Pharmacogenomics Education Strategies in the United States Pharmacy School Curricula

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BACKGROUND

Over the past 10 years, there have been many publications reporting pharmacogenomics education strategies in pharmacy schools and colleges in the US. However, there have not been many reviews summarizing these efforts.

OBJECTIVES

To evaluate and compare reported teaching strategies for pharmacogenomics to pharmacy students in the United States and propose an effective curriculum design.

METHODS

We searched PubMed in June 2022 for publications related to pharmacogenomics education to pharmacy students in the United States over the past 10 years (2012-2022) and identified 30 publications. We then evaluated similar articles, references, and articles that cited these publications, and identified 15 additional publications. All 45 publications were evaluated and summarized.

"pharmacogenomics education" and pharmacy (2010-2022)	"pharmacogenetics education" and pharmacy (2012-2022)	Reference search
Murphy, 2010	Lee, 2012	Latif, 2005
McCullough, 2011	Nickola, 2014	Knoell, 2009
Kuo, 2011	Munson, 2015	Krynetskiy, 2009
Formea, 2013	Rao, 2015	Springer, 2011
Formea, 2015	Weitzel, 2016	Roederer, 2012
Lee, 2015	Remsberg, 2017	Vaksman, 2012
Adams, 2016	Galvez-Peralta, 2018	Kisor, 2013
Frick, 2016	Patel, 2018	Farrell, 2014
Weitzel, 2016	Rao, 2018	Calinski, 2016
Kisor, 2018	Haga, 2019	Surofchy, 2017
Marcinak, 2018	Powers, 2019	Frick, 2018
Quesnelle, 2018	Assem, 2021	Gammal, 2020
Coriolan, 2019	Calinski, 2021	Bailey, 2021
Shatnawi, 2019	Roosan, 2022	Burghardt, 2021
Hayashi, 2022		Grace, 2021
Lee, 2022		

Table 1. 45 publications related to pharmacogenomics education to pharmacy students in the United States over the past 10 years (2012-2022) were listed.

CONCLUSIONS

Based upon each teaching strategy's strengths and weaknesses, authors propose a longitudinal curriculum design, in which pharmacogenomics is offered to P1/P2 students using didactic teaching, to P3 students using simulation activities, and to P4 students through experiential experiences. A longitudinal curriculum design equips students to lead clinical pharmacogenomics in practice.

RESULTS

Didactic lecture	Personal genotyping	Simulation laboratory activity	IPE	Practice-based activity	Combinational design	Longitudinal design
Kuo, 2011	Kneoll, 2009	Patel, 2018	Formea, 2015	Rao, 2018	Remsberg, 2017	Vaksman, 2012
Springer, 2011	Krynetskiy, 2009	Powers, 2019	Calinski, 2016	Coriolan, 2019	Galvez-Peralta, 2018	Rao, 2015
Lee, 2012	Kisor, 2013		Kisor, 2018	Gammal, 2020	Assem, 2021	Weitzel, 2016
Formea, 2013	Adams, 2016		Quesnelle, 2018	Bailey, 2021	Hayashi, 2022	Lee, 2022
Farrell, 2014	Frick, 2016		Calinski, 2021		Roosan, 2022	
Nickola, 2014	Weitzel, 2016					
Lee, 2015	Surofchy, 2017					
Munson, 2015	Frick, 2018					
Marcinak, 2018	Burghardt, 2021					
	Grace, 2021					

Table 2. Educational strategies include didactic lecture, personal genotyping, simulation laboratory activity, IPE, practice-based activity, combinational, and longitudinal design.

Table 3	Strengths	Weaknesses
Didactic lecture	· Increases students' knowledge · Is a great tool delivering foundational knowledge	· Does not provide long-term retention of knowledge · Lacks practice application
Personal genotyping	· Increases students' knowledge · Prepares students for future practice · Increases students' understanding of patient's experience with genotyping	· Costly · Has legal and ethical concerns · May have limited educational outcomes suggested by a randomized controlled trial
Simulation laboratory activity	· Increases student's knowledge · Provides long-term retention of knowledge · Prepares students for future practice	• Could be costly when SPs are involved
IPE	· Improves students' understanding of pharmacogenomics · Prepares students for future practice · Potentially increase the understanding of different discipline's role in precision medicine	• Is logistically complicated to organize

Table 3. Strengths and weaknesses of individual teaching strategies

Table 3 (continued)	Strengths	Weaknesses
Practice-based activity	· Improves students' understanding of pharmacogenomics · Prepares students for future practice	· Requires students to have foundational knowledge · Needs relevant resources that are scarce in the nation
Combinational design	· Increases student's knowledge · Provides long-term retention of knowledge · Increase students' competency and confidence in pharmacogenomics	· Not enough to support clinical pharmacogenomics
Longitudinal design	· Increase knowledge and self-efficacy	· Not yet tested in SOP curriculum

Table 4	
Professional year 1 or 2	• Provides didactic courses to cover foundational knowledge • Provides lab activities to practice results interpretation • Offers personal genotyping if budge allows • Includes ethical and legal discussions
Professional year 3	• Offers simulation lab activities • Focuses on case analysis, therapy recommendation, and patient counseling • Includes SP or IPE if budget and resources available
Professional year 4	· Offers APPE rotations · Designs APPE rotation in different formats based upon resources

Table 4. Longitudinal curricula design for pharmacogenomics education

REFERENCES

See table 1.

CONFLICT OF INTEREST

The authors have nothing to disclose.