RESEARCH ARTICLES

Economic Impact of Pharmacy Graduates on a Regional Economy

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Objectives. To analyze the impact of recent pharmacy graduates on a local economy.
Methods. Input-output analysis was applied to data from Spokane County, Washington, in 2006 and the findings were reviewed and conclusions were drawn.
Results. The local college of pharmacy added nearly $1 million (in 2006) directly to the local economy. New pharmacists added nearly $400,000 in direct value. However, because the graduates alleviated a shortage of pharmacists in the area, thereby avoiding both the tangible and intangible (eg, human health) economic costs of a continued shortage, the true economic impact may have been even greater.
Conclusions. Doctor of pharmacy (PharmD) graduates entering the workforce add substantial value, both to the local retail pharmacy industry specifically and the local economy in general. Thus, the economic impact of the pharmacy practice program training these students is also substantial.

Keywords: economic impact, input-output modeling, program assessment

INTRODUCTION

Economists generally define an economy as a series of interconnected markets. In each market, households, firms, and the government interact to facilitate an exchange of goods, services, and resources. Because markets are linked, a change in one market can have a fundamental impact on other markets and the economy as a whole. Investment in labor or capital in one sector of an economy stimulates demand in other sectors, leading to economic growth.

Perhaps this linkage is more apparent in higher education than in any other sector. Higher education increases human capital, supplying skills needed by industry and entrepreneurs, and thus is one of the key drivers of economic growth. Not surprisingly, a plethora of academic studies (in addition to scores of unpublished papers and professional reports) have attempted to estimate the economic impact of higher education on local economies.[1-3] Florax cites over 40 such studies conducted between 1960 and 1992[4] while Giesecke and Madden[5] cite more than a dozen studies conducted between 1992 and 2006. In the United States, multiplier estimates of every state dollar spent on universities on the local economy range from 8 for Bowling Green State University on the local economy to approximately 3.5 for Washington State University on the State economy.[6,7] In addition, the economic impact of higher education spending is disproportionately higher for small and medium-sized economies (ie, those with fewer than 200,000 nonfarm jobs) because there are fewer large industries available to drive local economic growth.[8]

While the economic impact on the local economy of some university departments and colleges, such as business schools, athletic departments, and health science centers, have been studied,[9-11] little research has been done on the economic impact of schools and colleges of pharmacy. Several factors unique to pharmacy education may explain why conducting an economic impact study is challenging. First, there are relatively few pharmacy programs accredited by the Accreditation Council for Pharmacy Education (ACPE) and these are dispersed throughout the country. As a result, programs often recruit students from surrounding geographic areas, and a significant percentage of those students remain and work in the regional economy after graduation.[12,13] Second, the relatively small number of pharmacy programs compared to medical and nursing programs results in a correspondingly lower number of new pharmacists being licensed each year, while the number of employment opportunities for these graduates is actually higher.[14-16] Third, the majority of (but not all) pharmacists work in outpatient, retail

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settings that are often geographically separate from other sources of health care. This makes the economic impact of these pharmacists on the regional economy distinct and more easily quantified compared to other types of practitioners. In addition, because of pharmacists' specialized areas of knowledge, their role cannot be filled by a less-knowledgeable healthcare worker, as might be possible in some other health care fields where skills and training of workers may overlap. For example, although pharmacy technicians are trained to count pills and label bottles, they can only perform their duties under the supervision of a licensed pharmacist who has a thorough understanding of drug interactions and disease states.

