

CPHHS Quantitative Methods Courses
(01/2020)

Inventory of Graduate Courses on Quantitative and Analysis Methods in the CPHHS						
		The quantitative courses listed are based on a broad definition of what constitutes a quantitative course. For example, courses could focus on quantitative methods, including study design and analytical methods, while other courses might include hands on quantitative data analysis.				Link to graduate course offerings: https://health.oregonstate.edu/academics/graduate-courses Link to course syllabi: https://health.oregonstate.edu/academics/syllabi
Discipline	Course	Name	Credits	Software	Hands on data analysis	Course Content Notes
MPH core	H513		12	R	Y	some basic R
BIOS	H 524	Introduction to Biostatistics Prereq: none	4	R or STATA	Y	Quantitative analysis and interpretation of health data including probability distributions, estimation of associations, and significance tests such as chi-squared, one-way ANOVA, and linear regression.
BIOS	HHS 526	Linear Regression in Public Health Prereq: H 524	2	R	Y	Biostatistical tools for scientific applications in public health using linear regression analysis. Confounding, effect modification, variable selection, assessing model fit, observational studies, and exploratory data analysis. Emphasis on the use of statistical packages for analyzing public health data.
BIOS	HHS 527	Logistic Regression in Public Health Prereq: H 524	2	R	Y	Biostatistical tools for scientific applications in public health using logistic regression analysis. Confounding, effect modification, variable selection, assessing model fit, exploratory data analysis, and observational studies. Emphasis on the use of statistical packages for analyzing public health data.
BIOS	H 564	Computing Tools and Health Data Analysis Co-req: H 524	3	R and SAS	Y	Understand structures of data sets, read in data sets, and export data sets. Create and add new variables to data sets using mathematical functions and conditional execution. Merge, combine, and reshape data sets. Perform simple statistical procedures and interpret the statistical results from the R and SAS outputs. Generate publication-quality figures and annotate them
BIOS	H 566	Data Mining in Public Health Prereq: H 581 & H 564	3	R	Y	Stepwise regression, bootstrap and permutation methods, Penalized methods and cross-validation, Classification and Regression Trees (CART), Random Forests, Hierarchical Clustering, Support vector machines (SVMs) and general kernel methods, Generalized additive models, Principal components analysis (PCA) and related methods, Finite mixture models
BIOS	H 580	Linear Regression and Analysis of Time to Event Data Prereq: H 524 or HDFS 530	4	R	Y	Multiple linear regression analysis for measurement data and survival analysis methods for time to event health data, including modes of inference, diagnostics, model selection, and reporting conclusions. Note: Shared elements of HDFS 531 and HDFS 532, but not exchangeable.
BIOS	H 573	Introduction to Multilevel/Hierarchical Models	3	R	Y	Introduction to R. Review of regression using R. Frequentist Single-level/Multi-level Modeling in R. Bayesian Single-level/Multi-level Modeling in R/BUGS/JAGS/Stan. Causal Modeling (if time permits) Presentation of student-related research problems
BIOS	H 578	Introduction to Molecular Epidemiology I Prereq: H 524 or H 526	3	none	N	A survey of and introduction to the methods and issues arising in genetics and molecular epidemiology, including key biostatistical methods, study designs, and technologies used in the conduct of these studies. Students will gain experience conducting critical reviews of research papers with respect to study design and biostatistical analysis

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BIOS	H 581	Generalized Linear Models and Categorical Data Analysis	4	R	Y	Will provide a foundation for understanding and implementing generalized linear regression models used to analyze categorical data in epidemiological and public health settings. Focus will be on understanding and formulation of models that properly deal with relevant substantive modeling assumptions and on interpretation of results in context. Model estimation will be performed using the statistical language R and will also include additional R-based instruction on preparing data for analysis and presenting results. Note: Shared elements of HDFS 531 and HDFS 532, but not exchangeable.
