



# INTERSECTIONS

THE EDUCATION JOURNAL OF THE  
WOODRUFF HEALTH SCIENCES CENTER

## Integrating Clinical and Research Training: Reconfiguring the MD/PhD Dual Degree Curriculum

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DOI: 10.59450/UPTO9363

Date Published: 10/16/2024

**TAKE HOME POINT** – The sequence of training in dual degree programs may be important in helping students perceive connections between fields of study and may lead to a more integrated professional identity.

### ABSTRACT

MD/PhD dual degree programs are one of the primary mechanisms of training physician scientists in the United States. In the traditional MD/PhD training model, students are immersed in one aspect of clinical or research training at a time; however, successful physician-scientists must learn to combine their clinical and research interests into a single professional identity. Failing to form an integrated physician-scientist identity may contribute to attrition from the workforce. This manuscript provides a description of the process that was used at Emory University School of Medicine to create a more integrated training model in which each training phase influences the other. In this model, MD/PhD students undertake the core clinical rotations prior to graduate school and then continue clinical work during their research years. Preliminary data suggest that students have a more

integrated view of research and medicine than they had prior to their clinical training. A qualitative study is underway to further explore how MD/PhD students at Emory University perceive the integration of clinical and research training and whether students consider themselves to have a unified “physician-scientist” identity.

Physician-scientist training pathways aim to create a robust workforce of clinician-scientists who bridge clinical medicine and research. MD/PhD dual degree programs were created in the 1960s to train physicians and researchers to integrate basic science research and clinical applications and are one of the primary mechanisms for training physician scientists in the United States (Harding, Akabas, & Andersen, 2017). Students in these programs typically complete 1-2 years of pre-clinical

classwork in medical school, followed by 3-5 years of graduate studies. After graduate school, students return to medical school to complete clinical training (Brass et al., 2010).

In this "2-4-2" training model, students are immersed in one siloed aspect of training at a time (Goldberg & Insel, 2013). Physician-scientists' work in one domain usually informs work in the other (coined the "discovery-invention" model for research in engineering), so lack of significant clinical exposure prior to research training may limit students' ability to utilize both perspectives (Narayanamurti & Odumosu, 2016; G. P. Sarma, Levey, & Faundez, 2019). Successful physician-scientists may benefit from forming professional identities that combine clinician and researcher into a single unique identity, as cultures and even approaches to problem solving can be very different between the research and clinical environments (Chakraverty, Jeffe, & Tai, 2018; Rosenblum, Kluijtmans, & Ten Cate, 2016). Students in siloed training programs may not experience the unique approach to problem solving that informs the professional identity of a physician-scientist; failing to form such a unique identity may contribute to attrition from the workforce (Chakraverty et al.; Ng et al., 2019; Rosenblum et al., 2016).

Prior to 2019, Emory's MD/PhD program followed the traditional 2-4-2 model of

training. As with many other programs, there was little clinical exposure prior to graduate school. Most students did not opt to have meaningful clinical experiences during their graduate training and frequently chose residency training in fields very different from their initial area of research. At the same time, the Emory medical school curricular components became more interdependent over time, with curricular threads weaving from the first year of medical school into the third year. Students returning to the third year of medical training after graduate school experienced disruption in these aspects of their training.

To address these challenges as well as create opportunities for training phases to influence each other (and facilitate the students developing a unique professional identity), the MD/PhD program leadership made the decision to move a portion of clinical training such that it occurs prior to research training. While some programs have students do a partial block of third-year rotations, we discarded this idea. It would have been very challenging to schedule in our curricular timeline, would not fully incorporate longitudinal aspects of the medical school curriculum, and would not allow students exposure to the full variety

of third year clerkships. Instead, we felt that allowing students to complete their entire third year of medical school prior to

entering graduate school, as suggested by Sarma et al., would lead to a more richly integrated research experience,

Table 1: Concerns raised by MD/PhD program stakeholders about placing the third year of medical school prior to graduate school.

