Creating a Trainee-Level Longitudinal Education Database: *Conceptual and Methodological Considerations*

Perri Morgan, PA-C, PhD
Brandi Leach, PhD

Duke Community & Family Medicine
Duke University School of Medicine

Objectives

- Discuss potential uses of a longitudinal educational database.
- Describe examples of education studies using longitudinal databases.
- Summarize a conceptual approach to creating education databases.
- Identify existing sources of information for inclusion into a database.
- Describe processes associated with development and maintenance of a longitudinal database.

Why longitudinal?

- Longitudinal analysis allows analysis of *changes* at both the *group* and the *student* levels.
  - As educators, we are interested in changes in our students/graduates over time.

- This is the example we give our students when explaining our Education Research Database (ERD):

Cross-sectional vs. longitudinal data: *An example*

Anne and Sue both respond to a survey about their attitudes toward working in surgery.

How likely are you to choose a career as a surgical PA? (1-10 scale with 1= very unlikely and 10=very likely		
Student	1st year response	Response at graduation
Anne	1	10
Sue	10	1

An example: Cross-sectional data

How likely are you to choose a career as a surgical PA? (1-10 scale with 1= very unlikely and 10=very likely		
Student	1st year response	Response at graduation
	1	10
	10	1
Mean student response	5.5	5.5

Conclusion: Student attitudes toward working in surgery do NOT change over the course of their PA education.

An example: Longitudinal data

How likely are you to choose a career as a surgical PA? (1-10 scale with 1= very unlikely and 10=very likely			Absolute value of change in student response
Student	1st year response	Response at graduation	
Y	1	10	9
X	10	1	9
			9 mean change

- Conclusion: Student attitudes about working in surgery change during their PA education.
- For the longitudinal analysis, we have to be able to link each student's first response to their later response.

Reasons we chose a student-level, longitudinal approach

- We want to avoid the potential fallacy of equating group changes with individual change.
- We will be able to limit some research to students/trainees with certain characteristics.
- We collect data at the individual level anyway—why not use them?

An essential question

- Will our student-level education database be used for program evaluation or for research, or both?

Research vs. Evaluation

Research

- Produces generalizable knowledge
- Uses scientific methods
- Requires human subjects review (IRB)

Evaluation

- Intent is to improve a *specific* program
- Findings are expected to directly impact a program and to identify potential improvements
- Geared toward program decision-making
- Sometimes does not require human subjects review (IRB)

Why might you want a longitudinal database for evaluation purposes?

- To help organize your data
- To use for program improvement
- To analyze issues specific to your students or your program
  - Ex: Does a specific admissions factor predict a specific problem in your program?
  - Ex: Does a specific educational intervention work better for a particular type of student in your program?
- You do not want to deal with human subjects review and informed consent (but we think this is a weak excuse!)

Why would you want a longitudinal database for research?

- To share your findings with other programs and the education community
- To help your faculty produce research
- To facilitate use of previously collected data into research on new questions
  - This might lead to shorter surveys and
  - This *might* reduce survey fatigue among your students
- You might be able to combine your program data with those of other institutions in the future

When does evaluation NOT require human subjects review?

- When the activity does not involve non-standard interventions
- The intent is to only provide information for and about the setting in which it is conducted
- The activity is part of standard operating procedures

Human subjects review: Our experience

- We have a separate protocol approved for creation of the database.
  - Each new survey that is added to the database requires IRB approval. So do alterations to existing surveys.
  - These are expedited, with 2-3-day turnaround.
- **Any research using the database will require individual protocols.**

Examples of education research using longitudinal databases

- Jefferson Medical School started a longitudinal database in 1970.
  - Over 150 articles have been published based on it.

- Papadakis MA, Teherani A, Banach MA, et al. Disciplinary action by medical boards and prior behavior in medical school. N Engl J Med. 2005;353:2673–2682.

- Tamblyn R, Abrahamowicz M, Dauphinee D, et al. Physician scores on a national clinical skills examination as predictors of complaints to medical regulatory authorities. JAMA. 2007;298:993–1001.