The sparse literature that exists on the local economic impact of community pharmacies and the academic programs training pharmacists for these programs strongly suggests high impact. Hodur and Leistritz found that community pharmacies add over 10,100 full-time equivalent jobs and a gross business volume of over $900 billion (in 2006 dollars) to the North Dakota economy.[13] Gourley, White-Means, and Wallace found that the economic impact of the University of Tennessee's College of Pharmacy (in 2004-2005 dollars) added over 600 jobs and $18 million to the state's economy.[17]

Moreover, since pharmacy training is specific, the economic impact can easily be attributed to the academic programs training local pharmacists. This provides a unique and as yet unexplored means to measure the full economic impact of a typical pharmacy practice program. Hodur and Leistritz looked only at the economic impact of pharmacies as a type of *business*, but did not explicitly account for the educational process in the creation of registered pharmacists.[13] Gourley, White-Means, and Wallace examined the economic impact of programs that *train and educate* pharmacists, but did not account for economic gains that accrued once those students graduated, passed their licensing examinations, and began to practice.[17] Our study focused on this crucial aspect. We estimated both the economic impact of the pharmacy program and the direct impact of pharmacy graduates entering the workforce on the local economy, thus providing the first full estimate of a pharmacy program's impact.

METHODS

Identification of Data Sources

Our analysis focused on the greater Spokane, Washington, economy. In an effort to maintain consistency with the manner in which the U.S. Census Bureau and other government agencies report data, we defined the greater Spokane economy geographically at the county level (Spokane County). The County has also been designated as a distinct Metropolitan Statistical Area (MSA) by the Census Bureau and a separate Work Development Area (WDA) by the Washington State Employment Security Department (ESD).

The Spokane MSA is a community of nearly 450,000 residents and is the largest MSA between Seattle, Washington, and Minneapolis-St. Paul, Minnesota.[18] It has a relatively strong mix of businesses in the wholesale, retail, finance/insurance, construction, and manufacturing industries. However, its largest individual employers operate in the healthcare, education, and government (federal and state) service industries.[19] In particular, Spokane houses 2 major health systems (including 4 hospitals) and more than 5 institutions of higher education (including 2 public universities, 2 private universities, and a community college system). A large U.S. Air Force base (Fairchild Air Force Base) also operates within county limits. The Washington State ESD estimated that, in June 2006 (which represents the midpoint of our analysis), there were approximately 13,518 firms operating in the MSA, employing 207,395 individuals.[18,19]

Of particular interest is the nature of the retail pharmacy industry in the Spokane MSA. According to the Minnesota IMPLAN Group (MIG), in 2006 there were 1,761 people employed in the health and personal care sector of the Spokane economy, which is comprised primarily of retail pharmacies.[20] These workers generated just over $51 million in earnings, which translates to approximately $30,000 of income per employee. While estimates varied slightly over the year, approximately one-fourth of these employees were pharmacists, while the remainder included pharmacy technicians, pharmacy aides, and general retail employees. For example, in the second quarter of 2006, the ESD reported that 519 people in the Spokane MSA were employed as pharmacists. Clearly, because pharmacists may also be employed in hospital, long-term care, and other related settings, the number employed by retail pharmacies is likely to be below 500, and most likely between 400 and 450. Additionally, in 2004 the ESD estimated that employment among pharmacists, pharmacy technicians, and pharmacy aides was 504, 467, and 75, respectively.[18,19] ESD data from March 2007 indicated that for pharmacists (510) and pharmacy aides (70), these numbers have not changed dramatically. Mean wages for pharmacists were $43.56 per hour, compared to $11.86 for pharmacy aides.

In Washington, the maximum ratio of technicians and aides to registered pharmacists is 3 to 1.[21] Thus, the data in our analysis were at, or slightly exceeded, this allowable maximum. We offer 2 possible explanations for the high ratio of nonpharmacists to pharmacists in our data. First, Spokane exhibits a wide array of retail chain stores (eg,

Walmart, Rite Aid, Walgreens, and Savon Drugs) as well as a number of smaller, independently owned pharmacies. To maintain a market niche (eg, operating as a compounding pharmacy, or simply catering to a particular market segment which prefers dealing directly with the pharmacists), smaller independent pharmacies typically utilize fewer technicians. Large chain stores, however, not only utilize the maximum number of technicians and aides but also are likely to have additional retail staff members who may temporarily assist in pharmacy-related activities, which may have been counted in this ratio. The high proportion of retail chain store pharmacies in Spokane weights ratios towards this higher level. Perhaps more importantly, the numbers represent headcounts, not full-time equivalent employees (FTEs). If we had data on FTEs rather than headcounts, this ratio would be smaller. In any case, given the empirical technique we chose to utilize (see the following sub-section), these issues are only of significant concern if, in the long run, Spokane's retail pharmacy market evolves in a significantly different manner than those in other parts of the country. Since we can identify nothing unique about the Spokane market that would point to a long-term difference, we assumed that any discrepancies would average out in our analysis. The competitive nature of the retail pharmacy industry and the preponderance of large chain stores make this issue an insignificant concern.

