



April 12, 2021

Dr. Michael Baumgartner
Executive Director
Coordinating Commission for
Postsecondary Education
140 N. 8th Street, Suite 300
Lincoln, NE 68509

Dear Michael:

Enclosed is a copy of the proposal to create a Master of Science in Biostatistics to be administered by Graduate Studies and the Department of Biostatistics in the College of Public Health at UNMC. The proposal was approved by the Board of Regents at the April 9, 2021 meeting. Also enclosed is the Proposal for New Instructional Program Form 92-40.

Please do not hesitate to contact me if you have any questions.

Sincerely,

A handwritten signature in blue ink that reads "Susan M. Fritz".

Susan M. Fritz, PhD
Executive Vice President and Provost

Enclosures

c: Chancellor Jeffrey Gold
Senior Vice Chancellor Dele Davies
Dean Ali Khan, College of Public Health
Vice Provost David Jackson

**COORDINATING COMMISSION
FOR POSTSECONDARY EDUCATION**

140 N. 8th Street, Suite 300
Lincoln, NE 68508

Telephone: (402) 471-2847
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PROPOSAL FOR NEW INSTRUCTIONAL PROGRAM
Form 92-40

SECTION I

Institution Submitting Proposal: University of Nebraska Medical Center

Title of Program: Biostatistics

CIP Code: 26.1102

Organizational Unit in which program will be located:

Department of Biostatistics
College of Public Health

Name of contact person in the event additional information is needed: Dr. Susan M. Fritz

Telephone: 402-472-5242

Degree, Diploma, or Certificate to be offered (use separate submittal for each level):

Master of Science in Biostatistics

Proposed date to initiate program: When approved by the Coordinating Commission

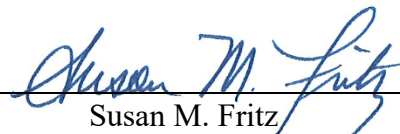
List the location(s) where this program will be offered: UNMC

If the program has a projected ending date, please so indicate:

Date approved by Governing Board: April 9, 2021

(Attach all documents related to this proposal upon which the Governing Board made its decision to approve the proposal.)

Chief Executive Officer's or other Authorized Officer's signature: _____


Susan M. Fritz

TO: The Board of Regents Addendum XI-A-7
Academic Affairs Committee

MEETING DATE: April 9, 2021

SUBJECT: Creation of a Master of Science in Biostatistics to be administered by Graduate Studies and the Department of Biostatistics in the College of Public Health at the University of Nebraska Medical Center

RECOMMENDED ACTION: Approval to create a Master of Science (MS) in Biostatistics to be administered by Graduate Studies and the Department of Biostatistics in the College of Public Health at the University of Nebraska Medical Center (UNMC)

PREVIOUS ACTION: June 26, 2020 – The Board approved the continuation of the PhD in Biostatistics at UNMC and the forwarding of the associated review report and monitoring plan to the Coordinating Commission for Postsecondary Education.
December 8, 2011 – The Board approved the creation of a PhD in Biostatistics at UNMC.

EXPLANATION: The proposed 36-credit hour online and in-person UNMC MS degree program in Biostatistics will focus on providing students with essential skills in statistical methods and data science techniques for biomedical research and clinical studies. The curriculum includes biostatistics theory, statistical modeling of clinical data, clinical trials methodology, biostatistical computing, and methods of machine learning. The proposed degree will provide a strong educational foundation to individuals who want to pursue a career as a statistician or data analyst in a health care research institution or pharmaceutical industry, or who plan to continue their education in a doctoral program of Biostatistics.
This proposal has been approved by the Council of Academic Officers and the Executive Graduate Council. This proposal also has been reviewed by the Academic Affairs Committee.

PROGRAM COST: \$36,554 for Year 1; \$183,901 over five years

SOURCE OF FUNDS: Existing College of Public Health funds and tuition and fees

SPONSORS: H. Dele Davies
Senior Vice Chancellor for Academic Affairs
Jeffrey P. Gold, Chancellor
University of Nebraska Medical Center

RECOMMENDED: /s/ Susan M. Fritz
Executive Vice President and Provost

DATE: March 5, 2021



September 4, 2020

Susan Fritz, Ph.D.
Executive Vice President and Provost
University of Nebraska
3835 Holdrege Street
Lincoln, NE 68583
smfritz@nebraska.edu

Dear Provost Fritz:

We are forwarding you the materials relating to the creation of a Master of Science in Biostatistics, administered by Graduate Studies and the Department of Biostatistics in the College of Public Health. This program has both campus and online options, designed to prepare biostatisticians for their critical role in research. It will provide students with essential skills in statistical methods and data science techniques for biomedical research and clinical studies. The goal is to provide quality education to individuals who want to pursue a career as a statistician or data analyst in health care research institution, pharmaceutical industry, or plan to continue their education in a doctoral program of Biostatistics. The online option will expand our reach to train individuals outside of Nebraska in one of the most high demand and fastest growing professions.

This proposal has been reviewed by us, and it has our approval. We are requesting your review and approval, that of the Chief Academic Officers, and that it be reported to the Board of Regents at an upcoming meeting.

Sincerely,

A handwritten signature in black ink, appearing to read 'H. Dele Davies'.

H. Dele Davies, MD, MS, MHCM
Senior Vice Chancellor

A handwritten signature in purple ink, appearing to read 'Jeffrey P. Gold'.

Jeffrey P. Gold, MD
Chancellor, University of Nebraska Medical Center

Proposal to Create the Master of Science in Biostatistics

I. DESCRIPTIVE INFORMATION

- **The name of institution proposing the program:**
 - University of Nebraska Medical Center (UNMC)
- **The name of the program proposed:**
 - Biostatistics
- **Degrees/credentials to be awarded graduates of the program:**
 - Master of Science (MS)
- **Other programs offered in this field by this institution:**
 - PhD in Biostatistics and Master of Public Health (MPH) Concentration in Biostatistics
- **CIP code:**
 - 26.1102
- **Administrative units for the program:**
 - College of Public Health, Department of Biostatistics
- **Proposed delivery site(s), and type(s) of delivery, if applicable:**
 - Sites: UNMC
 - Type(s) of delivery: On-campus and online
- **Date approved by governing board:**
 - Pending
- **Proposed date (term/year) the program will be initiated:**
 - Upon approval by the Coordinating Commission
- **Description, including credit hours and other requirements (program of study) and purpose of the proposed program:**

1. Abstract of the Program Proposal

The Department of Biostatistics in the College of Public Health (COPH) at the University of Nebraska Medical Center (UNMC) proposes to establish a Master of Science (MS) degree program in Biostatistics. The program focuses on providing students with essential skills in statistical methods and data science techniques for biomedical research and clinical studies. The

curriculum includes biostatistics theory, statistical modeling of clinical data, clinical trials methodology, biostatistical computing, and methods of machine learning. The goal is to provide quality education to individuals who want to pursue a career as a statistician or data analyst in health care research institution, pharmaceutical industry, or plan to continue their education in a doctoral program of Biostatistics.