BIOS	H 582	Analysis of Correlated Health Data Prereq: H 581	4	R	Y	Identify longitudinal and hierarchical data. Discuss issues involved in analyzing longitudinal and hierarchical data. Conduct and interpret output from exploratory analysis of correlated health data. Develop and interpret a model for the population mean for correlated data. Develop and interpret a model for correlation structure. Implement proper usage and interpretation of conditional models and marginal models. Use statistical software to conduct defensible analyses of continuous, binary and count longitudinal and hierarchical data. Identify and differentiate among methods used in conducting analyses of correlated data. Employ model building and diagnostic tools and corrective procedures. Provide clear and accurate interpretations and written and oral presentations of the results from correlated data analysis. Note: Shared elements of HDFS 531, HDFS 532, and HDFS 630, but not exchangeable.
BIOS	H 584	Analysis of Intervention Studies and Clinical Trials Prereq: H 524 or HDFS 530 **not currently being offered**	3	R	Y	Describe and implement the elements of an experimental protocol. Describe and implement methods of randomization and blinding. Describe the reasons for stratification and implement methods for analyzing such studies. Compute sample sizes or power for various types of experimental designs. Describe intervention studies. Design a basic clinical trial. Analyze data and report findings from a clinical trial
BIOS	H 586	Bayesian Biostatistics in Public Health Prereq: H 581 **Not currently being offered**	3	R	Y	This course introduces the principles of Bayesian Statistical Analysis. The course will include a large amount of Bayesian theory, though much of the course will involve hands-on work analyzing problems using computer software packages WinBUGS and JAGS and perhaps Stan.
BIOS	H 587	Time to Event Analysis of Health Data Prereq: H 524 or HDFS 530 **Not currently being offered**	3	R	Y	
BIOS	H 599	Intermediate R with Applications	3	R	Y	Introduction to and development of the R programming language for use in Public Health data analysis.
EOH	H 547	GIS and Public Health	4	GIS	Y	Identify the importance of a spatial perspective in public health. Explain basic concepts of spatial data as they apply to health data and public health applications. Recognize different uses of GIS in public health. Use GIS to map health data. Apply a number of spatial techniques to analyze health data. Critically interpret spatial approaches and methodology in public health.
EOH	H 542	Environmental and Occupational Health Risk Assessment	3	none	N	Understand concepts, principles and practices in modern environmental and occupational risk analysis and how they are utilized to make evidence-based decisions by regulatory agencies.
EOH	H 543	Exposure Science I	4	R	Y	Provides a broad introduction to environmental and occupational exposure assessment methods. Students collect and analyze environmental data, using R for data analysis.
EOH	H 592	Spatial Epidemiology Prereq: H 547 or H 581 **Not currently being offered**	3			

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EOH	H 642	Environmental and Regulatory Risk Assessment	3	none	N	Understand the concepts, principles and practices that are the basis for modern risk analysis. Critically examine the different types of evidence needed to support risk-based decisions and sources of scientific uncertainty. Develop skills to communicate the results of risk assessments. Understand the factors shaping public perception of risk and how this may differ from scientific determinations of risk. Explore the role of risk assessment in establishing evidence-based decisions by regulatory agencies responsible for protecting the public from environmental hazards.
EOH	H 683	Advanced Research Methods in EOH	3	none	N	framing environmental and occupational health issues into testable hypotheses, designing appropriate studies, and identifying strengths and weaknesses of different research methods.
EPI	H 525	Epidemiological Methods I Prereq: H 513 B- or better or H 535 B- or better	3	None	Y calculator based	Introduction to the concepts and methods of epidemiology. Topics include measures of population health, screening, study design, measures of association, and interpretation of epidemiological data.
EPI	H 526	Epidemiological Methods II prereq: H 524 B- or better or H 525 B- or better	3	Excel	Y	Concepts and methods of epidemiological analysis; planning and conducting epidemiologic research; role of multivariate analysis in standardization; stratified analysis; confounding and its control;
EPI	H 535	Interpreting Epidemiologic Evidence	3	None	Y calculator based	Intended for students in the human sciences and allied health fields, H535 will introduce students to basic epidemiology concepts. Topics will include: measures of disease frequency, assessing population health, causal logic, quantifying associations between exposures and health outcomes, epidemiologic study design, and threats to study validity (random error, bias, confounding)
EPI	H 537	Injury Epidemiology Prereq: H 513 B- or better or H 525 B- or better for H 535 B- or better or HHS 513 B- or better	3	None	N	An overview of the distribution and determinants of injuries, methodological issues specific to injury epidemiology, and approaches to injury control.