Retail pharmacists working in the Spokane MSA are mostly trained at 1 of 3 institutions. Washington State University's (WSU) College of Pharmacy offers a traditional PharmD program. The first 2 years of the program are offered on its main campus in Pullman, while the final 2 years are delivered on its Spokane campus. This program enrolled 376 students and graduated 75 students in 2006.[22] The WSU College of Pharmacy employed approximately 21 (out of 27 total) pharmacotherapy practice FTEs on its Spokane campus [e-mail, Washington State College of Pharmacy, July 22, 2008]. Within the state, the University of Washington (UW) also offers a PharmD on its Seattle campus, which is approximately 280 miles west of Spokane. During the 2006-2007 academic year, this program enrolled 348 students and awarded 94 PharmD degrees.[23] In addition, the University of Montana (UMT) offers a PharmD on its Missoula campus, which is approximately 185 miles east of Spokane. This program is slightly smaller than WSU or UW, enrolling (and presumably graduating) approximately 65 students per year.[24]

All 3 programs offer similar curricula. The WSU and UMT programs have similar faculty sizes and student demographics. UW's program has more faculty members, its faculty is much more involved in grant-related research, and students have more opportunities to earn joint degrees, particularly doctoral degrees in areas such as medicinal chemistry and outcomes research.

One issue in our analysis is how many of the locally trained pharmacists remain to practice in Spokane. We use the Washington State Employment Security Department Occupational Employment Projections for pharmacists (and other pharmacy staff) in the Spokane WDA as our baseline growth and assume, as discussed below, that the ability to fill this growth depends crucially on whether or not a pharmacy practice program is extant in Spokane.[25-27]

Empirical Framework

In this study, we employed the most commonly used empirical framework to evaluate the economic impact of a particular industry on a local economy: input-output analysis.[3] Specifically, we used the IMPLAN (Impact Analysis for Planning) modeling system to generate estimates of the multiple and simultaneous changes that occurred in 2006 to the local Spokane economy due to pharmacy graduates and the presence of the WSU Pharmacy Practice program. IMPLAN was developed jointly by the USDA Forest Service, the Federal Emergency Management Agency, the Bureau of Land Management, and the University of Minnesota, and is now owned and disseminated by the Minnesota IMPLAN Group (MIG).[20] We used the IMPLAN software because it is relatively simple, provides reasonable estimates, and is the approach most widely accepted by policymakers.[28] Other approaches to economic impact modeling have also been developed and utilized previously; for example, regression-based modeling, the Regional Economic Model Incorporated Policy Insight (REMI) input-output model, and in the case of the forest service industry, million board feet (MMBF)-based input-output modeling.[8,28,29]

The mechanics of input-output analysis are straightforward.[30] Within a particular economic region, there are *n* different (mutually exclusive and collectively exhaustive) industries. Consumption comes from 2 sources: household consumption of final goods and services (Y) and intermediate consumption by firms (X) representing those firms' supply chains. Thus, we have $X = AX + Y$ where X is an nx1 matrix of production; Y is an nx1 matrix of household consumption; and A is an nxn "absorption" matrix identifying the average interrelationships across firms' supply chains, ie, how much of a firm's output is purchased by other firms to facilitate their production.