Our current project

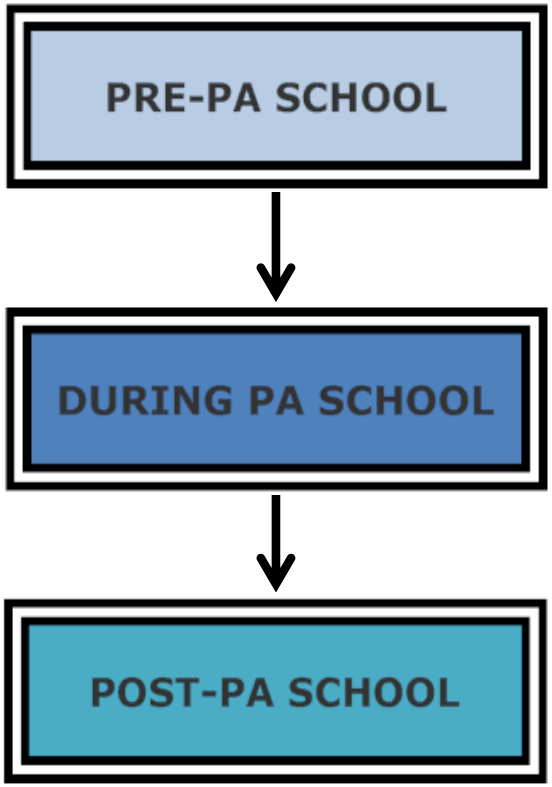
- The Education Research Database (ERD) is a permanent database that contains extensive longitudinal student-level data from the Duke PA Program (DPAP).

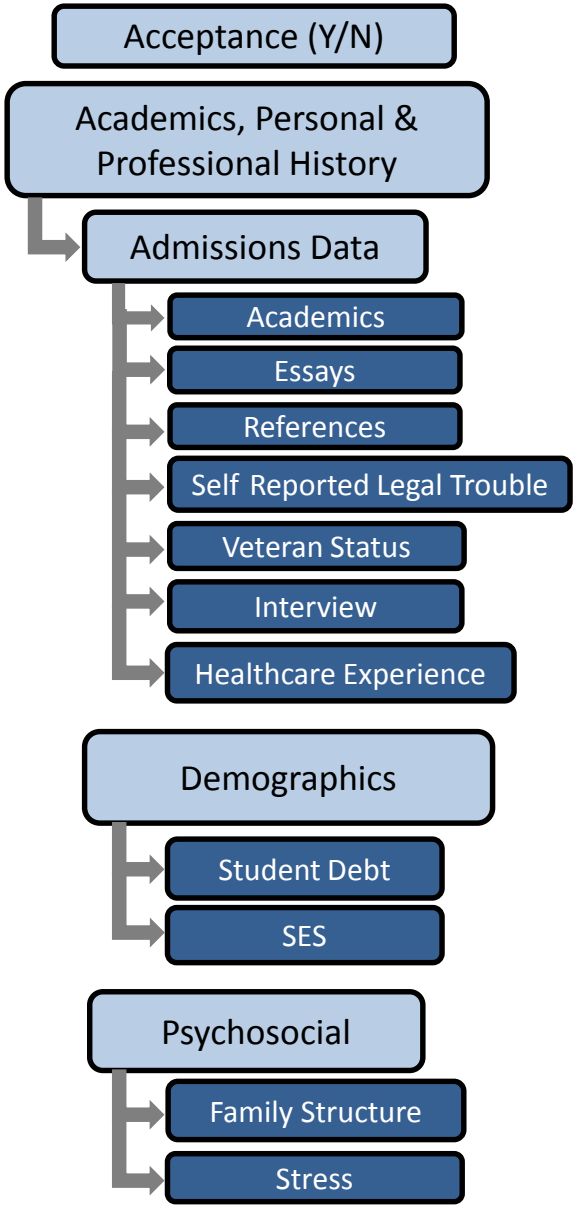
- Data collection starts with the admissions process and will continue throughout DPAP graduates' professional lives.

- Supports research on PA selection, training, and practice.