EPI	H 544	Environmental and Occupational Epidemiology prereq: H 525 C or better	3	None	? May be part of project	Independent Project: You will complete an independent environmental or occupational epidemiological research analysis in this course. You can either i) design a new study, ii) analyze your own data, or iii) request a data set from the instructor. The study design and/or data must include both an exposure and a health outcome. The project will include 2 elements: a written proposal and a scientific poster.
EPI	H552	Disaster Epidemiology Prereq: H 513 B- or better or H 525 B- or better or H 535 B- or better or HHS 514 B- or better	3	EpInfo	Y	Describe the impact of natural and manmade disasters on populations at the global, national, and regional levels; Apply epidemiologic methods to identify the impact and determinants of disaster-related death, illness, injury, disability, or other health outcome; Identify appropriate sources of surveillance data used in disaster epidemiology; Develop a Rapid Needs Assessment tool and sampling plan for a community affected by a disaster; Analyze data generated from an epidemiologic field investigation following a disaster; Identify appropriate intervention and prevention strategies; Critically evaluate published epidemiologic studies of the health impact of disasters; Develop skills in oral and written communication of epidemiologic findings and analyses.

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EPI	H 551	Applied Epidemiological Analysis of Secondary Data Prereq: H 526 B- or better and H 560 B- and H 580 B-	3	SAS	Y	Practical experience performing a hypothesis driven epidemiological analysis utilizing secondary surveillance or other appropriate data set, writing an analytical plan, appropriate programming for the analysis (using SAS), understanding the analysis output, preparing tables, and interpreting results.
EPI	H 554	Epidemiology of Aging Prereq: H 513 B- or better or H 525 B- or better or H 535 B- or better or HHS 514 B- or better **Not currently being offered**	3	None	N	not currently offered due to Odden leaving
EPI	H 555	Cancer Epidemiology Prereq: H 513 B- or better or HHS 514 B- or better or H 525 B- or better or H 535 B- or better	3	SEER*STAT	Y	Introduction to basic concepts and methodology in cancer epidemiology.
EPI	H560	Public Health Surveillance Prereq: H 524 B- or Better or H 525 B-	3	None	N	Describe the principles of public health surveillance. Describe and critically evaluate existing surveillance systems, both nationally and internationally. Explain and critically discuss the methods for analyzing and interpreting surveillance data. Research and design a secondary data analysis project utilizing an existing surveillance system. Students prepare specific analytical plan including operationalizing variables.
EPI	H 562	Infectious Disease Epidemiology prereq: H 513 B - or better or H 525 B - or better or H 535 B- or better or H 514B- or better	3	EpInfo	Y	Describe the global, national, and local burden of infectious diseases and their sources of exposure to human populations; Apply infectious disease principles and epidemiologic methods to investigate occurrence of infectious diseases in communities; Identify appropriate sources of data for infectious disease epidemiology. Apply epidemiologic methods in the prevention and control of infectious diseases; Analyze epidemiologic data generated from an outbreak investigation; Conduct critical appraisals of published epidemiologic studies of infectious disease; Develop skills in oral and written communication of epidemiologic findings and analyses
EPI	H 563	Physical Activity Epidemiology Prereq: H 513 B- or better or HHS 514 B- or better or H 525 B- or better or H 535 B- or better	3	Excel	Y	small data collection and analysis related to PA questionnaire
EPI	HHS 584	Surveillance/Field Epidemiology for Public Health Prereq: H 524 B- or better or HHS 514 B- or better	3			
EPI	H593	Reproductive Epidemiology Prereq: H 513 B- or better or HHS 514 B- or better or H 525 B- or better or H 535 B- or better	3	None	N	current research, controversial issues, and methodological problems in the epidemiology of reproductive health
EPI	H 596	Healthcare Epidemiology Prereq: H 513 B- or better or H 525 B- or better or H 535 B- or better or HHS 514 B- or better	3	None	N	current research, controversial issues, and methodological problems in the epidemiology of healthcare
EPI	H650	Reporting results: writing for epidemiology Prereq: H 526 B- or better and H 551 B- and H 580 B-	3	SAS	Y if additional analyses is needed	Focus on interpretation of data and presenting results in tables and figures. Identify a suitable journal or other appropriate format for disseminating results. Critically evaluate and determine the components of the data analysis to include in the paper. Demonstrate appropriate presentation of results in tables and/or figures. Develop and write the key components of the paper, including revisions. Demonstrate a clearly written lay summary, cover letter, and response to reviewers. Critically evaluate a manuscript submission and provide a written review.