Each year, MIG gathers data at the national, state, and local levels on inputs and outputs for hundreds of different industrial sections. The data are collected at the 4-6 digit NAICS code level from a variety of different sources, including (but not limited to) the Bureau of

Labor Statistics, the Department of Commerce, and the Bureau of Economic Analysis. MIG uses this information to compute absorption levels and market shares, among other factors, and subsequently uses these calculations to estimate national, state, and county level input-output models for the entire United States.[20,31]

IMPLAN, using the MIG data, gave us a baseline for the matrices A and X. To simulate a shock or change to a sector in the local economy, we imposed a change on X, and IMPLAN allowed us to trace the impact on both the element of X corresponding to that particular industry (ie, the direct impact) and also the effect on other industries in that economy (ie, the indirect and induced impacts). This also allowed us to calculate the multipliers for each industry as the ratio of the total impact to the direct impact. For a national economy with k local economies, we could simply redefine X, Y, and A to be (k*n)x1, (k*n)x1, and (k*n)x(k*n) matrices, respectively.

Applying IMPLAN

We used a 3-step approach with IMPLAN to conduct our analysis. First, to obtain a reasonable baseline to interpret our results, we conducted an analysis to examine the overall economic impact of the retail pharmacy industry on the Spokane economy in 2006. Next, using our previous analysis, we estimated the economic impact of an entering cohort of registered pharmacists on the Spokane economy. The Employment Security Department estimated that on average there were 27 openings for pharmacists and 38 openings for pharmacy technicians and aids each year in Spokane County. Of these, approximately 5 would be new positions and the rest would be replacement positions.[25] We also assumed that 4 of the technician and aid positions would be net additions to the Spokane economy each year.[26,27] This analysis assumed that the WSU Pharmacy Practice program was already in place.

Numerous studies have argued that pharmacists often work where they are trained, and in the absence of a local college of pharmacy, a location like Spokane might have trouble attracting and retaining pharmacists.[12,14] Thus, to measure the overall impact of the WSU Pharmacy Practice program, we analyzed 3 additional scenarios. In the first scenario, the portion of the WSU program based on Spokane was disbanded but pharmacists positions were filled from outside the area. The 2 other scenarios assumed that the Spokane portion of the WSU program was disbanded, but that there was a shortage of pharmacists to fill the open positions. In the first of these 2 scenarios, about 25% of open pharmacist positions remained unfilled, and in the second, 50% remained unfilled. In both cases, we assumed that open pharmacy technician and aid positions were filled.

RESULTS

Table 1 contains the results of our baseline model, which estimated the total economic impact of all sectors (which number more than 400) in the Spokane economy, including that of the health and personal care sector, which is predominately composed of retail pharmacies. In 2006, the Spokane economy accounted for over $16 billion in value added, with a total of $31 billion of output produced by over 261,000 employees, who generated nearly $10 billion in compensation. Firm owners earned a profit of over $839 million.

Household production was the largest component of value added production (Table 1, Panel A), followed closely by wholesale trade. Other sectors of the economy adding substantial value included the real estate, banking, healthcare (including both practitioner offices as well as hospitals), government (including military activities as well as local government services), education, and retail industries. The health and personal care sector ranked 48th, with an added value of approximately $75 million.

Table 1. The Impact of All Economic Sectors on the Economy of Spokane, Washington, in 2006

Industry	Value Added	Rank
Panel A: Value Added in Millions of 2006 Dollars		
Owner-occupied/household production	1,180.02	1
Wholesale trade	1,071.21	2
State & local education	740.53	3
Real estate	735.52	4
Depository financial institutions	642.62	5
Physician, dentist and other health care offices	594.23	6
State & local non-education	538.76	7
Hospitals	454.15	8
Federal military	373.41	9
Food services and drinking places	369.60	10
Health and personal care stores	75.82	48
Spokane economy total	16,241.01	
Panel B: Value of Output in Millions of 2006 Dollars		
Electronic computer manufacturing	1,623.75	1
Wholesale trade	1,590.15	2
Owner-occupied/household production	1,321.54	3
Real estate	1,048.06	4
Depository financial institutions	898.76	5
Insurance carriers	864.32	6
Hospitals	853.70	7
Physician, dentist and other health care offices	850.42	8
Food services and drinking places	780.89	9
State & local education	740.53	10
Health and personal care stores	118.43	62
Spokane economy total	31,028.38	

Panel B shows the value of output produced in the economy, again for the top 10 sectors and the health and personal care sector. While the rankings vary slightly compared to value added, the majority of the sectors producing high value added also produce large values of outputs. (IMPLAN also reports the number of employees, value of compensation, and value of profit for each sector. A full set of results for each of these are available from the authors upon request.) In Spokane County, the health and personal care sector ranks 43rd with 1,761 employees. It ranks 46th in compensation at just over $51 million, and 51st in profit of just under $3.5 million.

