

## RESEARCH ARTICLES

# Economic Analysis of Earning a PhD Degree After Completion of a PharmD Degree

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**Objective.** To determine the net present value (NPV) and internal rate of return (IRR) for earning a doctor of philosophy (PhD) degree and pursuing careers commonly associated with that degree after completion of a doctor of pharmacy (PharmD) degree compared to entering pharmacy practice directly upon completion of the PharmD degree.

**Methods.** Income profiles were constructed based on 2008 annual salary data. NPV and IRR were calculated for careers resulting from the PhD degree and compared to those of the practicing community pharmacist. Trends in IRR also were examined across career paths from 1982 to 2008. *A priori* assumptions were developed and sensitivity analyses were conducted.

**Results.** The NPVs for all careers associated with the PhD degree were negative compared to that of the practicing community pharmacist. IRRs ranged from -1.4% to 1.3% for PhD careers. Longitudinal examination of IRRs indicated a negative trend from 1982 to 2008.

**Conclusions.** Economic financial incentives for PharmD graduates to pursue graduate school are lacking. The study illustrates the need to consider financial incentives when developing recruitment methods for PharmD graduates to pharmacy graduate programs.

**Keywords:** salary, internal rate of return, graduate education, economic analysis, career

## INTRODUCTION

Pharmacy school graduates are presented with many career and postgraduate educational options once the doctor of pharmacy (PharmD) degree is earned. Attending graduate school to obtain a degree in a pharmacy-related area is an option chosen by few pharmacy school graduates. Only 9.8% of graduate students enrolled in pharmacy PhD programs have earned a United States (US) pharmacy degree.<sup>1</sup> This percentage has steadily decreased over the last 4 decades.<sup>2-4</sup> There also has been a downward trend in enrollment of foreign students holding pharmacy degrees into US graduate school programs in pharmacy. Pharmacy educators have hypothesized that financial incentives in practice, the transition to a more clinical focus in pharmacy curricula, and implementation of the 6-year PharmD as the entry-level pharmacy degree have led to the downward trend in graduate school enrollment by US pharmacy graduates.<sup>5-7</sup> Concern has been raised regarding the lack of faculty in US colleges and schools of pharmacy who have earned US pharmacy degrees and pursued graduate education.<sup>5,8-13</sup>

To encourage pharmacy graduates to enter graduate school, researchers have suggested colleges and schools use such interventions as stressing scientific inquiry, utilizing marketing models, mentoring students, promoting flexibility within pharmacy curricula, and providing competitive stipends to graduate students.<sup>8,14-22</sup>

Completion of graduate education constitutes an investment. The pharmacy school graduate who chooses to invest in graduate education must forego considerable financial incentives associated with entering pharmacy practice directly. The pharmacy profession is one in which new college graduates can earn an average starting salary in excess of \$100,000. This salary presents significant opportunity cost to the student interested in graduate study. Moreover, completion of a PhD in a pharmacy-related area and employment in academia or industry are often associated with starting salaries \$20,000 less than those of newly licensed community pharmacists.<sup>23</sup> Regarding graduate education, the question becomes, "Is the investment worth it?"

Considering the relatively lower starting salaries, continued increase in number of colleges and schools of pharmacy, and demand for pharmacists in practice settings, the US shortage of 425 faculty members is not surprising.<sup>24</sup> Pharmacy graduates with residency and/or fellowship training have filled positions in academic settings as the profession

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has developed an increasingly clinical orientation. Thus, the need for PhD graduates who are pharmacists can be questioned. A comparison of residencies, fellowships, and graduate programs, however, reveals distinct objectives for each of the post-PharmD educational options. In the last 30 years, pharmacy educators have stressed the need for faculty members with PhD training and the skills learned therein to advance the profession.<sup>10,15,25</sup>

Given the financial opportunity cost and time associated with pursuing a graduate degree, why then would anyone with a US pharmacy degree consider pursuing graduate school? There are 2 hypotheses that justify pursuing graduate school: (1) there are long-term financial incentives associated with obtaining a PhD and/or (2) pharmacy school graduates are motivated to pursue the PhD degree by non-financial motivational beliefs. Research regarding the long-term financial outlook of careers commonly pursued by PhD graduates is lacking. Financial data collected by the American Association of Colleges of Pharmacy (AACP) and the American Association of Pharmaceutical Scientists (AAPS) indicate that the mean starting salary for PhD-trained pharmacy faculty members is indeed less than the mean starting salary for practicing community pharmacists.<sup>26,27</sup> The comparison of faculty and community practitioner salaries is confounded by many pharmacy faculty members and graduate students enrolled in pharmacy graduate programs not having a US pharmacy degree. Faculty members and graduate students with non-pharmacy backgrounds would not be able to practice as pharmacists; therefore, their earning potential can not be compared directly to the salaries of practicing pharmacists. If the pharmacy profession wishes US pharmacy students to consider attending graduate school, a better understanding of the financial factors involved is warranted.