Duke PA Program
Education Research Database (ERD)

Conceptual Approach – Big Picture



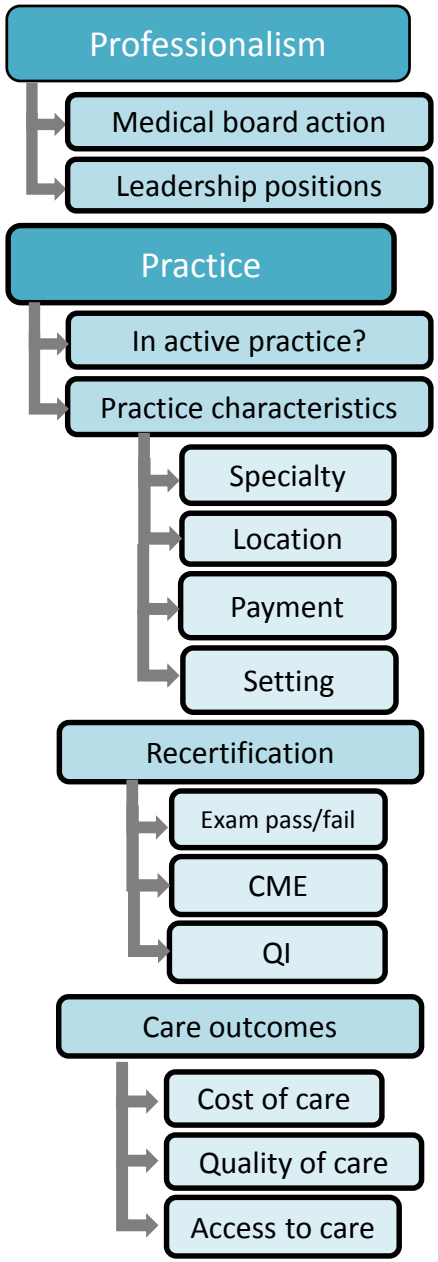


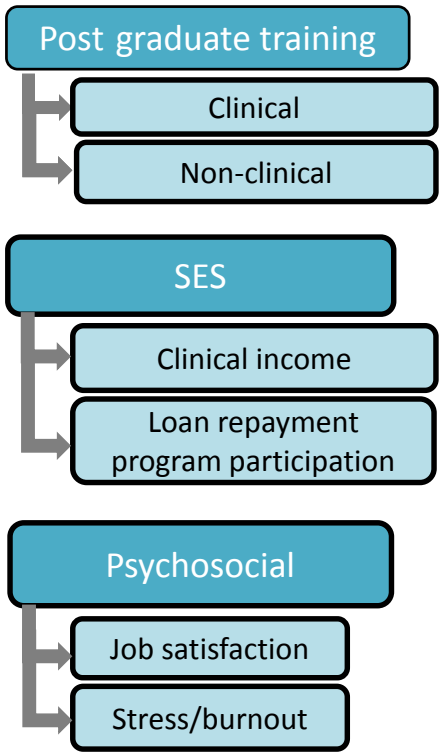
Pre-PA School Data Sources

- Admissions data
- New student survey

During PA School Data Sources

- Midpoint student survey
  - Repeats select items from new student survey
- Academic data during PA training
- PANCE (certification exam) pass/fail
- Graduation student survey





Post-PA School Data Sources

- New graduate survey
- Practice-related data
  - Claims data
  - State medical board sanctions data

