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CTSI 500 Stars Initiative (CTSI of SE-Wisconsin)

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OBJECTIVES/SPECIFIC AIMS: Our Goal is to enroll 500 students over 10 years into the CTSI 500 Stars Initiative. Student family members and community members are essential to career achievement and success; as such, the program also engages student families, along with key community members, as part of an Advisory Group, throughout the entire student experience. Besides programmatic and planning activities, students, family, and community members participate in our CTSI Community Engagement Science Café monthly series, where students may also present on a number of research and health-related topics of interest. The Advisory Group meets every 3–4 months in ensuring continuous engagement and overall program success. METHODS/STUDY POPULATION: Our Initiative takes both direct and supportive roles in offering 2 educational and training pathways; namely, our Summer Internship Program (6–8 wk duration) and our Students Modeling a Research Topic (SMART) Year-round Education Program (usually offered in Fall and Spring academic semesters) for high school students only. In the SMART Teams program, we work with regional public and private school districts to train science teachers, and assist them in developing and/or enhancing their science curriculum, thus creating pathways towards careers in translational science settings. Our aim is that students who participate in the year-round program (along with additional students) subsequently participate in our summer program. Therefore, overall program engagement is continuous throughout the year. In Summer, 2017 we engaged with well-established regional partners and collaborators (CTSI affiliated numerous public school districts, and community-based organizations) to move the translational workforce along existing regional diversity education and training pipelines. A Kick-off event was held on June 15, 2107 and attended by students and family members. We offered 6–8 weeks of hands-on experiences working with faculty researcher mentors and their research teams conducting real-life studies, in addition to professional experiences in research "support" settings, as well as in the community. We also developed established a "Summer" SMART (Students Modeling a Research Topic) Teams Program and a Summer "Advanced" SMART Teams Program, where a number of students were placed at 2 CTSI partner and collaborator institutions. The primary goal of the SMART Teams experience is to introduce students to translational science by building upon laboratory research to better understand clinical and community impact of disease within a patient population. Overall, internship sites included research labs, protein modeling labs, numerous research support settings, clinical care settings, and community sites for those students who were interested in population health sciences. In addition, students were offered career enrichment and professional development lunch and learn sessions, career panel sessions presented by long term, expert professionals in various fields translational science, and confidence building and networking sessions. Students also participated in a community volunteer day activity, a trip to the Chicago Science Museum, and numerous CTSI engagement activities (Science Cafés, simulation lab tours, etc.). RESULTS/ANTICIPATED RESULTS: The 2018 year-round program will initiate in the Fall. Our 2017 Summer Internship Program received 192 students/trainees applications of whom 133 were underrepresented minorities (URMs). We enrolled 109 participants, including 83 URMs (84 high school students and 25 college students). A total of 53 Wisconsin high schools and 19 colleges and universities (local and out of state) participated. Students engaged in all activities as outlined in the Methods section. At the end of the summer program, students created and presented posters as part of the closing ceremony. Certificates of completion were given to the students by program leadership and the Al Hurvis/ADAMM leadership (program funding agency). Students wore white lab coats to create an atmosphere of cohesion and accomplishment. Parents and other family members attended the closing ceremony, demonstrating strong support for students and the program. Our anticipated results for CTSI 500 Stars Initiative is to increase diversity in the Translational Science Workforce via education and training of 500 high school and college students over 10 years. We will also remain engaged and track student's various venues for at least 10 years to determine the outcome of their experiences towards careers in Translational Science settings. We will continue to engage community members and community-based organizations as collaborators and advisors to participate in every stage of our activities. Moreover, we plan to broaden our reach by establishing additional relationships with additional high schools and middle schools to further enhance the 500 Stars Initiative. In addition, we will develop metrics by which to measure the validity and success of our program. DISCUSSION/SIGNIFICANCE OF IMPACT: The aim of the CTSI 500 Stars Initiative is to provide real-life, practical experiences in translational science settings as a part of our efforts to train and cultivate the translational science workforce, while also engaging patients, families and community members in every phase of the translational process. Targeting under-represented minority students contributes towards increasing diversity in the workforce. It is also our hope that by increasing URMs in the workforce, there will be positive impact on communities of color, with respect to increasing participation in their health care decision making and in clinical/translational research; thus, ultimately leading to better health outcomes in the communities we live and serve. Our overall framework is to engage, educate, enrich, empower, elevate, enable students towards careers in clinical and translational settings.

