THE **U**
UNIVERSITY
OF UTAH

March 30, 2017

Ruth V. Watkins
Senior Vice President for Academic Affairs
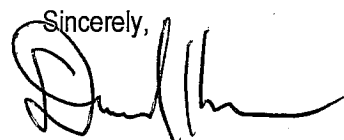205 Park Bldg.
Campus

RE: Graduate Council Review
        Master of Statistics Program

approved
RVWatkins 4-4-17
David V. Pershing 4-5-17

Dear Vice President Watkins:

        Enclosed is the Graduate Council's review of the Master of Statistics Program. Included in this review packet are the report prepared by the Graduate Council, the Program Profile, and the Memorandum of Understanding resulting from the review wrap-up meeting.

        After your approval, please forward this packet to President David Pershing for his review. It will then be sent to the Academic Senate to be placed on the information calendar for the next Senate meeting.

                                        Sincerely,

                                        David B. Kieda
                                        Dean, The Graduate School

Encl.

XC: Michael K. Gardner, Director, Master of Statistics Program
        David B. Kieda, Dean, The Graduate School

The Graduate School - The University of Utah

**GRADUATE COUNCIL REPORT TO THE SENIOR VICE PRESIDENT
FOR ACADEMIC AFFAIRS AND THE ACADEMIC SENATE**

October 31, 2016

The Graduate Council has completed its review of the **Master of Statistics Program**. The External Review Committee included:

Howard Bondell, PhD
Associate Professor and Co-Director of Graduate Programs
Department of Statistics
North Carolina State University

Weng Kee Wong, PhD
Professor, Department of Biostatistics
School of Public Health
University of California, Los Angeles

Guofen Yan, PhD
Associate Professor of Biostatistics
Department of Public Health Sciences
University of Virginia

The Internal Review Committee of the University of Utah included:

Mia Hashibe, PhD
Associate Professor, Division of Public Health
Department of Family and Preventive Medicine

Akiko Kamimura, PhD
Assistant Professor
Department of Sociology

Don G. Wardell, PhD
Professor
Department of Operations and Information Systems

This report of the Graduate Council is based on the self-study submitted by the MStat Program, the reports of the Internal and External Review Committees, and the Interim Program Chair's letter dated September 24, 2016 in response to the Internal and External Committee Reports. The Dean of the Graduate School, who has oversight of the MStat Program, provided a separate response, concurring with reviewer recommendations and endorsing the Program Chair response.

PROGRAM PROFILE

Program Overview

The mission of the MStat program (hereinafter the "Program") is "to train students whose primary interest lies in application of statistical methods in government, health care, and industry positions." The master's program is administered by faculty from five tracks: Biostatistics, Econometrics, Educational Psychology, Mathematics and Sociology. The MStat Program currently has 40 affiliated faculty, one 75% FTE staff member, and 65 students. Given its status as a program, housed in the Graduate School, it draws on faculty members appointed from their own home departments. The University Statistics Committee (USC), which consists of five members from the five tracks, operates the MStat Program. A committee chair is appointed by the Dean of the Graduate School and rotates every three years. Other affiliated faculty members support the program but do not have voting rights.

Students are admitted to the Program through one of the tracks and take three core courses, usually offered through the Department of Mathematics, and a capstone course. Upon the completion of the program requirements, students are expected to a) have a better understanding of fundamental statistical concepts, b) possess a degree of statistical expertise in a specific discipline of their choice, and c) conceive, execute, interpret, and present, verbally and in written form, a statistical analysis project. The student's supervisory committee for an MStat project includes an advisor in the student's MStat track and two other faculty members. Many students obtain placement in high paying professional jobs, while a small fraction continue on to PhD programs.

The MStat Program has several short-term goals and several long-term goals. The first short-term goal is the amplification of its tracks and curriculum beyond the original five, to follow national trends in disciplines requiring statistical science, such as astronomy, bioengineering, demography, geography, family and consumer studies, and psychology. This enlargement would bolster its interdisciplinary character, which has been identified as a strength and opportunity for the program and the University. Another short-term goal is the development of a Graduate Certificate in Statistics. The certificate would increase visibility, marketability for students, enrollments, and reflect industry needs.