The MS in Biostatistics addresses the state's needs in higher education in the following ways. First, the program recognizes the demand for students in the discipline of biostatistics. Students applying for jobs in Biostatistics will be more marketable if they have an MS degree in Biostatistics instead of a Master of Public Health (MPH) degree with a concentration in Biostatistics because the MS degree is more widely recognized by research institutes and the health care industry. Second, the UNMC Department of Biostatistics faculty have the most expertise in the state to deliver the unique educational needs of this discipline. Third, the MS in Biostatistics is specifically designed based on the knowledge and skills that are currently needed by professionals in this discipline. Attainment of an MS degree in Biostatistics is necessary for employment in many health care industries and will enable graduates to be well-positioned to secure and support grant-funded research projects that will boost Nebraska's economic competitiveness. Fourth, the MS degree program in Biostatistics will provide a pathway to the PhD in Biostatistics, a much-desired discipline in the state of Nebraska and nationally. Finally, offering both MS and PhD degrees will enhance the academic competitiveness of the UNMC Department of Biostatistics.

All courses in the program will be offered both on-campus (in-person) and online. The 36-credit hour program is designed to be completed in two years by full-time students, and four years by part-time students. The Biostatistics Graduate Program Committee, within the framework of the Office of Graduate Studies, will be responsible for coordinating overall strategy, formulating policies, and establishing general requirements for the program.

2. Program of Study

Program Philosophy

This program is designed to meet the needs of Nebraska for well-trained biostatisticians and health data analysts. This degree will train students in data management and computing, statistical reasoning, scientific logic, data analysis, and data interpretation. These skills are essential to prepare students to work as a biostatistician or health data analyst in research institutes and the health care industry. Students will receive a strong quantitative background which will prepare them to apply to the PhD program in Biostatistics should they desire academic careers or the next level of training.

Admissions Requirements

Applicants must follow the formal procedures established for admission to the graduate program at the UNMC campus. Admissions will take place in the fall. Students will select either a thesis or non-thesis option.

All applicants must hold (or be awarded before entry) a bachelor's degree from an accredited college or university, with a grade point average (GPA) of at least B (3.0 on a 4.0-point scale) and have a strong quantitative background. Applicants need to have taken undergraduate courses in Calculus I, Calculus II, Multivariable Calculus, Linear Algebra, and Introductory Statistics, each with a grade of B (3.0 GPA on a 4.0-point scale) or higher. Applicants who fulfill other requirements but lack one of the essential prerequisites as stipulated above may be admitted to the program; however, they must fulfill that requirement before registering for any course for which it is a prerequisite.

The following information is required for applicants to the MS Biostatistics program:

- Undergraduate transcripts reflecting an earned bachelor's degree.
- Three letters of recommendation, with at least one from a professor.
- A one-page personal statement describing the applicant's:
 - Interest in and potential for contributing to the field of biostatistics;
 - Career objectives; and
 - Self-assessment of computer, quantitative analysis, personal skills, and general preparation for succeeding in a biostatistics MS program.
- All applicants whose native language is not English and whose undergraduate degree is not from a college or university where courses are predominantly taught in English are required to submit satisfactory official scores on the Test of English as a Foreign Language (TOEFL) or International English Language Testing System (IELTS), according to the admission standard of UNMC for international students.

Options for the MS Degree

Students can choose a non-thesis or a thesis option to complete the MS in Biostatistics degree. Students choosing the non-thesis option are required to pass a written comprehensive exam. Those who fail the written comprehensive exam can retake the exam or move to the thesis option. Students choosing the thesis option will work with an advisory committee to complete a written thesis and present the research outcome from the thesis in a public forum.

MS in Biostatistics Student Faculty Advisement/Supervision

Upon matriculation, all students will be assigned an academic advisor who will help develop a personalized plan for completing the MS in Biostatistics program and evaluate academic progress in the program. Advisors will be faculty in the Department of Biostatistics. Advisors will work with students to complete an individualized plan of study by the end of the first semester of enrollment. For students selecting the thesis option, an advisory committee consisting of the students' advisor and a minimum of two more members will be responsible for supervising the student's thesis work toward earning the MS degree. The advisory committee must be formed by the time the student has completed 18 credit hours and will meet at least once every term until graduation.

MS in Biostatistics Program Competencies

CODE NAME	CONTENT
BIOSMS1	Demonstrate knowledge and skills necessary to conduct biostatistical research.
BIOSMS2	Think critically and creatively to solve problems in Biostatistics.
BIOSMS3	Effectively communicate biostatistical results
BIOSMS4	Apply appropriate statistical methods for estimation and inference, using a software package for data management, statistical analyses, and data presentation.
BIOSMS5	Apply statistical methods for quality control and data cleaning to already collected data, verify assumptions of statistical tests and models, and implement appropriate methods to address any issues discovered.
BIOSMS6	Evaluate the strengths and limitations of study design and statistical analyses of public health and biomedical studies.

Evaluation of Program Competencies

Several strategies will be used to evaluate student attainment of the MS in Biostatistics competencies. We will measure the extent to which the students have gained the competencies through:

1. Assignment and examinations in the core courses (BIOS 801, BIOS 802, BIOS 810, BIOS 815, BIOS 818, BIOS 823, BIOS 824, and BIOS 829).
2. Students in the non-thesis option will take a comprehensive exam.
3. Students in the thesis option will complete a written thesis and present research outcomes in a public forum.

Curriculum

The MS program in Biostatistics is 36 credit hours to be completed in two years by full-time students taking 18 credit hours per year, and four years by part-time students. All courses listed are offered both on-campus and online.