A review of the literature identified one study that examined internal rate of return (IRR), a method of measuring capital investment, across pharmacy postgraduate opportunities. Hartzema and Perfetto<sup>14</sup> examined the IRR associated with pursuing a graduate degree and taking positions in academia or industry. In their study published in 1991, the rates of return varied from 4.4% to 8.1% for PhD positions when compared to pharmacists with a bachelor of science degree practicing in the chain community pharmacy setting. The IRR for the PharmD graduate directly employed in academia was 16% (there was no mention of residency training). Pursuing a 2-year fellowship after obtaining a PharmD degree was associated with an IRR of 10.2%. Both options resulted in IRRs significantly higher than those of PhD graduates. The authors mentioned that, from an economic standpoint, PhD graduates would have been better off had they invested in 30-year US Treasury bonds rather than graduate education. Additionally, research on

the economics of pursuing graduate school has been conducted in other health professions.<sup>28-31</sup>

The purpose of this study was to compare the practicing PharmD graduate to the PhD graduate from an economic perspective. Specifically, what are the monetary economic returns associated with earning a PhD degree and following the career paths that commonly result from that degree? Whereas previous research has been conducted to examine the return on investment associated with graduate education in pharmacy, revisiting the issue is warranted considering the changes that have occurred in the profession since the original research (eg, transition to a PharmD as the first professional degree). Moreover, few US pharmacy graduates are choosing to pursue graduate education, and a shortage of pharmacy faculty members exists despite efforts to recruit individuals to academia. The objectives of this study therefore were: (1) to determine the NPV and IRR for careers commonly pursued after earning the PhD degree as compared to the practicing community pharmacist; (2) to examine trends in IRR for PhD-related careers over time given available salary data.

## **METHODS**

Two methods of measuring capital investment are net present value (NPV) and IRR. Specific to this study, net present value is the current value of future wage differences between a practicing community pharmacist and a PhD graduate across careers that are commonly pursued upon graduation. The internal rate of return is the discount rate at which NPV becomes zero. In other words, IRR is the compounded return rate that can be earned from an additional capital investment (ie, an investment in graduate education). Determining the NPV and IRR for graduate school and careers associated with completion of graduate school as compared to pharmacy practice can provide insight into the difference in financial returns that can be expected from the additional investment in education.

This study was developed within the framework of human capital theory. Human capital theory posits that differences in wages can be attributed to the amount of human capital each individual has obtained. One method of investing in human capital is education. Obtaining further education, in theory, should increase human capital and therefore increase earnings through increased productivity. The economics of education, like other areas of economics, studies how scarce resources are utilized and distributed, in this case, to produce knowledge, skill, and other characteristics of education in society. Cohn and Geske described the economics of education as “(1) the process by which education is produced; (2) the distribution of education among competing groups; and (3) questions regarding how much should be spent by society (or any of

its component individuals) on educational activities, and what types of educational activities should be selected.”<sup>32</sup>

If education is an investment, ideally one would expect a positive return on that investment. But, investments are inherently probabilistic; a positive return can not be guaranteed. Return on investment also can be quite difficult to quantify. Whereas money is one form of return, nonmonetary forms of return on investment also are possible. Examples of nonmonetary returns on investment include job satisfaction, job flexibility, and autonomy. To apply this theory to the pharmacy profession, a student pharmacist will be more likely to consider pursuing graduate school if the return on investment, either monetary, nonmonetary, or both, is positive and competitive with alternative investments from which the student could choose.

The NPV and IRR were used to evaluate the financial return on investment. The NPV of an investment can be calculated by the following equation:

$$NPV = \sum_{t=1}^n (Y_t - Z_t)/(1 + r)^t$$

$Y_t$  = annual salary resulting from earning PhD and assuming career associated with the degree

$Z_t$  = practicing community pharmacist annual salary  
 $t$  = number of years following completion of PharmD degree from 1 to  $n$

$r$  = discount rate

The IRR is calculated by determining the discount rate at which NPV is equal to zero. Therefore, the IRR can be calculated by the following equation:

$$0 = \sum_{t=1}^n (Y_t - Z_t)/(1 + IRR)^t$$

$Y_t$  = annual salary resulting from earning PhD and assuming career associated with the degree

$Z_t$  = practicing community pharmacist annual salary  
 $t$  = number of years following completion of PharmD degree from 1 to  $n$

IRR = internal rate of return

The assumptions employed in Hartzema and Perfetto’s study<sup>14</sup> for length of time to degree, age at which the student entered the PhD program, graduate student stipend, and length of postdoctoral work, could not be employed in this study given changes in pharmacy and postgraduate education. The following *a priori* assumptions were stated in a manner that served to maximize NPV and IRR for careers resulting from pursuance of graduate education.

