APPLICATION FOR NEW COURSE

1. Submitted by the College of Public Health Date: March 10, 2008

   Department/Division proposing course: Biostatistics

2. Proposed designation and Bulletin description of this course:

   a. Prefix and Number BST 762

   b. Title* Longitudinal Data Analysis

   *If title is longer than 24 characters, write a sensible title (24 characters or less) for use on transcripts:

   Longitudinal Data

   c. Courses must be described by at least one of the categories below. Include the number of actual contact hours per week for each category, as applicable.

   (___) CLINICAL (___) COLLOQUIUM (___) DISCUSSION (___) LABORATORY (3) LECTURE

   (___) INDEPEND. STUDY (___) PRACTICUM (___) RECITATION (___) RESEARCH (___) RESIDENCY

   (___) SEMINAR (___) STUDIO (___) OTHER – Please explain: _____

   d. Please choose a grading system: ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

   e. Number of credit hours: 3

   f. Is this course repeatable? YES ☐ NO ☒ If YES, maximum number of credit hours: _____

   g. Course description:

   This course presents statistical techniques for analyzing longitudinal studies and repeated measures experiments that occur frequently in public health, clinical trials, and outcomes research. This course will cover linear mixed models, generalized linear mixed models and an introduction to nonlinear models as they apply to the analysis of correlated data.

   h. Prerequisite(s), if any:

   BST 676(Biometrics II) and BST 760 (Advanced Regression) OR STA 532 and STA 603

   i. Will this course be offered through Distance Learning? YES ☐ NO ☒

   If YES, please circle one of the methods below that reflects how the majority of the course content will be delivered:

   Internet/Web-based | Interactive video | Extended campus | Kentucky Educational Television (KET/teleweb) | Other

   Please describe "Other": _____

3. Teaching method: ☒ N/A or ☐ Community-Based Experience ☐ Service Learning Component ☐ Both

4. To be cross-listed as: STA 632 _____
   Prefix and Number Signature of chair of cross-listing department

5. Requested effective date (term/year): Spring / 2010

APPLICATION FOR NEW COURSE

6. Course to be offered (please check all that apply): ☐ Fall ☒ Spring ☐ Summer

7. Will the course be offered every year? ☒ YES ☐ NO

If NO, please explain: _____

8. Why is this course needed?

This course is a requirement in the proposed PhD in Epidemiology/Biostatistics.

9. a. By whom will the course be taught? Heather Bush or David Fardo

b. Are facilities for teaching the course now available? ☒ YES ☐ NO

If NO, what plans have been made for providing them?

10. What yearly enrollment may be reasonably anticipated?

5-10 students

11. a. Will this course serve students primarily within the department? ☒ YES ☐ No

b. Will it be of interest to a significant number of students outside the department? ☒ YES ☐ NO

If YES, please explain.

The course will be a requirement for the proposed Ph.D. in Epidemiology/Biostatistics. Some of the students in that program may consider Epidemiology their home department.

It may be of interest to graduate students from other colleges and to the MPH and Dr.PH students in the College of Public Health. Also, it will be of interest to students pursuing an M.S. in Statistics.

12. Will the course serve as a University Studies Program course†? ☐ YES ☒ NO

If YES, under what Area? _____

†AS OF SPRING 2007, THERE IS A MORATORIUM ON APPROVAL OF NEW COURSES FOR USP.

13. Check the category most applicable to this course:

☒ traditional – offered in corresponding departments at universities elsewhere

☐ relatively new – now being widely established

☐ not yet to be found in many (or any) other universities

14. Is this course applicable to the requirements for at least one degree or certificate at UK? ☒ Yes ☐ No

15. Is this course part of a proposed new program? ☒ YES ☐ NO

If YES, please name: PhD in Epidemiology and Biostatistics

16. Will adding this course change the degree requirements for ANY program on campus ? ☐ YES ☒ NO

If YES ‡, list below the programs that will require this course:

APPLICATION FOR NEW COURSE

‡In order to change the program(s), a program change form(s) must also be submitted.

17. ☒ The major teaching objectives of the proposed course, syllabus and/or reference list to be used are attached.