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Cure Quest: Teaching the complexities of drug discovery and development through an adventure game

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OBJECTIVES/SPECIFIC AIMS: "Cure Quest" is an adventure quest game for mobile tablets that aims to teach the player about the complexities of discovery and development of new medicines. The game instills a sense of wonderment into the learning process, taking the player to a world of magic where a mysterious condition has affected the land and they must follow the steps of the discovery and development process to find a treatment. METHODS/STUDY POPULATION: The game is being developed through a collaboration between faculty and students at ISMMS and the Games and Simulation Arts and Science Program at Rensselaer Polytechnic Institute. The first target audience is 2nd–3rd year medical students, with the future goal of adapting the game to a broader population. RESULTS/ANTICIPATED RESULTS: The game is currently in development, but the project has yielded insight into the design process for serious games in medicine. We found that for a game of this type it is essential not just to have both designers and subject matter experts, but to enable cross-pollination of modes of thinking. Through multiple design iterations and focus groups, we found that a game design approach rooted in narrative and allegorical abstraction would have a better ability to engage the target audience than one focused only on realistic simulation. When complete, we anticipate that the game will improve understanding of the core concepts in drug discovery. DISCUSSION/SIGNIFICANCE OF IMPACT: If successful, the game-based learning approach can help fill key gaps in current formal medical and scientific training, as well as gaps in understanding among the general public. The design process serves as an informative model of evolving collaborative team science.

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Developing the future translational science workforce at the University of Iowa

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OBJECTIVES/SPECIFIC AIMS: To evaluate the extent to which the curriculum delivered via an innovative program, the Early Scholars Certificate in Clinical and Translational Science (CCTS) at the University of Iowa (UI), develops a translational science workforce pipeline by increasing awareness of and interest in translational science as a career goal for highly prepared undergraduates. METHODS/STUDY POPULATION: The CCTS's objective is to increase the awareness of the philosophy and tools of translational science and to incorporate critical evaluation and self-appraisal of the translational aspects of a scholar's own research. CCTS is a 16-semester-hour (sh) academic certificate program introducing translational science concepts and careers to undergraduate students. The CCTS is a selective program with requirements including a minimum GPA, minimum sh completed, completion of course prerequisites, and already engaged and supported by mentored research. The curriculum includes electives in the area of their research interests (6 sh); graduate level Epidemiology (3 sh); Biostatistics (3 sh); and 2 core Translational Research courses (4 sh total). The first core course, an Introduction to Translational Research, is a survey course providing students the opportunity to learn how translational research is conceived and developed. It is designed to instruct the student how to interpret their research in a translational T1 to T4 paradigm. The program's capstone course, Practicum in Translational Research, provides undergraduate students the opportunity to address how their research experience translates into clinical practice. Student's spend the majority of this course's contact hours in a shadowing experience with a clinician in the area of their research. Students reflect on this shadowing experience and its relevance to their academic and professional goals. The students also spend time developing skills in peer review—not only learning to

provide constructive feedback to other research professionals, but also how to receive and integrate the feedback. The course includes a mock research fair where both UI faculty and classmates provide feedback that is later integrated into their capstone projects—a poster presentation at the UI Carver College of Medicine Research Fair as well as a final translational paper. As part of the ongoing evaluation of the program and graduates, we examined the participant data, the course satisfaction with content, the change in understanding of translational science, and the intention to incorporate translational science into research and career goals. We also conducted course evaluation surveys and qualitative analysis of a focus group and interviews. RESULTS/ANTICIPATED RESULTS: Since 2015, the CCTS program has introduced translational science curriculum to 20 undergraduate participants (men/woman 40%/60%; 5% Hispanic or Latino; 15% Center for Diversity and Enrichment Eligible). Areas of academic interest include: biology, genetics, engineering, bioinformatics, biochemistry, neuroscience, psychology, and microbiology. Graduates of the Certificate and degree program to date (n = 8) have gone onto: Fullbright awards (1), medical school/Masters in public health (1), combined MD/PhD programs (2), biomedical PhD program (1), or currently work in translational science positions in industry (2). In questionnaire and focus group results, we found that in general, students reported increased understanding of the translational spectrum and felt the certificate program helped them clarify their educational or career goals. Data from both the focus group and the questionnaire demonstrate that students are strongly positive about the program in general, including its quality, faculty and guest speakers, structure, goals, opportunities, personality, and personnel. All students highly valued many elements of the program and each course, and particularly the opportunity for clinical shadowing. Among the questionnaire findings for 2016–17, all students (100%) rated program quality "excellent," and 7 of 8 (87.5%) "strongly agreed" that they better understood translational science, that they saw themselves continuing in translational science research after graduation, and they were better able to communicate how their lab research fits within the translational spectrum. In each case 1 of 8 "agreed." Participants also generally felt that their career goals had been affirmed or realigned, and that they were better able to communicate the meaning of translational science to multiple audiences. Responses on changes to career aspirations and plans were mixed, and are ambiguous. Questionnaire Item 4, "My UI curricular and/or co-curricular plans changed as a result of the CCTS program," which had mixed responses, asked specifically about the CCTS program as a reason for change, but it is not clear if, whether, or how the program specifically wants to change curricular plans. In the focus group, students reported using their individual shadowing and lab experience in determining preferences and intentions about future career choices (e.g., whether or not to apply to medical school and/or pursue basic science research). Participants perceived the shadowing experience, complementing or contrasting their lab research, as particularly relevant in deciding about their future careers. Other themes that emerged from the focus group and/or open section of the questionnaire demonstrate the impact of various course elements on participants' understanding of translational science and potential careers, including: quality of instruction, program and course content (including guest speakers, the shadowing experience, and the poster development process); the exposure to a range of possibilities along the translational spectrum and the expansion of ideas about what research could look like; the value of connections (to faculty, researchers and clinicians, and other CCTS students and alumni); the attributes of the cohort; and the "personality" of the program and personnel. DISCUSSION/SIGNIFICANCE OF IMPACT: Developing a pipeline for translational science workforce development has been problematic because a lack of the understanding of the need of translational research and a structuring a time efficient program for early career clinical and basic scholars. Undergraduates making critical decisions about educational paths and career goals and plans may not be aware of opportunities in translational science or the type of choices they need to make to prepare for such opportunities. Our data demonstrates that CCTS was an effective way of introducing translational science concepts and career paths to undergraduate students and potentially a powerful way to encourage them to consider these career paths. Participants in our program improved their knowledge of the field and expressed interest and intention to incorporate translational science training into their career plans. However, improvements can be made in the CCTS program. Additionally, CTSAs should consider ways to incorporate findings like these into a wider sphere of training to help develop and strengthen a translational science workforce for the future. The exposure to a variety of translational science career possibilities and specialties was important to students. Based on both focus group discussion and questionnaire data, a few students did expand slightly their sense of career possibilities, but the larger benefit may be their concrete experiences that validate or solidify their interests, making them more skilled at talking about and supporting their career goals on applications and in interviews. Shadowing did not always encourage students to go into clinical medicine, but often solidified interests or leanings students already had, giving them a more grounded basis for refining their decisions. For some students, shadowing a clinician confirmed ideas of being a physician; for others, it steered them away from it. Some now found ethical challenges, bureaucracy, or emotional challenges daunting or newly necessary to consider before focusing on clinical careers. This may be just what students need at this point, and emphasizes for them the relation between different kinds of research and application within translational science. Our evaluation suggests that CCTS contributes to academic choices for career development and additionally can help attract highly skilled students into TS research, including students of color. Future work to evaluate CCTS impact on graduates' career outcomes will inform the translational research direction and content. In terms of program design, it could be useful to build in multiple opportunities for students to understand the diversity of translational science careers and provide students more exposure to different possibilities in clinical and translational work.