Long-term goals include increasing student enrollment and augmenting budgetary support, as well as reducing program requirements to 33 credit hours or fewer.

In response to the recommendations in the previous review, the program hired a 75% FTE MStat Program Coordinator in 2010. They also have been trying to recruit more students and improve the dissemination of information about courses, the program, and job or internship postings to students. Previous recommendations that have not been effected to date include a change in the core course requirements, the development of a Graduate Certificate in Statistics, and creation of a Statistical Consulting Center.

It is significant that the University lacks a stand-alone statistics department on campus. The issue has been raised in the past and yet there has been no concerted decision to transform the administrative structure. However, the previous reviews and both external and internal reviews in this cycle do recommend transformation into a coherent centralized unit, such as a department.

Faculty

The Program is comprised of 40 faculty members listed as affiliate faculty, including 14 Professors, 7 Associate Professors, 13 Assistant Professors and 6 Adjunct Professors. The range of expertise in statistics across the five tracks is notable. Each faculty member has an appointment in their home department. Other than the MStat Program Director, who receives a small stipend ($12,000) of salary support, faculty do not receive salary support specifically to contribute to the MStat program, either from the program itself or from their departments. The term for the MStat Program Director is three years and the position is rotated amongst the faculty. Collectively, they provide superior training for the students in the five tracks of the program. Faculty participation in the MStat Program includes teaching courses, sometimes overload, to fulfill MStat requirements, participating in MStat faculty meetings, advising MStat students and supervising MStat projects, all categorized as service. For some of the tracks, affiliate faculty are unable to meet student demand. Furthermore, other disparities exist depending on the home department and faculty rank or overall responsibilities. They seem to be a highly dedicated group of faculty and effective mentors. Although they operate on a small budget with minimal resources and little support from the campus administration, faculty are considered the "backbone" of the program and receive little recognition for the high quality program offered and excellent caliber of graduates completing the program.

Comments from reviewer interviews suggest that the Program's faculty are actively engaged in teaching and are very committed to their students. The Internal Review Committee commended them, indicating that faculty members appear to be "the key component of the current MStat program cohesion and success thus far," though for some, lack of faculty time and overloads continue to be obstacles. This commendation was echoed by the External Review Committee, who noted that faculty are "well qualified to lead and have executed the program successfully for many years." However, both reports noted that, unless and until administration is centralized in some form, which may impact adversely the interdisciplinary nature of this Program, the inequities of service and teaching for faculty from distinct tracks will continue to affect enrollment growth, currently at maximum capacity and student outcomes.

Issues of faculty diversity were not addressed by the review teams since faculty affiliated with the program have appointments in their home departments.

Students

Student enrollments have seen a significant increase since 2008. Growth is a reflection of the national trends in statistical related jobs. Over the past several years, despite the loss of the Business track, the MStat program has nearly doubled, growing from 36 students in 2008-2009 to 65 students currently.

Students generally enter the program through one of the discipline tracks of their home department, while a few are enrolled directly by the Program. The program requirements include a sequence of three core courses in statistical theory, a capstone course (with an exception for students in the math track), other track specific courses, and a final project. During the capstone course (last semester of study), students have the opportunity to work with each other and leverage industry and/or alumni contacts during

the Alumni Open House. The student's supervisory committee works closely with them on the final project. Given the current limited resources for the MStat Program, it is commendable that students graduate with exceptional skills and are in high demand for employment. The job market for the students in the program is excellent and is forecast to remain very robust.

Students expressed appreciation for good communication and services.

To gain entry into the interdisciplinary program, potential students apply to the department that houses the track in which they are interested rather than to the program itself. The quality of applicants appears to be growing more competitive, with average GPA of incoming students at about 3.4. The External Report states the proportion of female students has hovered around 35-45% since 2008. While a significant number of Asian and other international students bring diversity to the program, the number of underrepresented minority students has been low. With the career boom in this field, diversity and equity should remain high on the radar.

