy				
PGY-1	-127 778	74 431	-138 750	63 459
PGY-2	-186 417	15 792	-209 844	-7635
4 Years Prepharmacy				
PGY-1	-127 842	67 855	-138 570	57 127
PGY-2	-188 149	7548	-211 576	-15 879

Values represent the differences in net career earnings (up to age 67) by completing either 1 or 2 years of residency after 3 or 4 years of prepharmacy work when compared to peers having entered community or hospital positions immediately after graduating from public or private pharmacy school. Residency training (PGY-1 or PGY-1 + PGY-2) is the comparator. Examples of how to interpret the table are as follows: A PGY-1-trained hospital pharmacist who attended a public pharmacy school after 3 years of pre-pharmacy study would have net career earnings of \$74 431 more than a hospital pharmacist without residency training who attended a public pharmacy school after 3 years of prepharmacy study. Likewise, a PGY-2-trained hospital pharmacist who attended a private pharmacy school after 4 years of pre-pharmacy study would have net career earnings of \$138 570 less than a community pharmacist without residency training who attended a private pharmacy school after 4 years of prepharmacy study

examined, thereby making job/career security (as denoted by market growth/shrinkage and unemployment rate) a central factor in assessing return on investment of post-secondary education. Health care employment increased 22.7% between 2003 and 2013, while all other US industries experienced growth of only 2.1%.³¹ Moreover, pharmacists have a low unemployment rate of approximately 3%, compared to the national average of 5.9%.^{17,32} Although concerns exist regarding a pharmacist job market bubble partly as a result of slowed growth in some sectors and increased number of pharmacy graduates⁹ (as evident by decreasing sign-on bonus offers, fewer open positions in certain areas, and a Pharmacist Aggregate Demand Index that declined from a prerecession high of 4.31 in mid-2006 to 3.49 in August 2015), it should be noted that the Index has generally held steady above 3.2 since the summer of 2012, suggesting a favorable job market for pharmacists.⁸

With the increasing number of pharmacy schools in the United States and the growth of existing programs, it is essential that pharmacy schools focus on outcomes, or indicators of success, of graduates. It has been suggested that a more true-to-life ranking system or model of evaluation of higher education is needed, one that considers factors such as educational quality, affordability, alumni job placement, and alumni earnings.³⁰ In other words, pharmacy schools that provide quality, cost-effective education (eg, lower tuition, more scholarships, greater job opportunities) will be better positioned in the educational market. Additionally, schools of pharmacy should use business models that prepare graduates for success in current and future job markets, and those pharmacy schools with proven track records have a distinct advantage compared to those without long-term positive outcomes.

Strategies should be focused on preparing graduates to be more competitive for desirable pharmacist positions and postgraduate training by offering additional degrees, certificates, and other marketable qualities such as leadership. Although many students enter pharmacy school with undergraduate degrees (more than 60% of the 2012-13 applicant pool), several schools offer students the opportunity to complete their undergraduate degree and/or pursue graduate degrees while in pharmacy school by offering degrees themselves or through agreements with other institutions.³³ Possessing a 4-year degree, graduate degree, or specialty certificate(s) offers students an opportunity to distinguish themselves. Likewise, completing postgraduate training may result in significant advantages. As this study indicated, such training can enhance long-term salary in hospital settings; moreover, many settings now require or at least prefer residency training when filling open pharmacist positions. Schools

with high rates of success in graduates obtaining residencies should present this data to prospective students. In this study, the percentage of public pharmacy school graduates entering residencies was higher than that of private pharmacy school graduates.

To reiterate, net career earnings is only one factor to consider when selecting an occupation, or even when selecting a specific practice setting within pharmacy. Thus, selecting a career path should be driven by one's passion, skill sets, competencies, and recognition of what choice will result in general life and work satisfaction. In contrast, it is easy to draw conclusions from the results of this study that choosing the shortest route into the pharmacy job market is the most advantageous career strategy. This view may be short-sighted. For example, in tightened job markets, where there are a higher number of applicants for each open position, employers may expand employment criteria such as requiring or preferring an undergraduate degree and/or specialty certification. Similarly, as stated previously, in many pharmacy settings, including community pharmacies, employment preference is increasingly given to pharmacists with residency training over those without. Collectively, for prospective or current pharmacy students, it may be wise to invest a few more years in education and/or postgraduate training to increase competitiveness in the job market and, in turn, increase job security.

As with any study, this one had limitations. The findings are subject to the validity of the data we used to create models. However, as well-established and reliable data sources were used, the data and models are valid under the assumptions but should not be used to predict future earnings. We assumed that employees remained in the same career track for the duration of their career, that no additional training or education was sought, and that student loan repayment periods were 10 years for those with bachelor's degrees and 25 years for those with PharmDs. In real life, changes in career/practice occur, earnings fluctuate, and student loan repayment periods vary. This represents a common limitation in economic models that is accepted under the described conditions and interpreted under these assumptions. However, as career changes often result in significant increases in income, our model is likely a conservative estimate of what may be experienced by some pharmacists throughout their professional careers. In the future, the availability of reliable employment data with more precise estimates of career earnings may make possible the modeling of career behaviors that more closely resemble real-world scenarios. Thus, future economic analyses of pharmacy education and career choices should consider the possible effects of career changes, earnings fluctuations, variable

student loan repayment periods, and other significant dynamic factors on net career earnings when reliable data are available. Additionally, this model was meant to represent the pharmacy career paths most historically explored by pharmacists; therefore, these results may not be applicable to those with different career paths. Nevertheless, the models provide a representation of diverging net career earnings estimates based on educational track, length of prepharmacy education, and pharmacy career track/path. Future studies should use both quantitative and qualitative data, in addition to factors such as net career earnings and time to employment, to explore student and graduate choices and satisfaction with education and career pathways.

CONCLUSION

The economic models presented in this study are based on assumptions described herein; as conditions are subject to variability, these models should not be used to predict future earnings. Nevertheless, the findings suggest positive financial outcomes of a pharmacy education and career under the model assumptions. Specifically, over the course of their careers (minus educational expenses), pharmacists may make approximately \$3.87 million to \$4.49 million more than high school graduates and \$2.06 million to \$3.03 million more than chemistry or biology degree holders who did not attend pharmacy school and practice as a pharmacist. On average, community pharmacists achieved the highest net career earnings of the employment options explored in this study, while those who completed PGY-1 residency training had greater net career earnings in hospital pharmacy than those who did not do a residency. Although graduates should find ways to distinguish themselves to increase their competitiveness in the job market, pharmacy remains a dynamic and remunerative career option.

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