Table 2 shows the total and direct impacts of the 4 hypothetical scenarios on the Spokane economy. The direct impact includes the value added, output, compensation earned, and profit generated. Direct effects represent the specific productive activities of these changes in employees; thus, there is no interaction between sectors of the economy. As such, we do not disaggregate these results as we do in Table 1. Since the direct effects do not consider the interaction between the various sectors in the economy, they are mostly proportional to the change in labor described by the scenario.

The second column of Table 2 shows that continued presence of the PharmD program in Spokane, along with anticipated growth in the number of pharmacists and aids employed as predicted by the ESD, will contribute $627,913 in value each year to the Spokane economy, of which $387,556 is from direct impacts. The value of output coming from the health and personal care stores sector total just over $1 million, with $605,392 of that directly from that sector.

Columns 3, 4, and 5 of Table 2 suggest different effects of removing the PharmD program from Spokane. In all 3 of these scenarios, we assume that all 21 College of Pharmacy positions in Spokane are eliminated and, to offer what we consider conservative estimates, open pharmacy aid and technician positions are filled. If open pharmacy positions are filled by pharmacists trained outside Spokane, the loss of jobs occurs in the education sector. Column 3 shows how value added and the value of output in the Spokane economy would contract in this case. Columns 4 and 5 respectively report projected contractions in value added and the value of output impacts if 25% and 50% of open pharmacy positions (which, recall, amount to approximately 27 positions per year) are lost simultaneously with the aforementioned education positions.

In Table 3, we break down the total impacts among the top 10 affected sectors for each scenario. As would be expected, the largest effects are on the sector that changes. Hence, in scenario 1 (Panel A), where the PharmD program remains and fuels growth in pharmacists in the retail sector, health, and personal care stores show the greatest value added and value of output increase. These numbers differ from the direct impacts because of (small) indirect and induced impacts within that sector as the new employees are also customers.

Panels B, C, and D show the breakdown by retail sector if the PharmD program were removed from Spokane. Since it is a publicly funded program, there are no indirect or induced effects, so in scenario 2, when the only change is a reduction of the PharmD program employees (Panel B), the direct impact of the change and the effect on state and local education are the same. If pharmacists positions go unfilled because of no "locally grown" new pharmacists (Panels C and D), the impact on health and personal care stores catches up to, and (in terms of the value of output) eventually overwhelms the impact from

Table 2. Direct Impacts of Spokane-based PharmD Full-time Employees on the Overall Spokane Economy Based on 4 Scenarios

	Scenarios			
	No change to spokane-based PharmD FTEs	**Lose spokane-based PharmD FTEs**	**Lose Spokane-based PharmD FTEs**	**Lose Spokane-based PharmD FTEs**
	and	**and**	**and**	**and**
Impact in 2006 Dollars	**Retail industry grows by 9 FTEs (5 pharmacists and 4 Aides)**	**No change in retail pharmacy employment**	**Retail industry shrinks by 25% (14 FTEs)**	**Retail industry shrinks by 50% (22 FTEs)**
Value Added				
Total Impact	627,913	-1,346,539	-2,288,409	-2,846,553
Direct Impact	387,556	-958,357	-1,539,691	-1,884,186
Value of Output				
Total Impact	1,013,116	-1,604,224	-3,123,898	-4,024,445
Direct Impact	605,392	-958,357	-1,866,444	-2,404,570

Abbreviations: FTE = Full-time employee

Table 3. Total Impacts of Spokane-based PharmD Full-time Employees on the Top 10 Spokane Economic Sectors, Based on 4 Scenarios