Required courses for both non-thesis and thesis options:

Core Courses (8 courses/24 credit hours)

- BIOS 801 Biostatistics Theory I
- BIOS 802 Biostatistics Theory II
- BIOS 810 Introduction to SAS Programming
- BIOS 815 Biostatistical Computing
- BIOS 818 Biostatistical Methods II
- BIOS 823 Categorical Data Analysis
- BIOS 824 Survival Data Analysis
- BIOS 829 Introduction to Biostatistical Machine Learning

Required Public Health Course (1 course/3 credits)

- HPRO 830 Foundations of Public Health

Non-thesis option:

The following list of electives is not all inclusive; any graduate level course offered at any University of Nebraska School that is approved by the student's committee may be taken for elective credit.

Electives (9 credit hours – at least 6 credit hours in Biostatistics or Statistics)

- BIOS 825 Correlated Data Analysis
- BIOS 835 Design of Medical Studies
- EPI 820 Epidemiology in Public Health
- EPI 845 Epidemiologic Methods
- EPI 945 Analytic Epidemiologic Methods
- STAT 803 Ecological Statistics (UNL)
- STAT 804 Survey Sampling (UNL)
- STAT 831 Spatial Statistics (UNL)
- STAT 841 Statistical Methods for High Throughput Biological Data (UNL)
- STAT 842 Computational Biology (UNL)
- STAT 8426 Exploratory Data Visualization and Quantification (UNO)
- ISQA 8206 Information and Data Quality Management (UNO)
- Other relevant courses upon departmental approval

Thesis option:

Thesis (3 credit hours)

- BIOS 899 Thesis

The following list of electives is not all inclusive; any graduate level course offered at any University of Nebraska School that is approved by the student's committee may be taken for elective credit.

Electives (6 credit hours – at least 3 credit hours in Biostatistics or Statistics)

- BIOS 825 Correlated Data Analysis
- BIOS 835 Design of Medical Studies
- EPI 820 Epidemiology in Public Health
- EPI 845 Epidemiologic Methods
- EPI 945 Analytic Epidemiologic Methods
- STAT 803 Ecological Statistics (UNL)
- STAT 804 Survey Sampling (UNL)
- STAT 831 Spatial Statistics (UNL)
- STAT 841 Statistical Methods for High Throughput Biological Data (UNL)
- STAT 842 Computational Biology (UNL)

- STAT 8426 Exploratory Data Visualization and Quantification (UNO)
- ISQA 8206 Information and Data Quality Management (UNO)
- Other relevant courses upon departmental approval

Plan of Study

Below are two sample plans of study for full-time students with the non-thesis option.

Plan 1:

<u>Fall 1st</u>	<u>Spring 1st</u>	<u>Fall 2nd</u>	<u>Spring 2nd</u>
BIOS 801	BIOS 802	BIOS 815	BIOS 829
BIOS 810	BIOS 823	BIOS 824	HPRO 830
BIOS 818	BIOS 835	Elective	Elective

Plan 2:

<u>Fall 1st</u>	<u>Spring 1st</u>	<u>Fall 2nd</u>	<u>Spring 2nd</u>
BIOS 801	BIOS 802	BIOS 815	BIOS 829
BIOS 810	BIOS 823	BIOS 824	HPRO 830
BIOS 818	Elective	Elective	BIOS 835

The plan of study for part-time students or students with the thesis option will be customized to their individual situation with the help of their Advisor.

Program Management

The Biostatistics Graduate Program Committee will be responsible for establishing admission criteria, admitting students, matching students with faculty advisors, and administering the Comprehensive Exam (non-thesis option). The student’s Advisory Committee (thesis option) reports to the Biostatistics Graduate Program Committee and is responsible for supervising the thesis and final presentation.

II. REVIEW CRITERIA

ADEQUACY OF RESOURCES

The MS program in Biostatistics will be managed by the Biostatistics Department in the College of Public Health (COPH) at UNMC. Adequate resources to develop and implement the program are available.

1. Faculty, Staff, and Other Resources

Department of Biostatistics

The Department of Biostatistics' main areas of research expertise include clinical trials, study design, survival analysis, generalized linear models, longitudinal analysis, survey methodology, analysis of microarray gene-expression data, imaging data and other high-dimensional data, and causal inference for electronic health record data. Department members assist investigators in planning and designing scientific studies, developing efficient and effective means of collecting and managing data, and identifying, strengthening, and communicating findings.

Faculty

UNMC's Department of Biostatistics has 12 full-time graduate faculty members (with five recruited in the last two years including the departmental chairperson), one instructor, seven Master-level staff biostatisticians, and two administrative staff members.

The Department of Biostatistics graduate faculty members include:

- Ying Zhang, PhD, Department Chair
- Hongying (Daisy) Dai*, PhD
- Ran Dai, PhD
- Jianghu (James) Dong, PhD
- Yeongjin Gwon, PhD
- Gleb Haynatzki*, PhD
- Jane Meza, PhD
- Kendra Schmid, PhD
- Lynette Smith*, PhD
- Christopher Wichman*, PhD, Graduate Program Director
- Fang Yu, PhD
- Cheng Zheng*, PhD

*Biostatistics Graduate Program Committee

Physical Facilities

The College is housed in the Harold M. and Beverly Maurer Center for Public Health, a state-of-the-art facility located on the UNMC campus. The 61,423 square foot facility provides offices, classrooms, workspaces, and meeting spaces for College students, faculty, and staff. The facility provides approximately 14,640 square feet of lockable office space for faculty and staff, and 5,330 square feet of modular office space for staff and teaching and research assistants. Centrally located space for core support function (mail, copying and general workspace) is provided on each of the facility's three floors.

Instructional Equipment and Informational Resources

The facility has four conference rooms plus three rooms that facilitate collaborative learning/research available to College administration, faculty, and staff. Three conference rooms are equipped, at minimum, with Smart Board technology. Additionally, one of these conference rooms is equipped to provide streaming Internet video and two-way video conferencing. The COPH features nine classrooms. Three of the rooms have Internet video streaming and two-way video conferencing, and two of these additionally have Echo 360 video/audio recording. Classrooms range in size from an 82-seat auditorium to multiple 16-20 seat classrooms. The combined education and student support area is approximately 6,740 square feet.

Students will have access to UNMC's McGoogan Health Sciences Library. The McGoogan Health Sciences Library serves the information needs of UNMC students, faculty, and staff. The Library website promotes selected full text resources, such as AccessMedicine and UptoDate. The Library's electronic collection includes over 6,100 health care and research-related e-journals, 43 databases, and 548 e-books; its print collections include 157,629 bound journals and 82,848 books. The Interlibrary Loan Department is part of an extensive, worldwide network that quickly obtains the full-text information required by students and faculty for research and education purposes.

