# Investing in Student Success Through the Use of Artificial Intelligence

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## INTRODUCTION

- The 2022 AACP Graduating Student Survey indicates an average loan of $170,444 to finance a three-to-four-year PharmD education.
- Students' career aspirations and post-graduate education and training plans are becoming wider and more diverse.
- The top choices of employment for our (P4) Class of 2024 are currently: 1) Pharmaceutical Industry (24.7%), 2) Clinic-Based Pharmacy (23.5%), and 3) Hospital (22.4%).
- The top desired post-graduate education and training plans for the (P4) Class of 2024 are currently: 1) Fellowship (35%), 2) Residency (32.5%), and 3) PhD Program (10%).
- There is a responsibility for schools to invest in student success by maximizing their chances of fulfilling their desired career aspirations and post-graduate education plans.
- This may be facilitated through the use of artificial intelligence (AI).

## OBJECTIVES

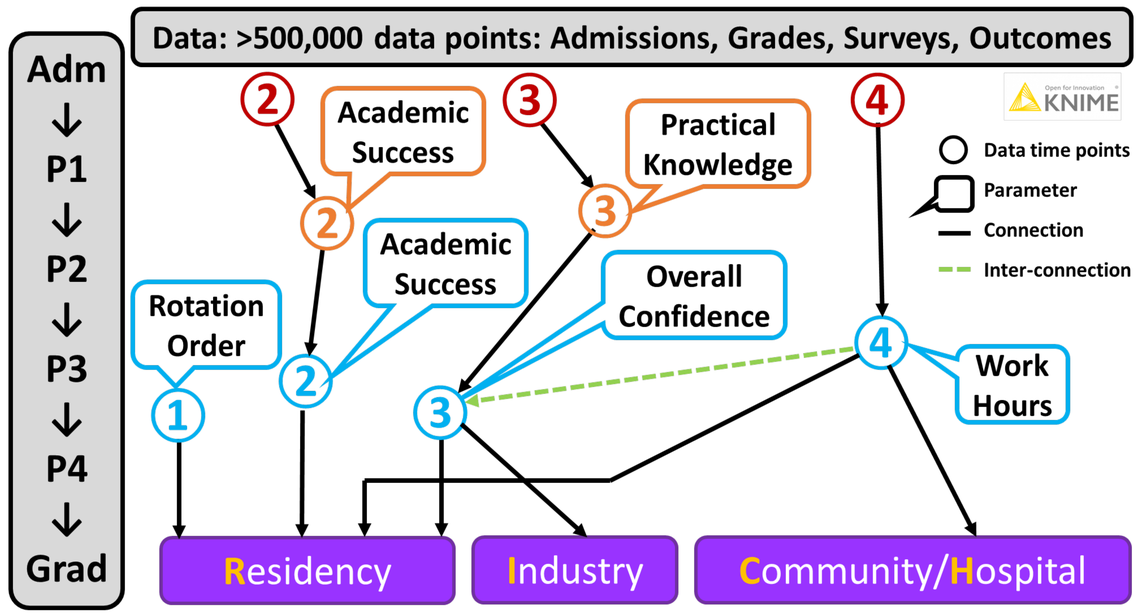
- To collect and curate curricular and co-curricular data related to student outcomes at multiple stages of the PharmD program.
- To build a multi-step AI model (AI-SiPS) that utilizes these data to identify variables that can be used to predict student success upon graduation.

## METHODS

- The current AI-SiPS model includes multiple steps in which "success" at a later stage is dependent on activities at an earlier stage. The model shown here is based on data from students from the classes of 2019 to 2022 (see Figure 1).
- Data include course grades (n=745 students), a year 3 (P3) survey on perceived readiness for advanced pharmacy practice experiences (APPEs) rotations (n=261), the student rotation assignments (n=740), the perceived experience in the APPE year (n=564), and the initial professional step the student is taking after graduation (also n=564), including data for residency matching (n=318, classes 2019-21 only).
- Student outcomes were divided into the broad categories of "Residency", "Industry", and "Community/Hospital" (RICH) (see Figure 1).
- AI-SiPS is implemented on the KNIME (ver. 4.5.1) platform.
- Using this platform, we examined ① relationships of APPE rotation order with residency matching, ② performance in didactic courses, ③ pre-APPE confidence with RICH outcomes, and ④ working hours (see Figure 1).
- Decision tree analysis was used to find data breakpoints in each relationship.