EPI	H 651	Advanced Epidemiological Methods prereq: H 526 B - or better and H 581 B- **Not currently being offered**	4	R	Y	Critique modern causal theory and apply causal models. Identify appropriate measures of disease and association. Apply advanced methods to address sources of bias in epidemiologic studies. Evaluate the role of statistical models in epidemiologic investigations. Assess confounding, mediation, and effect modification in epidemiologic studies. Identify strengths and weakness of study designs

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EPI	H 652	Causal Inferences in Epidemiology Prereq: H 651 B- or better **Not currently being offered**	3	R	Y	Critique modern causal theory. Calculate a propensity score and incorporate in an analysis. Evaluate the theory and assumptions of marginal structural models. Construct a marginal structural model using inverse probability of treatment weights. Evaluate the strengths and weakness of different estimation methods. Appraise modern methods to recreate experimental conditions based on observational data
EPI	H 662	Advanced Methods in Infectious Disease Epidemiology Prereq: H 526 B- or better and H 562 B-	3	none	N	Covers advanced methods and principles for infectious disease research, including framing infectious disease issues into testable hypotheses, designing epidemiologic studies using appropriate sampling strategies, and identifying strengths and weaknesses of various epidemiologic research methods.
GH	H516	Research Methods in Global Health	3	none	N	Overview of research methods used to understand health, illness, health care, and health-seeking behavior in global settings. Special emphasis on the use of qualitative and ethnographic health research.
HDFS	HDFS 529	Introductory Data Analysis with SAS	1	SAS	Y	Understand concepts related to univariate and bivariate statistics. Appropriately apply concepts related to univariate and bivariate statistics for the purposes of describing behavioral and social science data. Interpret, report, and communicate the results of data analyses in a professional and scientific fashion. Utilize SAS statistical software for the purposes of basic description and analysis of behavioral and social science research data.
HDFS	HDFS 530	Research in Human Development and Family Sciences I	4	SAS		No longer offered
HDFS	HDFS 531	Applied Quantitative Methods I: ANOVA prereq: HDFS 529 B- or better	4	SAS	Y	Study design, statistical power, GLM w/categorical predictors, interactions, BS, WS and Mixed Factorial-type designs. Understand the theoretical basis of the general linear model and assumptions of GLM-based analytic techniques including ANOVA, repeated measures ANOVA, ANCOVA and MANOVA. Appropriately apply ANOVA, repeated measures ANOVA, ANCOVA and MANOVA for the purposes of analyzing experimental and non-experimental behavioral and social science data. Interpret, report and communicate the results of data analysis in a professional and scientific fashion, using APA style. Utilize SAS statistical software for the purposes of the design and analysis of quantitative behavioral and social science research studies. Note: Shared elements of H580, H581, and H582, but not exchangeable.
HDFS	HDFS 532	Applied Quantitative Methods II: Linear Regression Prereq: HDFS 531 B- or better	4	SAS		Understand key aspects of multiple regression. Analyze data using multiple regression. Interpret, report and communicate the results of data analysis in a professional and scientific fashion, using APA style. Utilize SAS statistical software for the purposes of the design and analysis of quantitative behavioral and social science research studies. Note: Shared elements of H580, H581, and H582, but not exchangeable.