The Library has assigned a liaison librarian to serve public health students and educators. The COPH Library liaison has created and maintains a public health "libguide" (<https://unmc.libguides.com/publichealth>) that is stocked with and has links to journals and information of interest to public health students, faculty, and staff.

UNMC has significantly expanded its investment in information and educational technology over the past 10 years. This investment includes technical staff support; a robust, secure campus network; and a multi-campus, statewide video network. There is wireless high-speed internet access throughout the UNMC campus, and students have access to the Microsoft Office suite as part of an institutional license. Consistent with many other accredited MS in Biostatistics programs, students will be required to have a laptop and/or tablet for the duration of their program of study. All courses will follow campus policies and will be ADA (Americans with Disabilities Act) compliant. UNMC provides on-call support for information technology issues. Any additional students' needs will be addressed on a case-by-case basis.

The COPH's Information Technology Services unit supports all computing in the College, including supporting live stream lectures; maintaining College network servers; specifying, configuring, and ordering all equipment, software, and data; and troubleshooting hardware and software problems.

2. Five-Year Budget Projections (See Tables 1 and 2)

Revenue calculations are based on tuition dollars from students enrolled in the MS in Biostatistics degree program only: Year 1 – one resident and four online students; Year 2 – three resident, eight online, and two non-resident students; Year 3 – five resident, 11 online, and two non-resident students; Year 4 – eight resident, 12 online, and two non-resident students; and

Year 5 – 10 resident, 12 online, and two non-resident students. Courses offered for the MS program may bring in additional revenue from what is projected based on students in other degree programs registering for the courses included in the program of study. The remaining deficit will be covered by existing funds allocated to the department teaching the course.

3. Evidence of Need and Demand

In today's digital and data-driven age, skills to collect, maintain, and analyze data are in high demand, and the employment outlook for graduates with academic credentials in Biostatistics is very good. Nationally, the demand for statisticians is high and it is becoming recognized as a prestigious profession. U.S. News and World Report Best Jobs ranked statistician as #1 in Best Business Jobs, #6 in Best STEM jobs, and #6 in the top 100 of all jobs.¹ Statistics and Data Analytic jobs in Nebraska have more than doubled in the last five years, moving from 190 positions in 2015 to 480 positions in 2019.² A recent search of job posting websites Indeed, Glassdoor, Ziprecruiter, and LinkedIn produced 90 statistics and data science positions available in Nebraska with companies such as Celerion and Syngenta, the Nebraska Department of Health and Human Services, and the Department of Agriculture's office in Lincoln.

Graduates with biostatistics expertise will find employment with various government agencies, health care business, pharmaceutical companies, private industry in health data science and informatics, and consulting firms. *Fortune* magazine ranked MS in Biostatistics degree as #2 and #1 in the list of the 20 best graduate degrees for jobs, in 2015 and 2016, respectively. Katie Bardaro, the director of analytics and lead economist at *PayScale* stated: "On the best degrees' list, there are some emerging fields. Those who earn a degree in Biostatistics (which is in our top 10 list), work in healthcare, biotech, and life sciences, using computer models to, for example, predict cancer growth in cell. The degree still isn't offered by many schools but is gaining traction." (Fortune, 2015). *Fortune* in 2016 also predicted 23% increase in the Biostatistician job market by 2024.

Career opportunities for Biostatisticians are abundant. Biostatisticians find jobs in a variety of organizations, hospitals, academia, pharmaceutical and other research companies, independent research groups, technology industries, public health organizations, and government. The American Statistical Association shows an unemployment rate for Biostatisticians of 1.8% in 2014, far below the national average. The U.S. Bureau of Labor Statistics shows the projected percent change in employment for mathematicians and statisticians from 2018 to 2028 to be +30% compared to the average growth rate for all occupations of +5%. Recent increased demand for biostatisticians has reduced the unemployment rate to essentially zero.

A master's degree in Biostatistics, particularly the Master of Science degree, is often the entry degree in the job market for biostatisticians. It should be noted that a program offering an MS in Biostatistics that offers both on-campus and *online* options is lacking in the region. The available degrees most geographically proximal to the University of Nebraska (all are on-campus

¹ <https://money.usnews.com/careers/best-jobs/statistician>

² <https://www.bls.gov/oes/tables.htm>

programs) are at the University of Iowa (Iowa City, IA), University of Colorado (Denver, CO), University of Kansas Medical Center (Kansas City, KS), and University of Minnesota (Minneapolis, MN). In addition, biostatisticians can fill positions traditionally within the purview of statisticians and health economists or, in some cases, actuaries and insurance specialists, where their understanding of the biological or health aspect of the field will prove advantageous. With several life science ventures and numerous businesses in medical and health-related fields proliferating within the state, a program offering an MS degree in this area is long overdue.

Besides meeting the job market demand for Biostatisticians, the MS program in Biostatistics also will help advance UNMC's PhD program in Biostatistics by serving as a pipeline of highly qualified local talent with training on-par to that offered by other institutions across the United States.

4. Partnerships with Business

Dr. Spencer Lourens, Director of Data Analytics at CLA LLP (CliftonLarsonAllen), is currently an adjunct faculty member of the department. He has provided great insights into the future demand of data science in the health care fields, which prompted the inclusion of a data science component in the proposed MS curriculum (BIOS 815 and BIOS 829). He also will be available to serve as a member on advisory committees for students who choose the thesis option or to teach a course if needed. The Biostatistics Department actively seeks to develop training collaborations with business partners in Nebraska for students who desire summer internship opportunities (see the attached letters of support). In addition, the department plans to capitalize on the network that faculty members have established with their former PhD advisees to develop a pipeline for students' summer internship opportunities in the pharmaceutical industry such as Eli Lilly (see the attached letter of support) as well as with other health care institutes. Our current MPH students have completed internships with local public health departments within Nebraska and with the Nebraska Department of Health and Human Services, a partnership we intend to continue.