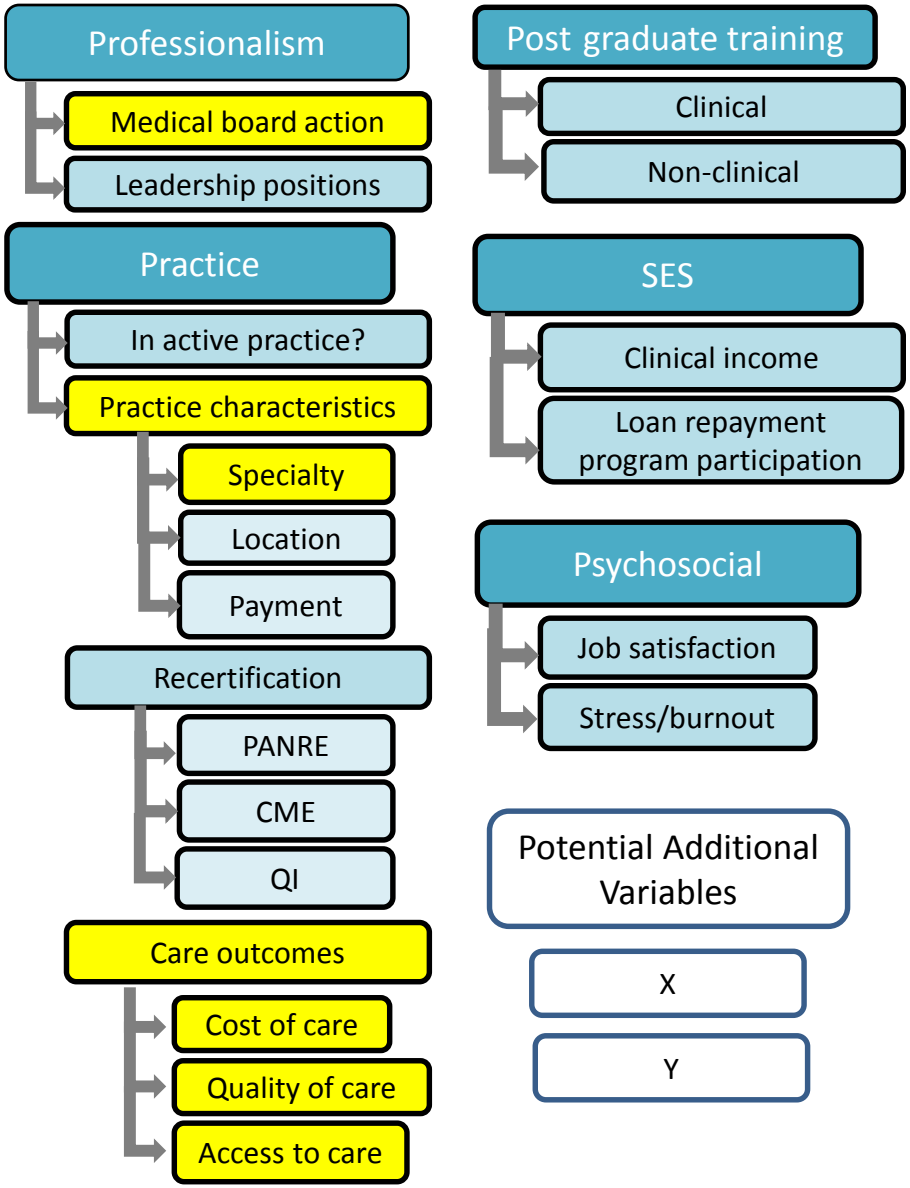
Examples of research questions with ERD

- What student characteristics predict admission into the Duke PA program?
  - Pre-PA School ⟹ PA School
- Which PA program experiences are associated with post-graduate leadership positions?
  - PA School ⟹ Post-PA School
- What PA program experiences are associated with the delivery of high-quality care?
  - PA School ⟹ Post-PA School

A PCTE longitudinal database?

- Additional post-graduation data collection could facilitate assessment of HRSA PCTE outcomes of interest including:
  - Rate of program graduates practicing in primary care or underserved areas at least 1 year after program completion
  - Type/amount of patient services provided by program graduates
  - Quality of care provided by program graduates
  - Care delivery by trainees and faculty at PCTE clinical training sites including the quality and cost of care, and patient service
- What additional variables would be required?
- What potential issues might arise?

ERD Data Points: Post-Graduation



HRSA PCTE Outcomes of Interest

Research Question	Data Source
Rate of program graduates practicing in primary care	Post-graduation survey that asks for practice specialty
Quality of care provided by program graduates	Use provider ID to link to claims data and regulatory board actions.
Patient services provided by program graduates	Use provider ID to link to claims data: types of services provided (e.g., do primary care physicians deliver babies?), productivity numbers (# visits per year, etc).

- Let’s take a break for questions and discussion

- But hold your questions about nuts and bolts, because we will discuss them next.

Nuts and bolts

Data that are NOT included

- Data not included because anonymity is necessary
  - Student evaluations of courses
  - Other student evaluations of the program (exit survey, etc.)

- Data not included because we consider them mandatory for every student
  - Data required for reporting to HRSA for grant applications and progress reports (data for determining # of disadvantaged students, etc.)

Practical issues

- Student participation
- Obtaining informed consent
- Privacy protection
- Choosing software
- Maintenance of database
- Linking data

Student participation and retention in longitudinal research

While students are in your program

- Program leadership emphasizes the contribution that students can make to knowledge about the profession by participating
  - Reiterate importance of student contributions before each new survey
- Provide incentives, such as snacks

After students leave your program

- Identify a student to act as a "champion" for your research database after graduation
- Offer incentives for survey completion
- Share results of any research using the database with students

Informed consent

- We give a 10-minute presentation to new students about the database and distribute the consent forms electronically.
- The next day, in the classroom, staff distributes paper consent forms and collects them. Faculty are not present.
- In order to obtain application data for all applicants (including those not admitted), we added a one-paragraph consent statement to our supplemental application.