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HDFS	HDFS 630	Quantitative Methods in Family and Individual Development Prereq: HDFS 532 B- or better	3	SAS	Y	Switches between multilevel models and SEM's yearly. For SEM: Understand and apply basic concepts related to factor analysis and SEM, Demonstrate familiarity with the Mplus and/or LAVAAN statistical packages, Interpret, report, and communicate the results of CFA and SEM. For multilevel models: Understand the theoretical basis and appropriate application of the multilevel model in the context of longitudinal/repeated measures data, Develop research questions that are most appropriately answered with longitudinal/repeated measures data and multilevel analysis, Appropriately apply MLM techniques for the purposes of analyzing longitudinal/repeated measures data in the behavioral and social sciences, Interpret, report and communicate the results of multilevel data analysis in a professional and scientific fashion both orally, and written using APA style, Utilize statistical software for the purpose of analyzing quantitative behavioral and social science research data. Note: Shared elements of H582, H573, H651, and H652, but not exchangeable.
HMP	H 598	Health Policy Analysis Methods prereq: H 513 B- or better and H 533 B-	3	Stata	Y	The Student will be able to (a) describe the linkages between health policy analysis and health policy; (b) synthesize health policy research literature; (c) generate health policy research questions; (d) identify potential data sources for health policy analysis; (e) outline a strategy for conducting quantitative health policy analysis using real-world data; (f) identify limitations of data sources to conduct policy research; and (g) conduct an empirical analysis
HMP	H 630	Quantitative Health Policy Research Methods I Prereq: H 524 B- or better	4	Stata	Y	Understand the quantitative approach to health services and health policy research and apply it to developing independent research questions. Understand the theory and practice of multiple linear regression and apply it to health policy research questions. Understand major health policy research journals and utilize them for independent research. Access and analyze major publicly available datasets for health policy research. Write a proposal for a secondary data analysis in health policy, including research question, literature review, methods, and descriptive statistics. Use the Stata statistical package for data management and linear regression models in health policy research
HMP	H 632	Applied Health Economics prereq: H 630 B- or better	4	Stata	Y	The Student will be able to describe the linkages between health policy/services research and health policy; evaluate health policy research literature; generate health policy research questions; outline a strategy for conducting health policy research; identify limitations of data sources to conduct policy research; perform quantitative analysis of secondary data; and write an empirical research paper. A particular emphasis will be given to fostering students' capability of actually carrying out state-of-the-art empirical analysis in health policy and services research using modern quantitative econometric methods that render strong causal inference.
HMP	H 635	Cost Effectiveness Analysis in Health and Medical Care	3	TreeAge	Y	Explain strengths and limitations of cost-effectiveness analysis in a variety of contexts. Discuss core concepts of cost-effectiveness analysis. Interpret cost-effectiveness results. Criticize cost-effectiveness research articles. Conduct all stages of a basic cost effectiveness analysis. Communicate a basic cost-effectiveness analysis to the relevant audience.
HMP	H 659	Quantitative Health Policy Research Methods II Prereq: H 630 B- or better	4	Stata	Y	The Student will be able to describe the linkages between health policy/services research and health policy; evaluate health policy research literature; generate health policy research questions; outline a strategy for conducting health policy research; identify limitations of data sources to conduct policy research; perform quantitative analysis of secondary data; and write an empirical research paper.

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HPHB	H 515	Research Methods in Social and Behavioral Health Sciences	3	none	N	Definition of research problems and questions, hypothesis generation, research design, sampling, variable definition and measurement, data collection, and ethical considerations. Also provides a brief introduction to qualitative and mixed methods.