5. Collaborations within the University of Nebraska

UNMC is geographically associated with University of Nebraska at Omaha (UNO), which will provide essential support to the development of the MS program in Biostatistics. As mentioned above, promising students without enough quantitative prerequisites will be admitted and sent to UNO to take the required courses to acquire these essential skills for success in the program. As indicated in the list of elective courses, leveraging course offerings from the other University of Nebraska campuses is important to the proposed program of study to allow students the flexibility in tailoring the degree program to their professional goals. In addition, the Department of Mathematics at UNO has developed a Master of Science degree in Data Sciences, and its curriculum, such as STAT 8426-Exploratory Data Visualization and Quantification and ISQA 8206-Information and Data Quality Management, are well suited for Biostatistics elected courses. We will communicate with UNO's Department of Mathematics for potential collaboration in developing a joint program in health data sciences and student recruitment.

6. Collaborations with Higher Education Institutions and Agencies External to the University

Though no collaboration has been formally established between the Department of Biostatistics and other higher education institutions and agencies external to the university, the department is actively seeking the opportunity to develop a joint MS and/or fast-track MS program with other institutions and is also open to international collaboration after this MS program is established.

7. Centrality to Role and Mission of the Institution

The proposed program addresses the UNMC mission, “*to lead the world in transforming lives to create a healthy future for all individuals and communities through premier educational programs, innovative research and extraordinary patient care,*” specifically by expanding educational opportunities and supporting the research mission by training biostatisticians who are critical partners in health research. As a matter of fact, the UNMC research programs are ranked 62nd in the nation by US News & World Reports.

Nearly 700 research projects are underway at UNMC today, conducted by some 190 full-time investigators in bench science labs, translational research centers and clinical trials. UNMC’s research funding continues to increase with over 66% growth since the beginning of the national financial crisis in 2008. This expansion has resulted in the creation of more than 3,200 highly skilled jobs in the state. Most, if not all, research projects in biomedicine and public health require masters’- or doctoral-level expertise in Biostatistics.

Biostatistics faculty, MS level Biostatisticians, and graduate students work as teams to support almost all major research projects, research centers, clinical study design and data analysis at UNMC. These research activities involve Biostatisticians either in a means of research collaboration or through the fee for service provided by the Center for Collaboration on Research Design and Analysis (CCORDA). On a yearly basis, UNMC biostatisticians (both PhD and MS levels) publish more than 100 peer-reviewed scientific articles by either leading the research or participating in team science biomedical studies with UNMC investigators. COORDA provides around 5,000 hours consultation service to the UNMC investigators with a majority of the service provided by our MS level biostatisticians. The biostatisticians are the critical force to advance the clinical research at UNMC campus, and this emphasizes the importance of well-trained MS level biostatisticians. **It is obvious that the research enterprise at UNMC and the Graduate program in Biostatistics need each other, and this need will grow even more in the future** (see the attached letters of support from UNMC investigators).

8. Consistency with the University of Nebraska Five-Year Strategy

The proposed degree strongly addresses the overarching goals of the University of Nebraska, as delineated in *The University of Nebraska Five-Year Strategy*,³ especially those emphasizing quality academic programs, workforce and economic development, and engagement within the state and beyond. Summarized here are several areas addressed in more detail elsewhere in the

³ <https://nebraska.edu/-/media/unca/docs/offices-and-policies/documents/strategic-plans/university-of-nebraska-five-year-strategy.pdf?la=en>

proposal: (1) Access, affordability, attainment: The online option for this program provides access across the state and for students outside Nebraska at an affordable rate; (2) Workforce development: Training is provided for new graduates or current workforce in a high-demand, high-paying skill set; (3) Partnerships: The department will actively increase partnerships with business for internships; and (4) Efficiency and effectiveness: This program is primarily utilizing existing courses at UNMC and others across the NU campuses will complement and add to the training while minimizing the need for new courses.

9. Avoidance of Unnecessary Duplication

Currently, there is no MS degree in Biostatistics offered in Nebraska. As a center for health and life sciences research in Nebraska, the UNMC campus is the ideal location for graduate programs in biostatistics. The MS program in Biostatistics has been designed to build on and leverage existing research and teaching strengths on the UNMC campus as well as the expertise and course offerings from other University of Nebraska institutions.

In addition to the PhD degree in Biostatistics, there are several similar statistical programs in Nebraska:

- The Master of Public Health (MPH Concentration: Biostatistics) at UNMC is offered both on-campus and online. It focuses on conventional statistics applications in public health issues, but does not emphasize the cutting-edge quantitative methods and technologies required in the dynamic job market of data science world nor does it prepare graduate students for research activities in Biostatistics (particularly, development of new biostatistical methods), including continuing in the PhD program in Biostatistics. The courses that distinguish the Biostatistics MS program from the MPH Biostatistics program are the mathematical biostatistics courses (BIOS 801, BIOS 802), the longitudinal data course, BIOS 824, the R-and-Python programming course, BIOS 815, and the biostatistical machine learning course, BIOS 829.
- The MS program in Mathematics with a concentration in Statistics at the University of Nebraska at Omaha and the MS program in Statistics at the University of Nebraska-Lincoln are also similar in scope. However, their focus (Industry and/or Agriculture) is outside of Biomedicine, Health Care, and Public Health. That is, neither of these two programs prepares the students to work in the biomedical, health care and public health fields, as the Biostatistics MS program does. Also, none of these are offered fully *online*, whereas the proposed Biostatistics MS program will build its online delivery on the nationally-ranked, *fully-online* MPH program in Biostatistics that has been offered by the Biostatistics Department for almost a decade already.

There are eight full-fledged Biostatistics MS programs (i.e., not mere concentrations) offered within the states (Indiana, Illinois, Iowa, Kansas, Michigan, Minnesota, Ohio, and Wisconsin) that are members of the Midwestern Higher Education Compact (MHEC), but these are not available *online*. There are only two full-fledged Biostatistics MS programs offered in contiguous states (Iowa, and Kansas), but these are not available *online*. The Biostatistics Graduate Program at UNMC has a solid track record in *online* delivery of high-quality

education. Particularly, our MPH in Biostatistics has been recently ranked 2nd through 11th nationally (depending on the ranking agency). We are confident that our high-quality Biostatistics MS program, with the online-delivery option, will be able to attract students from Nebraska and the MHEC states.

10. Consistency with the Comprehensive Statewide Plan for Postsecondary Education

The proposed program is consistent with the *Comprehensive Statewide Plan for Postsecondary Education*. The program meets the needs of the students. The program will have core classes, but also will allow for selection of elective courses to meet professional goals of each student.