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Development of toolkits to support for researchers integrating dissemination and implementation science into their translational research

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OBJECTIVES/SPECIFIC AIMS: To use a systematic and iterative process to develop and refine toolkits to support dissemination and implementation (D&I) research. METHODS/STUDY POPULATION: Participants included research staff from the Dissemination and Implementation Research Core (DIRC), a research methods core from the Institute of Clinical and Translational Science at Washington University in St. Louis, other D&I experts from the University, and national experts from the D&I field. This project used education design research methodology and a systematic and iterative process involving several phases. The first phase (preliminary research and initial development) consisted of analysis of the educational problem and its context, and led to the development of toolkit prototypes and plans for their implementation. In the second phase (development and formative evaluation), toolkits were iteratively evaluated with emphasis on content validity and consistency and effectiveness as perceived by the users. Finally, in the summative evaluation, the toolkits were evaluated based on their use as intended. RESULTS/ANTICIPATED RESULTS: Our team identified the target audience as DIRC customers and investigators from disciplines across the University, and found that resources for beginners to D&I were lacking. The team developed 8 toolkits: (1) Introduction to D&I; (2) How to develop D&I Aims; (3) D&I Designs; (4) Implementation Outcomes; (5) Implementation Organizational Measures; (6) Assessing Barriers and Facilitators; (7) D&I Designs; and (8) Guideline research. These prototypes were iteratively revised for content validity and consistency. Finally, each toolkit was evaluated by two national experts in D&I science, and further refined. DISCUSSION/SIGNIFICANCE OF IMPACT: This systematic and cyclical process led to the development of 8 toolkits to support researchers in D&I science, which are now available on the DIRC Web site. This set the stage for development of new toolkits as additional needs are identified.

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Drug formulation strategies: A vital but nearly invisible component in translational education

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OBJECTIVES/SPECIFIC AIMS: To develop a KL2 curriculum on the science and art of drug formulation. METHODS/STUDY POPULATION: Develop training materials for KL2 scholars that outline the art of formulation development. Materials will include syllabi, reading materials, and course work. RESULTS/ANTICIPATED RESULTS: This will enhance the training of KL2 scholars by incorporating formulation development concepts into their human health enhancing research projects. DISCUSSION/SIGNIFICANCE OF IMPACT: For new chemical entities, formulation goals must be realistic and move along in a step-wise manner from the laboratory bench, through toxicology studies, and on to Phase 1 studies. By training scholars in phase-specific formulation goals, their interactions with funding agencies, formulation scientists, and regulators will be more efficient, productive, and successful. For those scholars who are working to improve existing treatments, introducing the concept of formulation improvements that can create new indications, or improve efficacy, safety and patient compliance will open up more possibilities for creative product development.