Value Added: Top 10 Industries	Value Added in 2006 Dollars	Output: Top 10 Industries	Value of Output in 2006 Dollars
Panel A: Retail Industry Grows by 9 FTEs			
Health and Personal Care Stores	389,148	Health and Personal Care Stores	607,878
Real Estate	31,540	Real Estate	44,942
Household Production	28,401	Household Production	31,808
Wholesale Trade	12,669	Management of Companies and Enterprises	21,597
Management of Companies and Enterprises	12,303	Wholesale Trade	18,807
Phys., Dentist and Other Health Care Offices	10,075	Food Services and Drinking Places	15,295
Hospitals	8,128	Hospitals	15,280
Food Services and Drinking Places	7,239	Phys., Dentist and Other Health Care Offices	14,418
Depository Financial Institutions	7,188	Depository Financial Institutions	10,053
Non-Depository Financial Institutions	6,078	Non-Depository Financial Institutions	9,233
Spokane Economy Total	627,913	Spokane Economy Total	1,013,116
Panel B: Lose Spokane PharmD FTEs, No Change in Retail Industry FTEs			
State and Local Education	-958,357	State and Local Education	-958,357
Household Production	-73,709	Household Production	-82,549
Phys., Dentist and Other Health Care Offices	-26,139	Hospitals	-39,648
Wholesale Trade	-25,757	Wholesale Trade	-38,235
Real Estate	-24,524	Phys., Dentist and Other Health Care Offices	-37,408
Hospitals	-21,092	Real Estate	-34,945
Food Services and Drinking Places	-15,667	Food Services and Drinking Places	-33,102
Depository Financial Institutions	-11,874	Insurance Carriers	-17,697
Motor Vehicle and Parts Dealers	-10,272	Depository Financial Institutions	-16,607
Food and Beverage Stores	-7,771	Motor Vehicle and Parts Dealers	-15,654
Spokane Economy Total	-1,346,539	Spokane Economy Total	-1,604,224
Panel C: Lose Spokane Pharm.D. FTEs, 25% Reduction in Retail Industry FTEs			
State and Local Education	-958,357	State and Local Education	-958,357
Health and Personal Care Stores	-587,123	Health and Personal Care Stores	-917,130
Household Production	-116,311	Household Production	-130,260
Real Estate	-71,833	Real Estate	-102,358
Wholesale Trade	-44,761	Wholesale Trade	-66,446
Phys., Dentist and Other Health Care Offices	-41,251	Hospitals	-62,568
Hospitals	-33,284	Phys., Dentist and Other Health Care Offices	-59,035
Food Services and Drinking Places	-26,526	Food Services and Drinking Places	-56,045
Depository Financial Institutions	-22,656	Management of Companies and Enterprises	-37,992
Management of Companies and Enterprises	-21,642	Depository Financial Institutions	-31,686
Spokane Economy Total	-2,288,409	Spokane Economy Total	-3,123,898
Panel D: Lose Spokane PharmD FTEs, 50% Reduction in Retail Industry FTEs			
State and Local Education	-958,357	Health and Personal Care Stores	-1,455,972
Health and Personal Care Stores	-933,033	State and Local Education	-958,357
Household Production	-141,557	Household Production	-158,534
Real Estate	-99,869	Real Estate	-142,306
Wholesale Trade	-56,023	Wholesale Trade	-83,163
Phys., Dentist and Other Health Care Offices	-50,026	Hospitals	-76,150
Hospitals	-40,510	Phys., Dentist and Other Health Care Offices	-71,851
Food Services and Drinking Places	-32,961	Food Services and Drinking Places	-69,640
Management of Companies and Enterprises	-32,577	Management of Companies and Enterprises	-57,189
Depository Financial Institutions	-29,045	Depository Financial Institutions	-40,622
Spokane Economy Total	-2,846,553	Spokane Economy Total	-4,024,445

Abbreviations: FTE = Full-time employee

publicly funded education. As shown in Table 3, the PharmD program and the employment of pharmacists both add significantly to other sectors of the Spokane economy.