Workforce Development: The proposed program meets the needs of the state. (Bio)statistics and data analysis have become a significant part of the operations of all businesses, nonprofits, and governmental organizations, including those in the health fields. Meeting the needs of the workforce, the proposed program will graduate students who understand, collect, clean, analyze, and interpret data in the health and biomedical fields.

Attracting and Retaining Students: The Department of Biostatistics at UNMC has made substantial progress in addressing the shortage of workforce with health analytics skills in Nebraska through the MPH program with a concentration in Biostatistics, and most of the enrollments in the MPH program are from *online* students. In 2020-2021, among the total of 14 enrolled new Biostatistics MPH students, 12 enrolled in the *online* program. Administrators at *online* programs report enrolling students from across the US and from abroad. We predict the same popularity of the *online* program for the Biostatistics MS degree. The proposed Biostatistics MS program offers a rare opportunity for students to obtain an advanced degree through distance learning. At present, only the University of Florida and University of Louisville offer online MS program in Biostatistics. As the only *online* MS program in Biostatistics in the catchment area of MHEC, the proposed degree is strategically positioned to attract and retain students throughout the Midwest states, rural communities, across the US, and abroad.

Use of Instructional Technology to Broaden Access: The proposed Biostatistics MS program expands educational opportunities for Nebraskans as it is fully online and asynchronous (in addition to being offered on-campus). It is anticipated that some of the Biostatistics MS students will be working professionals and unable to enroll in a traditional on-campus degree program. There is no geographic barrier with an online program and students can access courses at any time and from nearly any place. It is also anticipated that the program will attract students throughout Nebraska, including rural communities, as well as students from other states and other countries.

Expanded Workforce Diversity: The proposed Biostatistics MS program will participate in the University of Nebraska's system efforts to enhance educational and workforce development opportunities for minority populations who have been underrepresented in the workforce.

Meeting Educational Needs through Exemplary Institutions: We believe the Biostatistics MS program will be highly effective and efficient in meeting the growing needs for skilled

researchers in biomedicine, health care and public health because of its emphasis on stakeholder-driven, competency-based education. The program is designed to leverage the existing resources of the University of Nebraska system in order to minimize program expenses. As a result, conservative projections of program revenues substantially exceed projected expenses over a five-year period (see above, the Five-Year Budget Projections). Also, the Biostatistics MS program as proposed is not duplicative of other programs in the state of Nebraska for the reasons given previously.

Research and Technology Transfer: The Biostatistics MS prepares students for evidence-based practice, generation of practice-based evidence, and leadership positions that apply and synthesize translational and implementation science findings in a variety of settings including, governmental, non-profit, and private-sector settings as well as research and service at medical centers and research hospitals. The proposed Biostatistics MS program curriculum is innovative, current, and proactive to adapt to the ever-changing biomedicine, and public health and health care landscapes. Graduates of the Biostatistics MS program will work in a variety of settings including pharmaceutical and health insurance companies and health care organizations. While often difficult to measure, scholarly research conducted at higher education institutions enhances not only the learning experience of students within the institutions, but also the knowledge base of Nebraska citizens. The Biostatistics MS program will facilitate students to conduct applied biomedical and/or public health research studies to produce evidence needed for improving the population's health.

Letters of Support

- Martin Frenzel, Senior Director, Statistics, Oncology, Eli Lilly and Company
- Jennifer Larsen, Vice Chancellor for Research and The Louise and Morton Degen Professor of Internal Medicine, UNMC
- Spencer Lourens, Director, Data Analytics, CLA (CliftonLarsonAllen LLP)
- Matthew Rizzo, Francis and Edgar Reynolds Professor, and Chair, Department of Neurological Sciences, UNMC
- Connie Ryan, CEO and Chairperson, Streck
- Lani Zimmerman, Professor, College of Nursing, UNMC

9/8/2020

Ali S. Khan, MD, MPH
College of Public Health
University of Nebraska Medical Center
Omaha, NE 68198-4355

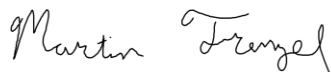
Dear Dean Khan,

I am very excited about the potential for UNMC to establish a Master of Science degree program in Biostatistics. The pharmaceutical industry employs thousands of biostatisticians to support preclinical science, clinical trials, and the analysis of real world clinical data sets. At Lilly, we hire many graduates of MS and PhD programs in biostatistics to fill these roles.

I have reviewed the proposed curriculum for the MS program and discussed the motivation for the program with Dr. Ying Zhang. I am impressed with the program's focus on statistical methods and techniques for biomedical research and clinical trials. Also, I believe the department's emphasis on educating students using real data arising from biomedical research occurring at UNMC will differentiate the MS program from other MS programs in statistics. The graduates of this program will be well qualified to enter the pharmaceutical industry. We have recently hired a PhD graduate from the UNMC Department of Biostatistics, and we look forward to having the opportunity to recruit both MS and PhD graduates in the future.

We wish to offer our sincere and enthusiastic support for the proposed MS program in Biostatistics. The addition of an MS program will certainly strengthen the department and provide much needed graduates for the pharmaceutical industry and other life science industries. Please feel free to contact me if I can offer additional support for the program.

Sincerely,

A handwritten signature in cursive script that reads "Martin Frenzel".

Martin Frenzel
Senior Director, Statistics, Oncology



August 31, 2020

Dr. Ying Zhang,
Chair, Dept of Biostatistics
College of Public Health
University of Nebraska Medical Center
Omaha, NE

Dr. Zhang:

As the Vice Chancellor for Research for UNMC, I fully support your proposal to develop a proposed Master of Science (MS) program in Biostatistics, within the Department of Biostatistics in the College of Public Health.

Biostatistics is in high demand for conducting any type of research at UNMC. We cannot compete for research funding at the national level unless we have adequate biostatistics manpower that is expected at peer review to assure the use of rigorously designed research projects. The Biostatistics MS program prepares those future researchers and collaborators with the methodological and quantitative skills of biostatistics that are required, including advanced application-oriented training in both theory and methodology. Your graduate program develops the type of independent researchers with skills in designing and conducting studies as well as analyzing and interpreting data from biomedical and public health research domains.

Having a growing number of trained and experienced biostatisticians is critical to the continued growth of UNMC's research funding, which in turn, creates jobs. Almost all funded and unfunded research projects at UNMC, whether clinical, laboratory, or community-based, are done in collaboration with Biostatisticians.