- (1) The PhD program begins at the age of 24 years
- (2) Graduate school time to completion is fixed at 5 years
- (3) Graduate students are provided an annual stipend of \$20,000

- (4) Graduate school involves zero out-of-pocket expenses for the student (ie, cost of books, tuition, supplies, etc, is negligible)
- (5) Postdoctoral work in medicinal chemistry/molecular pharmacology (MCMP) and industrial pharmacy/pharmaceutics (IPPH) disciplines is fixed at 4 years
- (6) Individuals work until the age of 65 years
- (7) Earnings within groups (career tracks) are similar (eg, job loss, premature death, etc, similar across career tracks)
- (8) Future earnings are discounted at a rate of 3%
- (9) Tenure process is 6 years for promotion from both assistant to associate, and associate to full professor
- (10) Upon achieving rank of full professor, the academic administration process is 6 years from professor to assistant dean, assistant dean to associate dean, and associate dean to dean

Students who complete a PharmD as their first professional degree usually do so in a minimum of 6 years. However, many PharmD students earn a bachelor of science degree prior to entering the program.<sup>33</sup> The assumption that students begin graduate school at age 24 allowed a 6-year window in which to complete the PharmD degree. Assuming that students are able to either enter the workforce or pursue further education at age 24 was a best-case scenario assumption in that it allowed the most time for graduates to earn a salary. Graduate and postdoctoral programs vary in length. For this study, the average length of time to complete a master’s degree was assumed to be 2 years; the PhD degree, 3 years; and postdoctoral work, 4 years.

The investigators used available regional data and data obtained from the National Institutes of Health (NIH) to determine an average graduate student stipend.<sup>34,35</sup> The direct out-of-pocket expenses (ie, tuition, textbooks, etc) for graduate education vary widely and could not be projected accurately; therefore, they were disregarded for purposes of this study. The commonly accepted retirement age of 65 years was employed. Additionally, a within-group similarity of earnings was assumed in the study despite inevitable variations in careers across individuals (eg, promotion, tenure, job loss, premature death). Salaries associated with academic administrative positions are significantly higher than non-administrative faculty positions.<sup>26</sup> The pharmacy practice track was used to evaluate and maximize the effects of administrative earnings on NPV and IRR. The largest percentage of current deans indicated pharmacy practice as their primary discipline.<sup>26</sup>

The discount rate employed in a study should reflect the rate of return an individual could expect if investing in the next-best alternative. A discount rate of 3% was

employed in this study based on conservative estimates of average prime lending rates and interest rates on US Treasury bonds.<sup>36,37</sup> A larger discount rate (eg, 5%) could have been employed; however, the 3% rate maximized the IRR and NPV for the individual who chose to pursue graduate education. The influence of fluctuations in discount rate was taken into consideration in the sensitivity analysis.

National-level data regarding the time to tenure and the manner in which PhD graduates enter and progress in academic administrative roles are not available. The investigators developed the assumptions for this variable based on input from administrative pharmacy faculty members. Those surveyed provided similar estimations regarding faculty time to receive tenure and pay increases associated with tenure and administrative positions.

Age-income profiles were constructed to assess differences in earnings across age. Although available salary data were organized according to experience rather than age, age and experience were expected to be highly correlated in the study if the other assumptions (eg, begin graduate school or enter workforce at age 24 years, fixed length of PhD program) were met. Base salary data were acquired from 2008 national salary surveys. The average PharmD salary was obtained using both the *Drug Topics* annual survey and the most recent Pharmacy Manpower survey.<sup>38,39</sup> The Pharmacy Manpower survey was used to determine differences in hourly rate across age. Hourly rates were converted to annual salaries based on a 40-hour work week. Percentage increases in salary were then transferred to current salary data published by *Drug Topics*. The Pharmacy Manpower survey indicated that relative differences in community pharmacist hourly pay across age were similar in 2000 and 2004. Data obtained from *Drug Topics* and the Pharmacy Manpower survey also were compared to annual data collected by one Midwest school of pharmacy.<sup>40</sup> A comparison of these sources indicated that data utilized from *Drug Topics* were conservative in nature compared to the individual school data. Given the lack of current data by age, this methodology was deemed the most reliable and valid method of determining annual salary. Academic salary data were obtained from the AACP 2008-2009 Profile of Pharmacy Faculty.<sup>26</sup> Industry-related pharmaceutical science salary data were obtained from the 2008 AAPS salary survey.<sup>27</sup> Salary information for contract research organizations (CROs) and pharmacy practice-related industry positions is not readily available. Estimations were made based on communication with PhD graduates currently employed in these areas and based on data obtained from the AAPS salary survey.