The majority of advertising for the program is local to Utah. Inconsistencies between tracks regarding recruitment efforts and resources to meet student demand are responsible in part for this geographic boundary.

The tracks with the largest number of students are mathematics, biostatistics and econometrics. On the low end, the sociology track has very few students, and those that do participate are PhD students concurrently obtaining an MStat degree. Disparities noted in the self-study indicate that in that last two years for which data were available, the overall admit rate was around 75%. In contrast, in Math only 25% are admitted.

Varied degrees of satisfaction among students reflect the disparities depending on home department for financial support, advising, career counseling, etc. Overall, students interviewed, especially those in the math and biostatistics tracks, indicated high satisfaction with the advising they receive, both from staff and faculty. Their main concern regarded scholarship opportunities.

Curriculum

Students are admitted into one of five tracks, each of which is housed in one of the home departments: Family and Preventive Medicine (Biostatistics), Economics (Econometrics), Educational Psychology, Mathematics, and Sociology. In recent years, Sociology appears to have the least participation in terms of number of degrees awarded, while other tracks show a non-decreasing trend, with Biostatistics generally leading the pack. The Program also provides professional development and outreach education. Different tracks have different course and credit requirements.

Generally, the programs offer broad coverage across important areas of application and research, with some classes considered by students to be more popular or better than others.

The internal review went into great detail regarding the curriculum and specific regimes of success or other curricular pathways that need to be revised. Disparities arising from the five distinct tracks, originating in five separate departments, seem to affect students most pointedly around curriculum and faculty engagement. Recommendations in the reports center on the need to

streamline these issues by way of administrative centralization or better cooperation and co-direction among the various stakeholders. Reviewers suggested a number of courses could be taught under the STAT prefix to bring visibility to the Program, as well as funding through SCHs. The three-semester sequence at the core being taught under the MATH umbrella can be taught as STAT courses. The first two courses can be the Mathematical Statistics sequence, while the third can be a more applied course that introduces methods that are common to all tracks, such as regression, ANOVA, and design of experiments. This third course can be taken simultaneously with the Mathematical Statistics sequence, so it would not need to be a three-semester sequence. An additional course in data manipulation is recommended, as either required or suggested as an elective. Currently the Biostatistics track has a course of this type.

The internal report also recommended better utilization of the alumni network to strengthen and leverage ties with industry. There may be curricular areas worth exploring from that contact. In related manner, the suggestion to develop central coordination of internships would be an asset to streamlining students' course of study. Finally, there are benefits and costs to adding new tracks, which relate to curriculum, the potential to respond to industry, and providing the certificate or MS to a broad array of students.

The most pressing curricular change addressed in both reviews has to do with the need to settle on the structure of the Math core. No consensus has been reached about the benefits and costs of the MATH 5010-5080-5090 core. Some advocate for a two-course sequence. However, the sequence ideally would meet the needs of all tracks, increasing the potential to lead to improvements to the Program, including higher retention rates and faster graduation times. This is one of the challenges of interdisciplinarity.

Program Effectiveness and Outcomes Assessment

Students are graduating and garner high paying jobs. However, degree completion and satisfaction differs by track, which could be resolved through the establishment of a departmental administrative structure. Centralized assessments and centralized resources would balance out these disparities. The faculty advisor plays a central role in the outcomes and smooth progress through the Program, and her/his participation is contingent on balancing needs with the home department and mitigating effects of low university support for their service and teaching.

The Internal Review Committee indicated that the effectiveness measures in this current structure depend primarily on faculty supervision of students. To ensure better, consistent outcomes for all students, they note the need for centralized assessment.

The External Review Committee noted that procedures exist to monitor student progress. However there seems to be no clear explanation for the high attrition rate. They recommended examination and clarification of this issue beyond their assessment that: "1) students started a full-time job before completing the program requirements such as the final project which took longer time than expected; 2) students withdrew from the program due to some difficulties in the common core courses which are currently offered through the Math department; and 3) misreporting may be possible as there has been no systematic way to collect these data across the participating departments, which may be related to students accepting jobs prior to completion of the degree."