It should be noted that the program you propose is unique in the state of Nebraska but is also critical to the region. The Department of Biostatistics already serves the biostatistics needs for multiple Nebraska and surrounding regional institutions due to shortage of biostatistics expertise. This program will help fill this niche as well.

Under your leadership as the new Chair of Biostatistics and with your track record of developing a broad range of biostatistical programs and conducting methodology research published in top-notch statistical and biostatistical journals, I am confident you will attract Master's students just as you have grown the PhD graduate program and biostatistics faculty needed as advisors.

In summary, you have my full support to start this MS program and I look forward to the growth of both the MS and the PhD programs in Biostatistics at UNMC as they are indispensable to our research enterprise at UNMC. Please let me know how else I might help your efforts.

Sincerely,

A handwritten signature in black ink that reads "Jennifer Larsen MD".

Jennifer Larsen, M.D.
Vice Chancellor for Research and The Louise and Morton Degen Professor of Internal Medicine
University of Nebraska Medical Center



CLA (CliftonLarsonAllen LLP)
220 South Sixth Street, Suite 300
Minneapolis, MN 55402-1436
612-376-4500 | fax 612-376-4850
CLAconnect.com

August 31, 2020

Dear Members of BOR:

I am writing with regard to the importance of and the demand for Master's (MS) level training in the field of Biostatistics. As an individual receiving his PhD in Biostatistics from the University of Iowa in 2015, I have first-hand, relatively recent experience in the job market from both the academic and non-academic perspective. There is an overwhelming amount of demand for graduate level students and graduates in Biostatistics, and many opportunities in both the academic and industry settings for individuals having attained this level of educational training in the field. At the time of this writing, many MS level positions in the healthcare industry and beyond are available for the right candidate. MS graduates in Biostatistics would have the requisite skills required to succeed in these posts.

Obtaining my PhD in Biostatistics has allowed me to work as both the Director of a BS degree in Health Data Science and the Director of Data Analytics at the eighth largest Certified Public Accounting firm in the United States, CliftonLarsonAllen (CLA), all within the first 5 years since my original graduation date. In my current role, I can confidently say that we are looking for individuals with a solid backing in statistical methodology in addition to the ability to implement and carry out reproducible analyses documenting actionable business or research insights. MS students in Biostatistics are taught these skills while in the classroom, and often receive hands on experience conducting analytical work as a part of their assistantship completed as part of their degree.

I can speak first-hand that we have more work than we are able to accomplish at my current place of employment, and it is only a matter of time before we begin expanding at a rapid pace. The need for quantitative skills like those learned in a MS program in Biostatistics will not subside. If anything, demand will increase with the increasing adoption of AI and ML based technologies and software. MS graduates in Biostatistics are well positioned to guide, plan, and conduct analyses, in addition to serving in advisory roles for so-called "citizen data scientists" and other folks with high levels of business acumen but lower levels of quantitative skill. In fact, my group at CLA plans to utilize MS students studying at UNMC for internships when mutually beneficial after the program is finalized.

Finally, our field is ever growing and adapting, not only in terms of the methods we apply to solve problems, but also the technologies utilized to bring those methods to bare. Since MS graduates are given a taste of the difficult, sometimes very fast paced nature of graduate study, they should be acclimated to the rapidly changing nature of the work.

Sincerely,

Spencer Lourens, Ph.D.
Director, Data Analytics
(317) 569-6135
Spencer.lourens@claconnect.com



August 24, 2020

Dear Dr. Zhang,

I am writing to express my gratitude for the support the Department of Biostatistics and your graduate program provide to advance our biomedical research, on behalf of the Department of Neurological Sciences and the Great Plains (GP) IDeA-CTR (Clinical Translational Research) network.

The Biostatistics faculty and graduate students are key members for achieving our team science mission to conduct innovative clinical, translational, and basic science research to advance knowledge and treatments for neurological disease. Headquartered at UNMC, the GP IDeA-CTR network spans Nebraska and Dakotas with links to Kansas to achieve the overarching goal of improving regional health through innovative research, the highest quality patient care, and premier educational programs. The Biostatistics program has made a significant impact to the success of GP IDeA-CTR network.

I was glad a year ago when you were named Chair of the Biostatistics Department at UNMC, after a two-year national search. I recognize that we share similar philosophies on the integral role of biostatistics in biomedical research from defining research questions, designing testable hypotheses, processing raw data, modeling research data, to developing new methods. I am glad to have you as the Director of BERD (Biostatistics, Epidemiology and Research Design) core within GP IDeA-CTR network as the BERD plays a critical role in team science approach for addressing complex biomedical and behavioral problems.

Your experience and understanding of academic biostatistics have created great momentum and early wins in terms of excellent new faculty members and PhD student recruits. Our projects generate high-dimensional complex data that standard biostatistical consulting cannot adequately address. We need these new Biostatistics talents to collaborate on our challenging research projects and we appreciate you for making these resources available to support our research.

Your proposal for developing Master of Science Program in Biostatistics is excellent. It will not only provide the opportunity to retain the local talents to strengthen your Ph.D degree, but also will infuse more much-needed manpower for data analysts in health care areas. You have my enthusiastic support for the Biostatistics Graduate Program, which has a bright future given the opportunity to develop further.

Please let me know if I may be of further help.

Sincerely,

A handwritten signature in blue ink that reads "Matt".

Matthew Rizzo, MD, FAAN, FANA
Francis and Edgar Reynolds Professor
Chair, Department of Neurological Sciences
Clinical Program Leader, Neurosciences
Director, Great Plains IDeA-CTR Network
Director, Mind and Brain Health Laboratories
Co-Director, Center for Integrative and Translational Neuroscience
Chair, American Brain Coalition



August 21, 2020

Nebraska Board of Regents
Timothy Clare
Howard Hawks
Jim Pillen
Elizabeth O'Connor
Robert Schafer
Paul Kenney
Bob Phares
Barbara Weitz:

Dear Mrs. Weitz:

I would like to express my gratitude for the outstanding preparation of graduate students in Biostatistics at UNMC. I am also reaching out to you in support of the newly proposed Master of Science graduate program in Biostatistics.

Our company, Streck (<https://www.streck.com/>), developed our core technology of cell stabilization at a time when blood cells were still being counted manually using microscopes. Today, innovation continues to drive our science. Streck holds over 40 patents on more than 20 products and manufactures testing and reagent materials for some of the industry's leading instrument manufacturers, such as Abbott, Siemens, and Sysmex, among others. Streck is located in a 200,000 square foot facility in La Vista, Nebraska. Here, our products are developed, manufactured, marketed to over 13,000 labs in 65 countries around the world.