As a means of validating or refuting study findings, a longitudinal examination of IRRs was conducted to examine trends from 1982-2008. Despite changes in the

structure of pharmacy curricula over the study timeframe, the original assumptions were held constant over time. Realistically, the entry-level pharmacy degree transitioned during this timeframe from the 5-year BS degree to the 6-year PharmD degree. The IRRs calculated are therefore conservative for early years, considering that the assumption of 6 years for completion of the entry-level pharmacy degree was held constant. AAPS did not conduct published salary surveys prior to 2004. Industry data therefore were not available prior to that year. Academic salary data were obtained from the annual AACP salary surveys. Graduate student and postdoctoral stipend information was calculated based on NIH predoctoral and postdoctoral award amounts during the timeframe of the analysis.<sup>34</sup> An assumption was made that percentage changes in hourly rates across years of experience for community pharmacists were similar throughout the study timeframe. Therefore, percentage changes in the salary of the community pharmacist were calculated based on hourly rates of pay determined in the Pharmacy Manpower survey. All years from 1982 to 2008 in which community pharmacy salary data were available were analyzed.

A sensitivity analysis was conducted to determine the variation in NPV and IRR as assumptions varied. The discount rate, length of postdoctoral work, graduate student stipend, and time to completion of graduate school each varied independently. One combination of increased graduate student stipends and decreased length of time in graduate school also was examined. Microsoft Excel (2003) was used to organize and analyze data.

## RESULTS

### Age-Income Profile

All salaries resulting from PhD career paths eventually surpassed that of the community pharmacist. The administrative career track, as expected, was associated with the largest annual salary as age increased. The net present value for all career paths is depicted in Figure 1. The NPVs for all PhD career paths, as compared to the practicing community pharmacist, were negative. NPVs for all PhD career paths ranged from -\$563,682 to -\$212,271. The NPVs declined until about age 40 to 45 years, at which time the NPVs for PhD careers began to show a positive trend. Despite this positive trend in later years of employment, the cumulative NPV never caught up to the value of the practicing pharmacist by age 65 years. Cumulative NPVs for PhD careers are presented in Table 1.

Table 2 presents the IRRs for PhD careers as compared to practicing community pharmacists. The highest IRR was associated with academic administration (1.3%). Pharmacy practice (PHPR) industry/CRO careers closely followed the academic administration track with an IRR

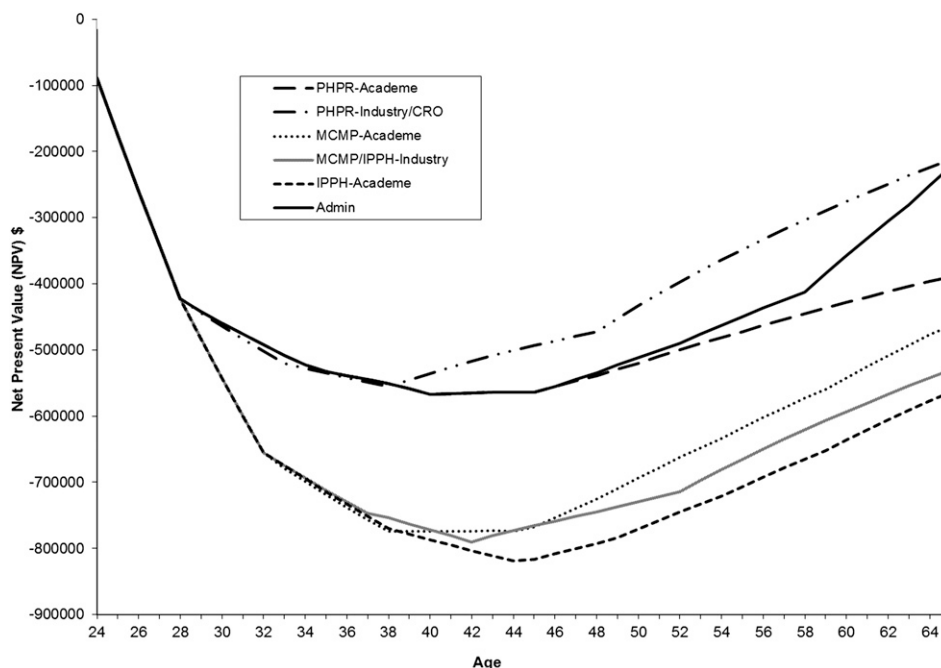


Figure 1. Net present value (NPV) for PhD-related careers as compared to career in chain community pharmacy. Abbreviations: PPHR = Pharmacy Practice; Admin = Administration; MCMP = Medicinal Chemistry/Molecular Pharmacology; IPPH = Industrial Pharmacy/Pharmaceutics; CRO = Contract Research Organization.