HPHB	H575	Evaluation of health promotion and education programs Prereq: H 513 B- or better or H 515 B- or better or H HHS 514 B- or better	3	none	N	Provides theoretical and practical bases for program evaluation. Develops basic skills in a variety of approaches to evaluation, including techniques that are suitable for evaluating health promotion, community health improvement, and related health and social services programs. Course learning is synthesized through designing an evaluation framework and methodology for a relevant program
HPHB	H 615	Advanced Evaluation and Research Design Prereq: H 515 and H 575	3	none	N	Provides an in-depth examination of advanced research designs and methods for establishing causal statements about efficacy, effectiveness, and generalizability of public health and social service interventions designed to alter public health and social risk or protective factors.
HPHB	H673	Measurement of health behavior concepts Prereq: H 524, H 515 and 3 credit in other quantitative research methods or social behavioral methods (eg. sociology or psychology or health promotion or education programs)	4	none	N	This course will provide training in the development and evaluation of structured-quantitative questions of relevance to public health. Course goals will be synthesized through readings, and didactic and hands-on experience in conceptualizing and developing structured quantitative items and multi-item measures (e.g., scales).
HPHB	H699	Research practicum				In this course, students (a) organize, refine, and sort literature searches; (b) develop and formalize research questions; and (c) contextualize their research questions within a single page NIH-style specific aims document.
HPHB	H699	Research manuscript	4	none	N	Receive instruction on writing scientific manuscripts for publication in public health, particularly social and behavioral sciences; develop writing skills by studying and modeling scholarly articles and practical examples, developing a series of iterative drafts, and through constructive and collegial peer review. The final product is a manuscript draft.
NUTR	None					
KIN	KIN573	Measurement in Human Movement	3	none	N	Measurement, reliability, validity, random and systematic errors and other terminology directly related to measurement and research design; Demonstrate conceptual understanding of validity; Be able to identify different strategies to evaluate validity of measurement. Demonstrate conceptual understanding of reliability and standard error of measurement under Classical Test Theory; Be able to identify and conduct different strategies to provide reliability evidence; Demonstrate conceptual understanding of Generalizability theory; Be able to design and interpret Generalizability theory;. Demonstrate knowledge of current measurement topics in Kinesiology; Comprehend and critically evaluate research; Demonstrate conceptual understanding of Item Response theory***
KIN	KIN575	Research Methods in Human Movement	3	none	N	On successful completion of this course, students will be able to: Define research and explain the scientific method; Demonstrate an awareness of ethical issues in research; Perform a literature search and compile a literature review; Comprehend and critically evaluate different research approaches and designs; Explain statistical concepts and choose an appropriate statistical analysis technique; Formulate the problem statement, aims, hypotheses, and methodology for a research study; Write and orally present a research proposal.

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KIN	KIN577	Multivariate Analysis in Human Performance Research **Has not been offered in more than 8 years.**				
KIN	KIN532	Physical Activity Assessment	3	R	y	Exposes students to the R programming language and environment using two integrated assignments – with the latter assignment building upon the former. Physical activity assessment often involves working with moderate-to-large quantities of data collected using a variety of subjective/objective measurement instruments. Most often, these data require significant processing and treatment before any formal analysis may be undertaken – particularly when dealing with objective data collected using modern wearable devices which may provide up to 4 GB worth of data per participant for every 7 days of assessment. Quantitative methods in KIN 532 focus on data handling, cleaning, and reduction. Specifically, students are exposed to R’s split-apply-combine data processing approach while learning how to compute basic summary statistics (e.g., means, frequencies, several dispersion statistics). Students also gain experience producing graphical depictions using R’s built-in and ggplot2 functions.
PHP	HHS 578	Evidence-Based Public Health I Prereq: H 513 B- or better or HHS 514 B- or better	3	none	N	This is the first in a two-course series and provides theoretical and practical bases to identify, implement and evaluate evidence-based research (i.e. programs, surveillance, policies).
PHP	HHS 579	Evidence-Based Public Health II Prereq: H 575 B- or better and HHS 578 B -	3			Develop a rationale for evidence-based public health programming. Develop process and short and long-term outcome evaluations. Identify necessary community and government partnerships. Write a program proposal and how to revise it for different types of funders. Incorporate ethical principles in development of a program plan. Describe the role of differences in program, development for diverse populations.