<i>Concern</i>	<i>Solutions/Mitigations</i>
Students will be tempted to leave the program after the third year of medical school.	Other programs did not report this experience. We believe that if students choose to leave after the M3 year, then our selection process is likely not optimal, and that individual would be less likely to remain in the workforce over time.
Students will choose clinical research over basic science research.	This was not observed by other programs. We plan to measure this outcome in future studies.
Graduate program directors/PhD advisors will not allow clinical activity.	Acceptance of MD/PhD students into a lab is contingent on them having some clinical activity.
Students will not have retained enough clinical competency prior to high-stakes fourth-year rotations.	This was not observed by other programs. Other programs have, however, observed that engaging in clinical activity prior to graduate school makes it easier to transition back to medical training.  We have a clear requirement for students and follow up with students to ensure this is happening. Some flexibility has been required.
Students will not be able to get enough high-quality letters of recommendation for their residency applications.	One letter should come from clinical advisor. Students should re-enter their M4 year early enough to get additional letters, and have more intensive clinical activity prior to their rotations so that they are strong candidates.
The time spent in medical school will be lengthened, as the fourth year of medical school only has 6 months of clerkships, but a large proportion will need to be taken prior to submitting residency applications in the Fall of their graduation year.	Unavoidable but hope to take advantage of the additional time through allowing more clinical electives and/or other research experiences.

allow continuity of the clinical curriculum, and permit students to begin to make residency decisions prior to their PhD training (G. P. Sarma et al., 2019).

To identify challenges to proposed curricular changes, we met with stakeholders at Emory University, including medical school faculty and leaders, Society advisors (sixteen clinician-educators in the School of Medicine who work with small groups of students longitudinally throughout the medical school curriculum), graduate program directors, and MD/PhD students. While all agreed on the potential benefits of a continuous 3-year (“M1 – M3”) curriculum prior to graduate training, the stakeholders raised several concerns (Table 1).

Through website searches as well as posting to the Association of American Medical Colleges (AAMC) Graduate Research and Education Training (GREAT) Group listserv, we identified 18 other MD/PhD programs in the United States that incorporated a block of clinical training prior to graduate school. We were able to obtain further information about 16 of the programs through the programs’ websites and direct communication with program directors. Eight programs only scheduled 1-2 rotations prior to graduate school. One program had only recently switched their curriculum and had not had an opportunity to evaluate the change.

Three programs allowed students to do 3-6 months of clinical rotations prior to graduate school, but not a full year. We identified only four programs that required students to have the full equivalent of core clinical training prior to graduate school. We were able to directly connect with three of these program directors through phone calls to obtain more detailed information. Program leaders at these MD/PhD programs stated that there was no observable difference in the students who pursued basic science research, and the number of students who dropped out of the program after clinical rotations prior to graduate school was minimal to none (personal communication, C Kontos, Duke University Medical Scientist Training Program (MSTP), C Williams and L Estrada, Vanderbilt MSTP, J Leibowitz, Texas A&M MD/PhD, Aug 2018) . They did not observe students having difficulties matching into residency programs, although they acknowledged that the students needed to be intentional in seeking out letter writers for residency program applications.

Using the input from Emory stakeholders and other MD/PhD programs, we reconstructed the curriculum in 2019 so that MD/PhD students now proceed continuously from pre-clinical training through core clinical clerkships. After completing the core clinical clerkships and taking the USMLE Step 2 exam, they

begin lab rotations and graduate school coursework. The students are required to select one or more clinical advisors in their field(s) of choice as their clinical advisor whose role is to ensure that students maintain competency in their chosen field, as well as to potentially serve as a letter writer for residency program applications. The students spend regular clinical time with their advisors during their graduate school training, seeing patients and acting as “sub-interns.” We initially recommended that the students spend an average of a half-day per month with their clinical advisor, although we have modified that recommendation over time to allow for flexibility of clinical experiences. After completing their PhD, the students return to medical school to finish their advanced clinical rotations. Each student constructs an elective rotation that serves as a time to refresh any necessary skills prior to taking any rotations that factor into residency program applications.

In 2019, we offered the new curricular timeline as an option to MD/PhD students who were then in their second year of medical school. All students that year elected to follow the new timeline. Subsequent years were required to follow the new curricular timeline. The first cohort completed their year of core clerkship clinical training and entered graduate school in 2020. No students

have yet completed their PhD and returned to the final year of medical school.