Our biostatistician, Karl Stessy Bisselou, himself a UNMC doctoral degree graduate, has been an outstanding addition for our company in the uniqueness of the skills he's brought, and has provided valuable quantitative insights for our biomedical research studies and regulatory compliance requisites.

There is a demand and opportunities for graduates with Master and PhD degrees in Biostatistics in our industry. Employees with graduate degrees in Biostatistics are greatly appreciated as part of our team, and likewise throughout the multitude of scientific disciplines.

Once again, thank you for preparing biostatistical researchers for the scientific industries. Streck believes that the new Master of Science in Biostatistics will help to fill the growing demand for the development and training of strong quantitative researchers.

Sincerely,

A handwritten signature in black ink that reads "Connie".

Connie Ryan
CEO & Chairperson

August 24, 2020

Dr. Ying Zhang
Professor and Chair
Department of Biostatistics
College of Public Health
University of Nebraska Medical Center
Omaha, NE

Dear Dr. Zhang:

First of all, I would like to thank you for recommending Mr. Ricard Ngaya, the current Ph.D student in your Biostatistics program to work with Center for Patient, Family & Community Engagement in Chronic Care Management (CENTRIC) as a graduate research assistant. Mr. Ngaya brings additional statistics skill to our team that helps advance our research significantly. I would like to attest that Biostatisticians with advanced degrees working as a team member is an important asset to nursing research.

As Director of the Mentored Scholars Program (MSP) at UNMC and as Operational Director of the Professional Development Core of Great Plains IDeA-CTR Network, I have been working with several Biostatisticians from your program. They bring knowledge and skill to the scholars in both of these Clinical Translational Research Programs and are needed as part of the scholar's teams. I appreciate that the Biostatisticians from your program are particularly specialized in clinical study design, grant development for biomedical research projects, clinical data analysis and research results interpretation, which are not generally strengthened in traditional statistics programs. These skills are greatly appreciated in our training program for MSP and the IDeA-CTR Research Scholars and for the forthcoming IDeA-CTR Early Career Investigators. Your team will play a critical role in these training programs.

As being said above, the demand for well-trained Biostatisticians with a higher scientific degree is increasing in the Great Plains area due to the progress of clinical research activities, but the supply of such professionals is seemingly scarce in the region and probably in the nation as well. I am glad to learn that you are proposing to develop a MS degree program in Biostatistics as one of your core's innovations for your training activities in the ongoing renewal of Great Plains IDeA-CTR network. I reviewed your plan and I think this proposed program will add significantly to the statistics education in the Great Plains area. Not only is there no MS degree program in Biostatistics in the state of Nebraska, your proposed MS program also designs the curriculum that reflects the new requirement on data science techniques for Biostatisticians for which you have recruited several new faculty with expertise in

this area. I am confident that you will build a successful MS program in Biostatistics at UNMC.

Therefore, I would like to enthusiastically support this degree program as I believe it will add great value to the UNMC overall education programs and produce professionals in demand for the local research communities. I am willing to offer advice to the development of the program whenever you need.

Sincerely,

Lani Zimmerman RN PhD

Lani Zimmerman PhD., RN, FAHA, FAAN
Professor
UNMC College of Nursing
1230 O Street Suite 131
PO Box 880220
Lincoln, NE 68588-0220
Phone 402-472-3847
lzimmerm@unmc.edu

**TABLE 1: PROJECTED EXPENSES - NEW INSTRUCTIONAL PROGRAM
UNMC MS in Biostatistics**

	(FY2022) Year 1		(FY2023) Year 2		(FY2024) Year 3		(FY2025) Year 4		(FY2026) Year 5		Total
	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	FTE	Cost	Cost
Personnel											
Faculty ¹											
Professional											
Graduate Assistants	0.50	\$27,030	0.50	\$27,030	0.50	\$27,030	0.50	\$27,030	0.50	\$27,030	\$135,150
Support Staff	0.05	\$3,662	0.05	\$3,772	0.05	\$3,885	0.05	\$4,002	0.05	\$4,122	\$19,443
Subtotal	0.55	\$30,692	0.55	\$30,802	0.55	\$30,915	0.55	\$31,032	0.55	\$31,152	\$154,593
Operating											
General Operating ²		\$2,500		\$2,500		\$2,500		\$2,500		\$2,500	\$12,500
Equipment											
New or Renovated Space											
Library/Information Resources											
Other (Student fees)		\$3,362		\$3,362		\$3,362		\$3,362		\$3,362	\$16,808
Subtotal		\$5,862		\$5,862		\$5,862		\$5,862		\$5,862	\$29,308
Total Expenses		\$36,554		\$36,664		\$36,777		\$36,894		\$37,014	\$183,901

¹ 36 credit hours for BIOS MS - No additional faculty needed.

² Includes communications and marketing.

**TABLE 2: PROJECTED REVENUES - NEW INSTRUCTIONAL PROGRAM
UNMC MS in Biostatistics**

	(FY2022) Year 1	(FY2023) Year 2	(FY2024) Year 3	(FY2025) Year 4	(FY2026) Year 5	Total
	Existing Funds ¹	\$19,784	\$0	\$0	\$0	\$0
Required New Public Funds						
1. State Funds						
2. Local Tax Funds (community colleges)						
Tuition and Fees ²	\$52,707	\$147,399	\$194,883	\$225,558	\$238,284	\$858,831
Other Funding						
Total Revenue	\$72,491	\$147,399	\$194,883	\$225,558	\$238,284	\$878,615

¹ Use of existing college funds may be necessary the first year to offset any deficit.

² Tuition rates = \$341 in-state; \$977 out-of-state; \$597 online.

Fees per student = \$225 in-person; \$840 online.

Hours taken per academic year per student = 18

Year	Students Enrolled*	Tuition Revenue Per Year	Fees Revenue Per Year	Total Revenue Per Year
Year One	5	\$49,122	\$3,585	\$52,707
Year Two	13	\$139,554	\$7,845	\$147,399
Year Three	18	\$184,068	\$10,815	\$194,883
Year Four	22	\$213,228	\$12,330	\$225,558
Year Five	24	\$225,504	\$12,780	\$238,284

* Expect between 4 to 8 current MPH students to transition to MS program in FY 2022.