We also considered some of the sectors within the local economy in which most of the earnings generated by these employees were spent or, if there was a loss of employment, where earnings would no longer be spent. Perhaps not surprisingly, much of the income earned (or lost) is spent in (or detracts from) the real estate sector (since a home is one of largest purchases an individual makes), the banking sector, various health care sectors (including physician and dentist offices as well as hospitals), automobile-related purchases, and in eating and drinking establishments. However, as shown in Table 3, household production (which occurs when an individual uses her/his income to purchase goods or services provided inside the home, for example, by supporting a spouse who stays home and raises children) consistently ranks among the top 2 or 3 categories. In particular, household production accounts for 3% to 5% of the total economic impacts, and 8% to 19% of the indirect and induced impacts.

DISCUSSION

Pharmacy education is a unique field. Its primary goal is to train workers who have high earning potential, have no close substitutes, tend to remain in the area where they graduate and work in retail settings, and receive virtually all of their specialized training from a specific department within a university. As such, retail pharmacists are likely to have a significant economic impact on a local community, and unlike many academic programs, this impact can be directly attributed to the program that trained them. In this paper, our goal was to characterize this economic impact on the economy of Spokane, Washington. To our knowledge, such a study has not been conducted in the literature. We found that the PharmD program in Spokane contributes significantly to the local economy not only through its employment, although this directly adds $958,357 each year, but also by securing pharmacists to fill the growth in local needs. Although these new pharmacists produce almost $400,000 in direct value added impact each year, a more significant factor for the local economy could very well be that it prevents a shortage of pharmacists in the local economy. As the results in Table 3 demonstrate, the negative economic impact of a pharmacist shortage can easily overwhelm the impact of the Spokane-based WSU pharmacy faculty and staff.

Our findings provide 2 insights for both academic administrators and economic policymakers. First, it provides a new and more direct approach to assessing the economic impact of academic programs, ie, instead of looking at the economic impact of a university, college, or program by assessing only economic impacts based on employment, analysts should also examine the economic impact of the outputs of the production process, specifically, by tracking the impact of trained students as they move into the economy. While this approach may not be useful for all academic programs, we believe it to be of significant use to many professional programs whose graduates may fill what might otherwise be a shortage of those professionals.

Second, our approach allowed us to characterize the distributional consequences of this impact on the local economy. We find that only about 60% of the total economic impact accrues through the direct productivity of these workers. The remainder is indirect and induced effects in the local economy, ie, how workers spend their money, and how this spending circulates through the various sectors of the local economy. Much of the spending accrues to obvious sectors, such as real estate, health care, wholesale trade, and eating establishments. However, a surprising amount is spent on household production as well.

While our study presents some interesting findings, we intend it as a first step, and our results should be viewed with caution. A limitation of our analysis is that we presume that the growth in pharmacy positions is in the retail sector. Growth in other Spokane County industries that utilize pharmacists, such as hospitals and industrial pharmacies, may alter (and most likely underestimate) the value of having the PharmD program in Spokane. In addition, we did not account for those graduates who migrate to other economies to practice pharmacy.

A final limitation of our analysis, which afflicts virtually all input-output models, is that it relied on a number of assumptions which are only reasonable in the long run. Thus, the short-run implications of our model have not been substantiated, and future work will be necessary to do so. In addition, we used without question the ESD estimates of new pharmacy positions in the Spokane WDA. Future work to check the appropriateness of these numbers would provide a useful extension of our analysis.

CONCLUSION

All of the scenarios analyzed in our paper suggest that removing the PharmD program from Spokane would have a dramatic impact on the Spokane economy. If the region is able to fill retail pharmacy positions with graduates of other ACPE-accredited institutions, the loss would be constrained to the education sector and the magnitude of the impacts would be slightly more than $1.6 million. However, the shortage of pharmacists in the region sug-

gests that this outcome is unlikely. If retail positions in the regional economy go unfilled and the retail pharmacy industry shrinks, the magnitude of the (negative) impact on the region would grow dramatically, and in the worst case scenario would exceed $4 million.

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