One year after implementation, we sent an electronic survey to the first class of students following the new schedule. The questions were open-ended. Six of the seven students responded and commented that they felt that they had a better clinical experience than their concurrent M3 MD/PhD colleagues who returned to clinical training following graduate training; they felt they understood the medical culture better, had an easier time taking exams, and were more connected to their classmates. Students stated they had early exposure to physician-scientists in their fields of interest, and two students changed their research interests as a result of their clinical training. All students felt they had a more integrated view of research and medicine (including the impact of basic science) than they had prior to their clinical year. However, five of the six students expressed some difficulty with the transition into graduate school, with less time during their clinical rotations to explore programs and meet potential advisors than MD/PhD students who transitioned into graduate school from the second year of medical school when there was more flexibility in their schedules to do so.

The first cohort is now in their fourth year of graduate school, with one student

anticipating a return to the last year of medical school in the coming fall. All students have maintained a level of clinical activity, although not as intense as initially envisioned. Most students have experienced disruptions in their clinical activity at some point during their graduate school, but found they were easily able to start back up again.

Students present their work annually at a program-wide conference; all students have made substantive and relevant clinical tie-ins to their projects in their presentations. Not all students continued with their original clinical interests, but all continued with clinical activity in their new fields. Some students have incorporated their clinical advisor into their thesis committee, and some have done research projects with their clinical advisors. The program does not track "basic science research" as a category, but we have not seen a reduction in students interested in labs performing basic science research. We have observed students enrolling in graduate programs that were previously unrepresented in the MD/PhD program, such as environmental health. No students have failed to continue into graduate school after their M3 year.

We have learned several lessons from the roll out. The first lesson is that greater attention is required for the M3 to Graduate school transition than for the M2 to graduate school transition. In the

previous curricular model, students had time in the M2 year to explore graduate school options, while the clinical schedule has made that challenging. In addition, there is an MD/PhD journal club in the second year of medical school that likely played a larger role in supporting the previous M2 to graduate school transition than we realized, possibly through informal discussions. Several students have been unable to start their clinical activity in their first year of graduate work due to graduate program class requirements; however, we have found that the initial timing of starting clinical activity during graduate school does not seem to impact ultimate clinical advisor selection or self-stated comfort in the clinical setting. We have found that it is important to continue to follow up with students regarding their clinical progress, as often students feel embarrassed to reach back out to their advisors after a lapse in clinical activity and need encouragement to do so.

Previous studies have suggested that traditional definitions of physician scientist success, such as publications and grants, may fail to fully capture deeper nuances of MD/PhD training (G. Sarma, Levey, & Faundez, 2020; G. P. Sarma et al., 2019). While it is still too soon to fully describe the impact of this curricular switch on residency choices and careers, we are currently exploring through qualitative methods how MD/PhD



students at Emory University perceive the integration of clinical and research training and whether students consider themselves to have an integrated “physician–scientist” identity. We are comparing differences in perception between students going through the new curriculum with perceptions of students and alumni who have trained under the older curriculum. Other future outcomes we will measure are success in residency matches, how much clinical time is necessary to maintain integration, and in the long term, whether there is improved workforce retention.

In conclusion, incorporating input from stakeholders and early adopters in other MD/PhD programs allowed us to successfully place the first year of clinical training before research training for MD/PhD students. Early results suggest

that the new training model improves the connection of the clinical and research environments and may encourage the “discovery–invention” cycle experienced by physician–scientists. The qualitative study underway will determine whether (and how) students feel the training phases influence each other and whether they are developing a unique identity as a physician–scientist. We believe that we will be able to demonstrate that exposing MD/PhD students to basic clinical training before they engage in research will help students form early connections between medicine and research and facilitate creation of an integrated physician–scientist identity. Future studies at other institutions will also be necessary to determine whether this should be the preferred way of training MD/PhD students.



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## ACKNOWLEDGMENTS

The author would like to acknowledge the other directors of the Emory MD/PhD program, who supported the curricular transformation: Drs. Robert Gross, Anita Corbett, Ann Chahroudi, and Cathy Quiñones. The author would also like to acknowledge Mary Ann Hall for her editorial assistance. This work is partially supported by a mini grant from the Woodruff Health Sciences Center and the Woodruff Health Educators Academy. The author declares that she received no payment or services from any third party to support this work.

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