## RESULTS

**Figure 1. Summary of Results from the AI-SiPS Model**




① P3 students assigned with an early versus late acute care rotation
② P3 students with a strong versus weak performance in a cardiovascular therapeutics course
② Earlier course performance related to later course performance
② Relationships to admissions data to be determined

③ P3 students' self-reported confidence level before APPEs
③ Strong versus weak practical knowledge obtained in earlier courses
③ Relationships to admissions data to be determined
④ Student reported work hours during the P3 year
④ Relationships to admissions data to be determined

**Table 1. AI-SiPS RICH Categories Aligned with Responses to the Question: "What are the key trends that may drive pharmacy education and training?"**

| | | RICH Categories | | |
|---|---|---|---|---|
| **Response** | **% of Respondents (n = 46)** | **Residency (R)** | **Industry (I)** | **Community/ Hospital (CH)** |
| Primary care provider shortage | 43% | X | | X |
| Growth in the use of technology and data | 43% | | X | |
| Raising drug costs | 40% | | X | |
| Growing regulatory oversight | 40% | | X | |
| Innovation in drug development and distribution processes | 35% | | X | X |
| Shift to value-based care | 33% | | X | |
| Chronic disease, mental illness, and addiction | 28% | X | | X |
| Need to address social determinants of health | 25% | X | | X |
| Consumerism and patient-driven care | 23% | | | X |
| Personalized medicine and tailored drug therapies | 15% | X | X | |

*Note:* Adapted from "Looking Ahead to 2030: Survey of Evolving Needs in Pharmacy Education," by V. Papadopoulos, D. Goldman, C. Wang, M. Keller, and S. Chen, 2021, Pharmacy, 9(1), p. 59 (https://doi.org/10.3390/pharmacy9010059). CC-BY-4.0.

## RESULTS

- Decision tree analysis using KNIME indicated the following results (see Figure 1):

① An early Acute Care APPE led to a higher residency match rate than a late Acute Care APPE (70.2% vs. 58.0%).

② Students who performed well in certain therapeutic didactic courses, such as cardiology, had a higher chance of matching for residency than those who did not perform well (77.8% vs. 51.7%).

③ Students who felt confident about starting their APPEs had a higher chance of matching for residency than those who reported not feeling confident (77.1% vs. 66.7%). Earlier didactic courses focused on practical application of knowledge showed an impact on self-perceived confidence. Pre-APPE confidence may also be related to pursuit of a career in industry.

④ Students who reported working 10-19 hours per week during the P3 year had a higher chance of matching for residency (77.5%) compared to working less than 10 hours (68.2%), or more than 19 hours (63.6%). Students who reported working more than 19 hours per week were more likely to work in the community setting after graduation (36.0%) compared to the whole student population (33.0%).

- RICH outcomes were also compared with the distribution of predicted needs of pharmacy in 2030 based on the opinions of 46 thought leaders in health care systems, government, supply chain, academia, venture capital, and others (Papadopoulos, 2021) to compare students' current career interests with alignment of societal needs (see Table 1).

## DISCUSSION/CONCLUSION

- We now have a working AI model that is beginning to be predictive of RICH outcomes based on student activities in their four years in the curriculum.
- Identification of factors throughout the curriculum that may lead to a student's desired outcome upon graduation may allow schools and colleges to modify programs in order to optimize students' outcomes.
- Knowing which factors lead to higher chances of success for a particular outcome may also allow for improvements with student career counseling and other interventions to advise students on how to maximize their chances of success at specific points throughout their education.
- Further analysis of additional data, such as other types of rotations, grade point average (GPA), and co-curricular involvement, may lead to improved accuracy to predict a student's outcome based on their characteristics and performance.
- Future plans are to provide KNIME workflows to other institutions interested in using AI to support student success.

## ACKNOWLEDGMENTS

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