18. ☐ Check box if course is 400G or 500. If the course is 400G- or 500-level, *you must include a syllabus showing differentiation* for undergraduate and graduate students by (i) requiring additional assignments by the graduate students; and/or (ii) the establishment of different grading criteria in the course for graduate students. (See *SR 3.1.4)*

19. Within the department, who should be contacted for further information about the proposed new course?

Name: Richard Kryscio Phone: 257-4064 Email: kryscio@email.uky.edu

20. Signatures to report approvals:

4-1-08	Richard Kryscio / Richard Kryscio	
DATE of Approval by Department Faculty	printed name	Reported by Department Chair signature
6-26-08	Linda Alexander / Linda Alexander	
DATE of Approval by College Faculty	printed name	Reported by College Dean signature
	/	
* DATE of Approval by Undergraduate Council	printed name	Reported by Undergraduate Council Chair signature
	BRIAN A. JACKSON	
* DATE of Approval by Graduate Council	printed name	Reported by Graduate Council Chair signature
8/19/08	Heidi Anderson /	
* DATE of Approval by Health Care Colleges Council (HCCC)	printed name	Reported by Health Care Colleges Council Chair signature
* DATE of Approval by Senate Council		Reported by Office of the Senate Council
* DATE of Approval by University Senate		Reported by Office of the Senate Council

*If applicable, as provided by the *University Senate Rules.* (http://www.uky.edu/USC/New/RulesandRegulationsMain.htm)

BST 762/ STA632: Longitudinal Data Analysis

Course Description: This course presents statistical techniques for analyzing longitudinal studies and repeated measures experiments that occur frequently in public health, clinical trials, and outcomes research. This course will cover linear mixed models, generalized linear mixed models and an introduction to nonlinear models as they apply to the analysis of correlated data.

Course Structure: 3 credit hours (3 hours of lecture, 0 hours of laboratory)

Prerequisites: BST 676 (Biometrics II) and BST 760 (Advanced Regression) OR STA 532 and STA 603

Initial Offering: Spring 2010

Instructors: Any faculty member in the Department of Biostatistics or Statistics

Philosophical Statement: Repeated measures experiments and the collection of longitudinal data occur frequently in clinical trials, public health research, and in marketing and business applications. The correlated nature of this data violates the independence assumption of most statistical tests. Advances have been made in statistical methodology and in the implementation of methods to correlated data. This course offers students an opportunity to put into practice methods for analyzing correlated interval level and categorical outcomes. Discussions of correlated data and the methodology of analysis will be motivated by case studies arising from health surveys, clinical trials, and longitudinal studies. Statistical software and statistical computations for implementing the methodology will be covered as well. Topics covered will provide students with the tools to implement analyses of longitudinal data and will provide a foundation for doctoral students as they pursue further coursework in advanced data analysis methods.

Objectives: A student in this course will be introduced to appropriate statistical methods used in the analysis of longitudinal data and the analysis of repeated measures experiments for both interval level and categorical measurements. Specifically, the objectives of the course are as follows:

- Learn how to analyze designed experiments with repeated measures from three points of view: analysis of variance, multivariate analysis, and linear mixed models
- Learn how to analyze and design observational longitudinal studies with linear trends
- Learn how to analyze models with random coefficients and to model covariance structures
- Become familiar with theory underpinning the software used to fit mixed models to data in the Gaussian outcomes case
- Utilize statistical methodologies for longitudinal and repeated measures data including restricted maximum likelihood, generalized estimating equations, and weighted least squares
- Learn how to analyze mixed models with non-Gaussian outcomes: binary, ordinal, and. Poisson response with random effects.
- Provide students with an introduction to nonlinear models as applicable to growth curve data, Zero -Inflated Poisson models, and pharmacokinetic models.

References:

1. Davis (2002) *Statistical Methods for the Analysis of Repeated Measurements.* Springer.
2. Diggle, Liang, Zeger, and Heagerty (2002) *Analysis of Longitudinal Data.* Oxford.