of 1.1%. Academic IPPH careers had the lowest IRR (-1.4%). Non-administrative academic IRRs ranged from -1.4% to -0.4%. Results of the sensitivity analyses manipulating the discount rate, length of postdoctoral work, and graduate student stipend are shown in Table 2. Whereas the IRR is the discount rate at which NPV is equal to zero, adjusting the discount rate only could be examined in relation to the NPV. Decreasing the discount rate to 0% increased NPVs to a range of -\$310,458 for IPPH academic careers to \$310,994 for the administrative track. At a discount rate of 1%, only the PPHR industry/CRO track and the administrative track show a positive NPV; additional career tracks never displayed a positive NPV regardless of the discount rate employed.

Sensitivity analysis of the length of postdoctoral work for MCMP and IPPH PhD careers led to positive changes in NPV and IRR. Basing calculations on a 2-year postdoctoral experience, IRRs ranged from 0.2% to 0.7%, with NPVs ranging from -\$334,859 to -\$303,383. Determining the effects of increases in graduate student stipends on IRR indicated that increasing the assumed stipend to \$30,000 increased IRRs from a range of -0.7% for MCMP and IPPH industry careers to 2.4% for administrative careers. Increasing the annual graduate student stipend to \$40,000 increased IRRs from a range of -0.5% for MCMP and IPPH industry careers to 2.8% for academic administration careers.

Time to complete graduate school also was examined as it impacted the IRR. IRRs ranged from 0.4% to 4.0%

when the time to complete graduate school was decreased to 3 years. The lowest IRRs were associated with MCMP and IPPH industry careers and IPPH academic careers, whereas the highest IRRs were associated with academic administrative and PPHR industry/CRO careers. IRRs associated with decreasing graduate school time to completion to 4 years ranged from -0.3% to 3.0%. One additional sensitivity analysis was conducted to examine the effect on IRR when considering a combination of decreased time to degree (4 years) and increased graduate student stipend

Table 1. Cumulative Net Present Value (NPV) for PhD-Related Careers as Compared to Career in Community Pharmacy

PhD Area of Study	Career Track	Net Present Value
		3% discount rate (\$), Age-Income Method
Pharmacy Practice	Academia	-389,219
	Industry/CRO	-212,271
MCMP	Academia	-464,183
	Industry	-530,839
IPPH	Academia	-563,682
	Industry	-530,839
Academic Administration		-223,099

Abbreviations: MCMP = Medicinal Chemistry/Molecular Pharmacology; IPPH = Industrial Pharmacy/Pharmaceutics; CRO = Contract Research Organization

Table 2. Internal Rate of Return (IRR) and Effects of Sensitivity Analyses for PhD-Related Careers Compared to Careers in Community Pharmacy

PhD Area of Study and Career Track	IRR (%)				
	Base Assumptions <sup>a</sup>	Student Stipend (\$40,000) <sup>b</sup>	Program Length (3yrs) <sup>c</sup>	Post-Doc Length (2yrs) <sup>d</sup>	Stipend/Length <sup>e</sup> \$30,000/4 yrs
Pharmacy Practice					
Academia	-1.25	-0.08	1.05	N/A	-0.21
Industry/CRO	1.11	2.23	3.46	N/A	2.27
MCMP					
Academia	-0.44	0.14	1.00	0.65	0.52
Industry	-1.22	-0.47	0.43	0.22	-0.07
IPPH					
Academia	-1.36	-0.34	0.54	0.24	0.64
Industry	-1.22	-0.47	0.43	0.22	-0.07
Academic Administration	1.29	2.75	3.99	N/A	3.28

Abbreviations: MCMP = Medicinal Chemistry/Molecular Pharmacology; IPPH = Industrial Pharmacy/Pharmaceutics; CRO = Contract Research Organization

<sup>a</sup> See Text for Study Assumptions

<sup>b</sup> Annual Graduate Student Stipend = \$40,000

<sup>c</sup> Length of Graduate Program = 3 years

<sup>d</sup> Length of Post-Doctoral Program = 2 years

<sup>e</sup> Graduate Student Stipend = \$30,000; length of graduate school = 4 years

(\$30,000). IRRs ranged from -0.1% for MCMP and IPPH industry careers to 3.3% for academic administration careers. Every calculated net present value resulting from the sensitivity analysis was negative.