Privacy protection

- Faculty does not know which students consented to participate.
- Staff assign a database identifier to each student and keep the code with student names under lock and key.
- Faculty who wish to use the database will be issued limited datasets by staff that include only the variables required for their project.
- Even without student names, faculty could identify many students using other variables. However, this would be a breach of research ethics and would violate institutional and/or federal guidelines.

Secure storage

- Data on a protected server
- Access to identifiable data limited
  - For example, researchers are only given access to variables necessary for their project
- De-identified datasets are created for individual research projects

Choosing software

- Institutional resources
  - Any existing programs available through institution (e.g., REDCap)?
  - Support readily available?
- Interface preferences – overall usability, security issues
  - Desktop-based (e.g., Microsoft Access, FileMaker Pro)
  - Server-based (e.g., MySQL)
  - Web-based (e.g., REDCap, Medrio)
- Import/export file type options (e.g., SAS, Stata, SPSS, Excel, others)
- Cost

Database software options

Software	Website	Where is database located?	Data export options	Cost
Microsoft Access	http://office.microsoft.com/en-us/access/	On user's computer	Excel, txt, Word, XML	Office 365—individual license $70
REDCap	http://www.project-redcap.org/	On Internet; need user rights to access	Excel, PDF, SPSS, SAS, Stata, R	Institutional partnership required; no cost
Medrio	http://medrio.com/	On Internet; need user rights to access	Excel, SAS, SPSS, STATA	Free for investigator-initiated trials; $1200/year once you hit 100k data points
StudyTrax	http://www.sciencetrax.com/studytrax/	Hosted on own server or ScienceTrax secure servers	Excel, CSV, SAS, SPSS, Word	$99 student license
OpenClinica	https://www.openclinica.com/	On user's computer (after free download)	HTML, tab-delimited, Excel, SPSS	Open source; no cost
QuesGen	http://www.quesgen.com/	On Internet; need user rights to access	Stats packages and Excel	Pay as you use, with per-user, per-month charge as set-up fee

Linking data

- Format matters
- IRB issues
- Data use agreements
- Data cleaning

The future

One big database for all of our programs?

References

- Ander-Peciva, S. (2005). Construction of longitudinal databases – for flexibility, transparency and longevity. International Commission for Historical Demography. Sydney, Australia.
- Chen, H. (2013). "Designing Education Lab: Evaluation vs. Research – What's the Difference?" Retrieved September 20, 2014, from http://web.stanford.edu/group/design_education/wikiupload/2/27/Helen_Evaluation.pdf
- Cook, D. A., D. A. Andriole, S. J. Durning, N. K. Roberts and M. M. Triola (2010). "Longitudinal research databases in medical education: facilitating the study of educational outcomes over time and across institutions." Acad Med **85**(8): 1340-1346.
- Ellaway, R. H., M. V. Pusic, R. M. Galbraith and T. Cameron (2014). "Developing the role of big data and analytics in health professional education." Med Teach **36**(3): 216-222.
- Gonella, J., M. Hojat and J. Veloski (2005). "Abstracts: Jefferson Longitudinal Study of Medical Education, 3rd edition [full volume]." Jefferson Longitudinal Study of Medical Education **Paper 1**.
- Papadakis, M. A., A. Teherani, M. A. Banach, T. R. Knettler, S. L. Rattner, D. T. Stern, J. J. Veloski and C. S. Hodgson (2005). "Disciplinary action by medical boards and prior behavior in medical school." N Engl J Med **353**(25): 2673-2682.
- Tamblyn, R., M. Abrahamowicz, D. Dauphinee, E. Wenghofer, A. Jacques, D. Klass, S. Smee, D. Blackmore, N. Winslade, N. Girard, R. Du Berger, I. Bartman, D. L. Buckeridge and J. A. Hanley (2007). "Physician scores on a national clinical skills examination as predictors of complaints to medical regulatory authorities." JAMA **298**(9): 993-1001.
- Triola, M. M. and M. V. Pusic (2012). "The education data warehouse: a transformative tool for health education research." J Grad Med Educ **4**(1): 113-115.