Facilities and Resources

The MStat Program operates on an annual budget of roughly $70,000, which encumbers the strengths of the program. The effects of low funding are observed in the quantity and nature of course offerings, financial support to students (e.g., TA assistantships), lagging recruitment of students, and limited extrinsic incentives for faculty to supervise student projects. This budget usually includes bare-bones funding for the MStat Chair, the track representatives, the Program Coordinator, 3-5 courses, student and alumni receptions, and recruiting. The budget, according to the Internal Review, "is grossly inadequate for this important program to expand and serve the students at the University of Utah."

There are no physical facilities specially designated for the MStat Program. No physical space exists for the students, staff or faculty. Furthermore, MStat Program students and faculty must use the campus library for computing resources. There is a hired 75% FTE Program Coordinator currently housed in the Educational Psychology Department who moves depending on the department of the program chair. She does not have a stable space, though support from the Graduate School has been instrumental. Both reports indicate the outstanding issues of consolidating a central physical space as well as an administrative unit in order to improve recruitment, organization, management and outreach.

COMMENDATIONS

1. The Program continues to be a model for interdisciplinary education that responds to strong national trends to train students in statistical science for many diverse industry demands. The robust placement rates, as well as graduates' ability to command excellent starting salaries, demonstrate the efficacy and innovative features of their training and educational program.

2. Faculty commitment, often with restricted resource and time available, is responsible for the sustained cohesion and success of the educational program.

3. Responding to feedback from the last review, the Program has shifted toward more centralized dissemination of information for the current students and potential recruits through their MStat website. In addition, the structural consolidation of courses and resources and improved interdisciplinary harmonization has been facilitated, though not solved, by a 75% FTE MStat Program Coordinator. They also have leveraged incremental revenue generation through the listing of courses under the STAT umbrella. This progress should continue and be supported.

4. Student diversity with respect to gender equity is positive. Given the high market demand, concerted efforts to continue to recruit diverse students is imperative.

RECOMMENDATIONS

1. Both reports urge the administration to seriously consider creation of a Department of Statistical Science. A task committee could evaluate the various existent models at top universities to determine the best fit for the University to adopt. The increasing importance of statistical science and its general applicability to all disciplines across campus, in our state, and the nation, as well as skyrocketing enrollments across the country suggest this is a timely, strategic opportunity to invest in such an administrative, pedagogical, and research unit.

2. The development of the Graduate Certificate in Statistics should be a top priority given the overwhelming demand for graduates in all disciplines to be well trained in Statistics. The certificate affords access to a much larger number of graduate students who will be able to receive additional training and add this credential, making them more competitive upon entering the workforce. Moreover, it may generate more SCHs for the MStat Program.

3. The MStat Program is operating at full capacity (perhaps over-threshold) with faculty and resources overextended beyond their limits. These are the most pressing areas in need of rectification: obtain FTEs to teach a minimum of six courses per year; commend faculty for their exceptional efforts in both research and education, and reward these efforts in a manner consistent with comparable duties.

4. The MStat Program is underfunded at the university and should have a commitment of funds made available to ensure growth and continued efficacy. Increased funding was recommended in reports for the development of the Graduate Certificate, staff to support growth and change of administrative structure, TA salaries, and faciltities.

5. While existing under the structure of a Program, the Committee Chair of the MStat Program has not been able to access the budget in the recent past, which has created difficulties in administration. Whatever structure they utilize, access to budget should be restored.

6. Investigate reasons for student attrition and how to improve retention.

7. Take assertive actions to increase recruitment of underrepresented minority students and to achieve more complete gender balance.