### Longitudinal IRR Analysis

Figure 2 indicates the extent to which IRRs have decreased over the study period. In 1982, the IRRs for PHPR academic and PHPR administrative tracks were 7.3% and 7.2%, respectively, compared to IRRs of -1.3% and 1.3% in 2008. The MCMP track IRR ranged from 4.1% in 1982 to -1.0% in 2007. Similarly, the IPPH track IRR ranged from 4.4% in 1987 to -1.5% in 2007. MCMP and IPPH academic career tracks were consistently lower than PHPR and administrative tracks given postdoctoral expectations. Analysis of the IRRs associated with industrial career tracks from 2004 to 2008 also showed a negative trend. Over the study timeframe, the IRR for the PHPR industry/CRO track dropped from 4.2% in 2005 to 1.1% in 2008. Given an inability to differentiate between MCMP and IPPH industrial track salaries based on AAPS data, the MCMP and IPPH industrial tracks were calculated based on the same data from AAPS. IRRs for the study period dropped from 1.3% in 2004 to -1.2% in 2008 for both career tracks.

### DISCUSSION

IRR allows investors (eg, prospective graduate students, prospective faculty members) to compare the prob-

able financial outcomes associated with various career options. The results of this study, while perhaps not surprising, quantify the opportunity cost associated with pursuing a graduate degree after earning a PharmD degree. US pharmacy school graduates who choose to pursue graduate school can expect a much lower return on their investment than if they had invested in a US Treasury bond or the stock market. Thus, from an economic standpoint, there is no reason to expect graduates of PharmD programs to consider pursuing the PhD degree.

As expected, the largest IRR in the academic setting was associated with the administrative career path. However, the majority of individuals who obtain PhDs and enter the workforce never hold administrative positions. Only 9.7% of pharmacy faculty members held administrative positions in 2008.<sup>26</sup> Thus, the IRRs and negative NPVs associated with non-administrative postgraduate education tracks, including pharmacy practice, industrial pharmacy, and medicinal chemistry, are a better representation of the PhD pharmacy faculty population.

Early differences in income between practicing pharmacists and pharmacy graduates who pursue graduate school had the greatest impact on IRRs. Essentially, the graduate student accumulates debt of approximately \$400,000 to \$600,000 (depending on postdoctoral requirements) realized as foregone income he/she could have earned in pharmacy practice while pursuing graduate school. Given the nature of returns on investments,

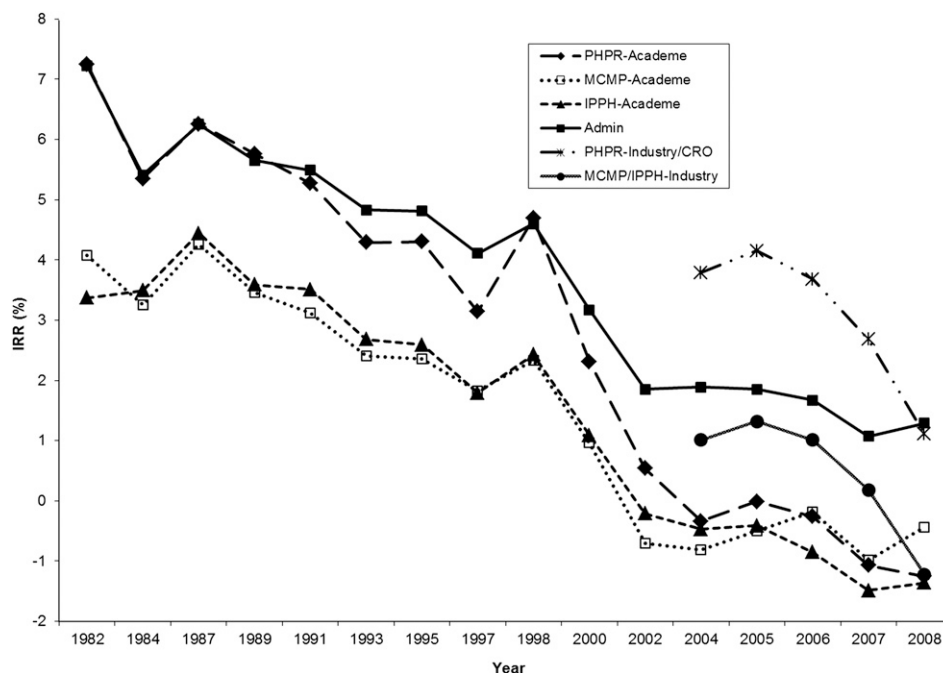


Figure 2. Internal rate of return (IRR) for PhD careers as compared to practicing community pharmacist: 1982-2008 (data for industry career tracks only available from 2004-2008). Abbreviations: PHPR = Pharmacy Practice; Admin = Administration; MCMP = Medicinal Chemistry/Molecular Pharmacology; IPPH = Industrial Pharmacy/Pharmaceutics; CRO = Contract Research Organization.