3. Little, Milliken, Stroup, Wolfinger, and Schabenberger (2006) *SAS for Mixed Models,* SAS Institute.
4. Brown and Prescott (2006) *Applied Mixed Models in Medicine*. Wiley.
5. Hedeker and Gibbons (2006) *Longitudinal Data Analysis* Wiley.
6. Fitzmaurice, Laird, and Ware (2004) *Applied Longitudinal Analysis*. Wiley

Detailed Outline:

1. Repeated Measures Introduction
    a. Univariate Methods
    b. Multivariate Approaches
    c. Repeated Measures ANOVA: single group case
    d. Repeated Measures ANOVA: multiple groups case
2. Linear Mixed Models: Gaussian Data
    a. Simple linear regression with random intercept
    b. Compound symmetry and intraclass correlation
    c. Simple linear regression with random slope and intercept
    d. Specification of the Linear Mixed Model for the linear regression cases
    e. Design of longitudinal Studies: sample size and power
3. Linear Mixed Models (LMM): General theory
    a. Matrix formulation
    b. Estimation in the LMM
    c. Two stage and weighted least squares
    d. Maximum Likelihood
    e. Restricted maximum likelihood
    f. Inference for fixed effects: Wald tests
    g. Inference for Variance components
4. Linear Mixed Models in Practice
    a. Robust estimation of errors in parameter estimates of fixed effects
    b. Approximate t statistics
    c. Covariance pattern models:
        (i) structured versus unstructured patterns
        (ii) autocorrelated errors
    d. Residual analysis / transformed residuals
    e. Prediction and shrinkage
    f. Software: Proc Mixed in SAS
5. Generalized linear models
    a. Exponential family
    b. Marginal models
    c. Generalized estimating Equations
    d. Weighted least squares
6. Linear Mixed Model: non Gaussian Case
    a. Binary outcomes
    b. Ordinal Outcomes
    c. Nominal Outcomes
    d. Count responses
    e. Software: Proc Glimmix in SAS
7. Cluster Randomized and Multi-center Trials

8. NonlinearMixed Models
    a. Specification of the Model
    b. Application: Growth Curves
    c. Application: Zero-Inflated and Hurdle Models
    d. Application: Pharmacokinetics
    e. Software; Proc Nlmixed in SAS

Grading Scale:

Grade	%
A	90-100
B	80-89
C	70-79
E	60-69

LaRoche, Adrea S.

From: Brothers, Sheila C
Sent: Monday, September 22, 2008 8:42 AM
To: LaRoche, Adrea S.
Subject: FW: HCCC Transmittal - Program Change: MS in Athletic Training
Attachments: PhD Epi Bio Final Signatures.pdf; FW: important--EPI 714; FW: regarding the New Program Proposal for the PhD in Epidemiology and Biostatistics

Follow Up Flag: Follow up
Flag Status: Flagged

Categories: Curricular Items

Don't let the subject line fool you – this is for a PhD in Epidemiology. ☺
Sheila

Office of the Senate Council
Phone: (859) 257-5872

From: Lindsay, Jim D.
Sent: Friday, September 19, 2008 2:20 PM
To: Nikou, Roshan; Jackson, Brian A
Cc: Brothers, Sheila C; Anderson, Heidi Milia; Flanagan, Rebecca; Alexander, Linda A; Kryscio, Richard
Subject: RE: HCCC Transmittal - Program Change: MS in Athletic Training

September 19th, 2008

T R A N S M I T T A L
TO: Brian Jackson, Roshan Nikou
Graduate Council
FROM: Jim Lindsay
Health Care Colleges Council

At its August 19th 2008 meeting, the Health Care Colleges Council approved the following proposal and is now forwarding it to the Graduate Council to approve:

College of Public Health
New Program: Ph.D. in Epidemiology

Attached are the materials to implement the requested action.

cc: Linda Alexander
Becki Flanagan
Richard Kryscio
Shelia Brothers
Heidi Anderson

Jim Lindsay
Health Care Colleges Council Coordinator
Associate Provost for Faculty Affairs Office
University of Kentucky, 205 Frazee Hall
Lexington, KY 40506-0031 Ph. (859) 323.6638
www.uky.edu/Provost/AcademicCouncil/council.php

APPLICATION FOR NEW COURSE

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   d. Please choose a grading system: ☒ Letter (A, B, C, etc.) ☐ Pass/Fail

   e. Number of credit hours: 3

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   i. Will this course be offered through Distance Learning? YES ☐ NO ☒

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   Please describe "Other": _____

3. Teaching method: ☒ N/A or ☐ Community-Based Experience ☐ Service Learning Component ☐ Both

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5. Requested effective date (term/year): Spring / 2010

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