Submitted by the Ad Hoc Committee of the Graduate Council:

Isabel Dulfano (Chair)
Associate Professor, Department of World Languages and Cultures

Linda St. Clair
Associate Librarian, Marriott Library

MASTER OF STATISTICS (MStat) PROGRAM – OBIA PROFILE*

R411 Data Table								
Master of Statistics (MStat) Program								
		Year	Year	Year	Year	Year	Year	Year
		2008-09	2009-10	2010-11	2011-12	2012-13	2013-14	2014-15
Faculty								
Headcount								
With Doctoral Degrees (Including MFA and other terminal degrees, as specified by the institution)								
Full-time Tenured								
Full-time Non-Tenured								
Part-time								
With Master's Degrees								
Full-time Tenured								
Full-time Non-Tenured								
Part-time								
With Bachelor's Degrees								
Full-time Tenured								
Full-time Non-Tenured								
Part-time								
Other								
Full-time Tenured								
Full-time Non-Tenured								
Part-time								
Total Headcount Faculty								
Full-time Tenured								
Full-time Non-Tenured								
Part-time								
FTE (A-1/S-11/Cost Study Definition)								
Full-time (Salaried)								
Teaching Assistants								
Part-time (May include TA's)								
Total Faculty FTE								
Number of Graduates								
Certificates								
Associate Degrees								
Bachelor's Degrees								
Master's Degrees		13	18	14	18	12	9	18
Doctoral Degrees								

*Many fields are blank because of the interdisciplinary nature of the MStat program.

	Year 2008-09	Year 2009-10	Year 2010-11	Year 2011-12	Year 2012-13	Year 2013-14	Year 2014-15
Number of Students—(Data Based on Fall Third Week) Semester of Data: _____, 20__							
Total # of Declared Majors	36	40	45	53	59	64	78
Total Department FTE*							
Total Department SCH*							
*Per Department Designator Prefix							
Student FTE per Total Faculty FTE							
Cost (Cost Study Definitions)							
Direct Instructional Expenditures							
Cost Per Student FTE							
Funding							
Appropriated Fund							
Other:							
Special Legislative Appropriation							
Grants of Contracts							
Special Fees/Differential Tuition							
Total							

Memorandum of Understanding
Master of Statistics Program
Graduate Council Review 2015-16

This memorandum of understanding is a summary of decisions reached at a wrap-up meeting on March 23, 2017, and concludes the Graduate Council Review of the Master of Statistics Program. Ruth V. Watkins, Senior Vice President for Academic Affairs; Michael K. Gardner, Director of the Master of Statistics Program; David B. Kieda, Dean of the Graduate School; and Katharine S. Ullman, Associate Dean of the Graduate School, were present.

The discussion centered on but was not limited to the recommendations contained in the review summary report presented to the Graduate Council on October 31, 2016. The working group agreed to endorse the following actions:

Recommendation 1: Both reports urge the administration to seriously consider creation of a Department of Statistical Science. A task committee could evaluate the various existent models at top universities to determine the best fit for the University to adopt. The increasing importance of statistical science and its general applicability to all disciplines across campus, in our state, and the nation, as well as skyrocketing enrollments across the country suggest this is a timely, strategic opportunity to invest in such an administrative, pedagogical, and research unit.

The MStat Program Director expressed neutrality on development of a departmental structure and recognized that such an initiative would need to be undertaken at a high level. SVP Watkins felt that this was a brewing conversation of interest, noting the Transformative Excellence Program that had nucleated around Statistical Science and Big Data. The need to converge conversations on this topic and make sure they involve all of the players in this area, including the University Statistics Committee that governs the MStat Program, was emphasized. SVP Watkins will help in syncing up these efforts such that we are not creating internal competition or pulling partners away from an existing program that is thriving on many accounts. We discussed that, if there were a departmental structure, it would be important to continue a master's level program and to keep an emphasis on applied statistics as part of the broader goals. Dean Kieda noted that the creation of a central home structure for statistics may aid in recruiting faculty with this expertise.

Recommendation 2: The development of the Graduate Certificate in Statistics should be a top priority given the overwhelming demand for graduates in all disciplines to be well trained in Statistics. The certificate affords access to a much larger number of graduate students who will be able to receive additional training and add this credential, making them more competitive upon entering the workforce. Moreover, it may generate more SCHs for the MStat Program.