interventions that produce the greatest impact, dollar for dollar, are those that occur early in the process, like tuition support, increased stipends, decreased time to earn the degree, early career increases in salary, or a combination of the aforementioned options, as these compound throughout the career of the PharmD/PhD graduate. Substantial increases in pay later in a career do not have as great of an impact as early interventions when taking into consideration the discount rate on earnings.

Increasing graduate school stipends to the \$40,000 level (a level similar to residency and fellowship stipends) in the sensitivity analysis increased the IRRs substantially. However, given that the original IRRs were quite low, even a 100% to 400% increase did not raise IRRs to a level where pursuit of graduate school and the resulting careers were financially attractive choices. This stipend of \$40,000 also might be considered representative of the pharmacist-graduate student who works part-time as a practicing pharmacist to supplement his/her graduate school stipend. Given hourly earnings for part-time pharmacists, it is quite feasible for a graduate student to double his/her income. However, working part-time also can increase the amount of time necessary to complete graduate school, potentially negating any increase in the IRR attributed to part-time practice.

Decreasing the time necessary to complete graduate school increased the projected IRRs of PhD career tracks by a larger magnitude than increasing graduate student

stipends. However, the maximum IRR resulting from a decrease of graduate program length to 3 years was still only 4%. In previous research, decreasing the time necessary to complete graduate school and increasing stipends to levels comparable to those of residents and fellows were the 2 factors that pharmacy students indicated would most positively influence their decision to pursue graduate school.<sup>22</sup> From an educational standpoint, however, the feasibility of completing requirements for the PhD in a 3-year timeframe is questionable. Decreasing PhD completion time to 4 years and increasing stipends to \$30,000 did increase IRRs. However, the rates of return were still relatively lower than those of the economic market, especially for MCMP and IPPH careers.

Economic theory posits that society should distribute resources to areas that provide a rate of return greater than or equal to the market rate of return. If other means of entering academia (eg, residencies or fellowships) or other careers often associated with having a PhD degree exist that provide a higher rate of return, resources should be allocated to those areas. The decreased length of time necessary to complete these post-PharmD options should make the career paths more attractive from an economic perspective. However, assuming an average annual resident salary of \$40,000, the pharmacist who completes a 2-year residency and is then employed in pharmacy academia can expect an IRR of only 2%, which is higher than the IRR for pharmacists

who choose to pursue graduate school but still low considering other training and employment alternatives. Fellowships can vary in length and requirements regarding residency training. If the fellow had completed a PGY1 residency and then completed a 2-year fellowship, the rate of return would be 1%. While not exceptional rates of return, the decrease in the length of the programs places these post-PharmD options at an economic advantage compared to graduate education as a means of entering an academic career. The clinical focus of the profession also serves as a good recruitment tool for residency and fellowship programs.

Comparing results of the study by Hartzema and Perfetto to the current study reveal significant decreases in IRR in the current study regarding PhD career paths.<sup>14</sup> Hartzema and Perfetto obtained IRRs ranging from 10.2% for pharmacy graduates completing 2-year fellowships to 4.4% for PhD graduates completing a 2-year post-doctoral fellowship. PharmD graduates who entered academia directly had an IRR of 16% when compared to BS graduates employed in the community setting. In 1982, the starting community pharmacist salary was approximately \$27,000, compared to an average assistant professor salary across common pharmacy departments of approximately \$29,100. Academia at one time provided financial incentive in terms of higher starting salaries as compared to pharmacy practitioners. That incentive no longer exists. Academic salaries do increase at a rate greater than that of the community practitioner; however, economic analysis indicates that the IRRs for academic careers are still low, even after completing only a 1-year residency.