Developing a Graduate Certificate program has been a priority of the Director this past year and many of the pieces of this proposal are in place. Due to the increased demand this would create for coursework, financial support is required. Dean Kieda plans to make these funds a prioritized request in the Graduate School budget. In addition, letters of support will be needed from Dean Kieda and SVP Watkins for the proposal prior to going before the Graduate Council. All agreed that this is an exciting initiative that will help the University train more students with quantitative skills that are in much demand in the current job market.

Recommendation 3: The MStat Program is operating at full capacity (perhaps over-threshold) with faculty and resources overextended beyond their limits. These are the most pressing areas in need of rectification: obtain FTEs to teach a minimum of six courses per year; commend faculty for their exceptional efforts in both research and education, and reward these efforts in a manner consistent with comparable duties.

If the budget request mentioned in Recommendation 2 is approved, the Program Director felt this would alleviate many of the financial concerns. The Program is also considering creative ways to further leverage current resources, such as allowing MStat students to perform projects in groups, which would consolidate the advising burden. The financial picture will need to be reevaluated as initiatives from the previous recommendations mature.

Recommendation 4: The MStat Program is underfunded at the university and should have a commitment of funds made available to ensure growth and continued efficacy. Increased funding was recommended in reports for the development of the Graduate Certificate, staff to support growth and change of administrative structure, TA salaries, and facilities.

See Recommendations 2 and 3.

Recommendation 5: While existing under the structure of a Program, the Committee Chair of the MStat Program has not been able to access the budget in the recent past, which has created difficulties in administration. Whatever structure they utilize, access to budget should be restored.

This problem has been rectified.

Recommendation 6: Investigate reasons for student attrition and how to improve retention.

Keeping track of students in order to promptly identify issues that may contribute to attrition is a challenge in this highly decentralized program. SVP Watkins felt that a certain level of data tracking would be possible with local solutions, and will follow-up with Enrollment Management. Such tracking might reveal if there is a pattern to the type of student who is not finishing and may lend insight into when retention becomes an issue. There may be other readily deployed options that could provide complementary information. For instance, the Program Coordinator could create an electronic survey that is sent to students at the end of each semester, asking a few simple questions about their progress and providing an opportunity to report problems. Keeping track centrally of students' milestone completions would also help identify those in need of additional advising. A second strategy, independent of tracking, is to continue to foster social activities that bring a sense of community to the MStat Program, such as the Spring Open House. Including alumni in some events has the added advantage of providing a networking opportunity for students, as well as useful and motivating exposure to career paths. It also seems likely that financial issues could underlie attrition in some instances, which is addressed in Recommendation 7. Finally, the possibility of developing online classes to increase scheduling flexibility was touched on, and while this does not seem practical at the present time, this option and the resources available for online initiatives are something to consider in longer-term planning, perhaps as a follow-up to this year's focus on the Graduate Certificate.

Recommendation 7: Take assertive actions to increase recruitment of underrepresented minority students and to achieve more complete gender balance.

To build further success in this area, two main tactics were emphasized in the discussion. First was the possibility of finding sponsors from industry that could provide funds for scholarships. Aligning these funds to achieve greater representation of underrepresented minorities and gender balance would both help the MStat Program and present an attractive opportunity for the business community, where diversity is also highly valued. Sponsors from sectors where alumni are hired, such as insurance and banking, seem like viable possibilities. It was noted that dispersing any such funding opportunities across different tracks within the Program would be important. A second tactic is to bolster recruitment efforts. The Program is represented at the Utah Graduate School Fair. This effort could be further leveraged by supplying Dr. Araceli Frias, Assistant Dean of the Graduate School, with recruitment material that she could take to the various forums she attends throughout the year.

This memorandum of understanding is to be followed by regular letters of progress, upon request of the Graduate School, from the Director of the Master of Statistics Program. Letters will be submitted until all of the actions described in the preceding paragraphs have been completed. In addition, a three-year follow-up meeting will be scheduled during AY 2018-19 to discuss progress made in addressing the review recommendations.

Ruth V. Watkins   _____
Michael K. Gardner   David B. Kieda
David B. Kieda   Dean, The Graduate School
Katharine S. Ullman   March 30, 2017