Perhaps the most striking finding in this study pertained to the longitudinal analysis, which indicated that, from 1982-2008, the IRRs associated with PhD academic careers decreased substantially. Disregarding changes from BS to PharmD length of degree requirements makes this analysis conservative in nature. Even if the accuracy of study assumptions and available salary data are questioned, observation of IRRs over time, holding assumptions constant, indicates that IRRs have indeed decreased for academic careers. Public institutions' reliance on government funding could potentially limit the ability of said institutions to provide salaries that compete with salaries provided by private for-profit corporations such as community pharmacies. However, failure to provide starting faculty salaries commensurate with those of community practitioners economically devalues graduate education from the perspective of the student pharmacist. Despite an investment in postgraduate pharmacy education, the PharmD/PhD graduate initially will be paid approximately \$20,000 less annually than could be earned in the community setting. The economic incentive for earning a PhD degree therefore is lacking.

Indeed, there is another lens through which the current faculty shortage and financial differences between practicing pharmacists and those who seek employment in careers resulting from PhD education can be viewed. The economic perspective does not take into consideration all factors that could motivate a student pharmacist to pursue graduate education. Arguably, academic positions do offer substantial non-monetary rewards, but the financial component of said positions has worsened even if it is assumed that non-fiscal rewards are held constant over time. Individuals may feel called to pharmacy education regardless of financial ramifications of the decision. While the calling to be an educator is desirable and may attract some individuals to academic careers, self-recruitment may not be sufficient to ensure an adequate number of pharmacy educators in the future.

The community pharmacy "bubble" may burst with respect to increases in community pharmacist salaries; however, there remains a moderate excess demand over available supply for pharmacists, specifically in community and institutional settings.<sup>41</sup> With an increase in the number of pharmacy schools/colleges, the supply of pharmacists is likely to increase. Furthermore, the shortage of pharmacy faculty members is likely to increase. The potential exists for a supply/demand equilibrium or pharmacist surplus that could positively influence recruitment of PharmD graduates to graduate education. However, reliance on this recruitment technique, ie, pursuing graduate education out of necessity or desperation, does little to increase the perceived value of graduate education to student pharmacists.

Faculty encouragement of pharmacy students to pursue graduate education is associated with increased student interest in pursuing graduate school.<sup>22</sup> Relying on faculty members to encourage students to pursue graduate school operates under the assumption that faculty members enjoy their occupations and promote positive aspects of their career choices to students. Moreover, as a smaller percentage of pharmacy-educated individuals (both US- and foreign-educated) comprise the total number of pharmacy educators, the profession eventually may rely on a non-pharmacy educated majority of its faculty members to provide encouragement to student pharmacists to consider careers resulting from completion of pharmacy graduate school.

If academic pharmacy desires to recruit US pharmacy graduates to graduate education, justification as to why pharmacy graduates should forego practitioner income and be willing to assume a starting salary approximately \$20,000 less than that of a pharmacy practitioner should be apparent. If the discrepancy in IRR and starting salary upon completion of the graduate degree is not justifiable, efforts should be taken to increase the perceived value of the pharmacy graduate degree.



## Limitations

Conducting this study on the projection of future earnings was limited by the fact that it is a projection. Nevertheless, employing assumptions based on current data is the most appropriate manner in which valid projections regarding the future can be made. Sensitivity and longitudinal analyses supported the findings in this study. One career characteristic not examined in this study was the difference in hours worked across professions. The authors assumed hours to be similar across community pharmacy, academic, and industry career tracks. One aspect of careers resulting from completion of graduate education that was not taken into consideration was the extent to which faculty members who are registered pharmacists supplement their income by working outside of academia as pharmacy practitioners. Additionally, the extent to which pharmacy faculty members supplement their income through consulting services was not taken into consideration. An additional limitation is the availability and accuracy of salary data for all career tracks. Whereas a portion of the data sources are quite reliable, some data sources are questionable. However, the data employed in the study were the best currently available data sources. Multiple sources of community pharmacy salary data were analyzed in an effort to increase the reliability and validity of available data.

## CONCLUSION

Completion of a PhD degree and employment in an academic or industrial setting was associated with low positive or negative internal rates of return. Moreover, net present value for all PhD-related career paths was negative as compared to the practicing community pharmacist. Longitudinal analysis showed a decreasing trend in IRRs associated with academic- and industry-related PhD careers. Considering the shortage of pharmacy faculty members, the likelihood of increased vacancies within academic pharmacy as the current faculty ages and more schools/colleges open, and the small percentage of graduates of US colleges and schools of pharmacy that comprise pharmacy PhD programs, recruitment methods should be implemented that take into consideration both non-economic and economic characteristics of the career paths that can result from completion of the PhD degree. From an economic perspective, pharmacy educators must be able to demonstrate the benefits associated with obtaining a PhD degree and pursuing PhD-related careers. Moreover, differences in starting salary for practicing pharmacists and those who enter academia should be justifiable to prospective academicians.

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