

Course Title: MOD8-HON211G-Statistics**Introduction to Statistics for Midwives**

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Credits: 3.00

Course Description: This course provides midwifery students with the basic statistical skills needed to interpret scientific studies. Students will learn the fundamentals of the scientific method and implementation of research studies, an overview of commonly applied statistical methods used in health research, practice analyzing actual birth related studies and exposure to basic calculation of descriptive statistics. Students also look at ethical and political issues around how statistics are gathered and calculated, the process involved in the creation of clinical studies and how results from these are applied to maternity care.

Learning Objectives:

- A: Student will be able to answer the Study Questions (below).
 B: Student will be able to demonstrate thorough knowledge of the Clinical Skills required for this course: (None required for this course)
 C: Student will demonstrate thorough knowledge of the MANA Core Competencies for Midwives required for this course (below).
 D: Student will be able to demonstrate knowledge of any new information in the area of study.

Learning Activities:

- I. Student Reads required texts.
- II. Student Completes study questions.
- III. Preceptor elaborates on study questions.
- IV. Clinical Skills and Core Competencies training consists of the following (may take place at clinical visits or at childbirth education classes):

1. Preceptor Explanation of	Safe, evidence-based midwifery care for the individual Clinical Skills and Core Competencies including etiology, sequelae, appropriate management and follow-up for the individual patient, appropriate times and reasons for consult and referral, access to relevant resources and information, complete, thorough and timely record keeping, appropriate, professional, and compassionate management of every task involved, receptiveness and responsiveness to patient's concerns. The Explanation will include a discussion of midwifery decisions and actions as they relate to possible outcomes and their wider impact, based on the Midwives Model of Care®.
2. Preceptor Demonstration of	
3. Student Practice of	
4. Student Demonstration of	

- V. Student researches and presents to the preceptor relevant latest developments in academic and clinical midwifery as relevant to the subject.
- VI. Student/Preceptor discussion.

Learning Materials / Resources:

(Please use textbooks less than 5 years old, or most recent edition)

1. Cluett, Elizabeth R. (Author), Bluff, Rosalind (FE). Principles and Practice of Research in Midwifery. 2nd edition. Churchill Livingstone. 2006.

Part I (*click on the links to open the readings*):

2. [Definitions](#)
3. [Introduction to the scientific method](#)
4. [L. Cheney Lab 1](#)

Part II:

5. [Murphy, Patricia Aikins, and Albers, Sarah L. Evaluation of Research Studies. J. of Nurse Midwifery. Vol 37, No. 4. 1992.](#)
6. [Flint, Caroline. The Know Your Midwife Scheme.](#)

Part III:

7. [Mehl-Madrona, Lewis and Morgaine. Physician and Midwife-Attended Home Births. J. of Nurse Midwifery. Vol 42, No. 2. 1997.](#)
8. [Cheyney Definitions-Mortality Statistics](#)
9. [Induction, Mosoprostol Controversy](#)
10. [Planned Home Births in BC, Janssen](#)
11. [Washington State Planned \(Pang\)](#)

Part IV:

12. [Cheyney Spreadsheet](#)
13. [CMSC-MANA Stats Form](#)

Other resources:

14. MANA Core Competencies for Midwives
15. MANA Website, regarding collection of statistics:
<http://mana.org/statform.html>
16. Midwives Model of Care®.
17. Internet links as needed for latest developments in midwifery care:
[The Cochrane Collaboration](#)
[EBSCO](#)
[National Library of Medicine](#)
[PubMed](#)
[Medline](#)
[SCIRUS](#)
[Medscape](#)
[World Health Organization](#)
18. Course Bibliography (at the end of syllabus).

Evaluation Tools / Methods:

1. Answers to study questions: Student must achieve at least 80% correct to pass. The preceptor evaluates each answer for correctness and explains the questions that were incorrect. Study questions count for 90% of the final grade.
2. Clinical Skills: no clinical skills required for this course.
3. MANA Core Competencies: Student's ability to apply MANA Core Competencies for Midwives in discussion to simulated and real-life situations. This counts for 5% of the final grade.

Evaluation of NARM Skills and MANA Core Competencies: The student demonstrates thorough knowledge to the satisfaction of the preceptor in the following areas:

**The student will be able to, in accordance with safe, evidence-based midwifery care, explain the condition, verbalize etiology and sequelae, verbalize appropriate management for the individual patient, follow up appropriately, consult and refer appropriately, access resources and information, accomplish complete, thorough and timely record keeping, appropriately manage every task involved correctly, professionally, and compassionately, while being receptive and responsive to patient's concerns. She/he will be able to explain her decisions and actions as they relate to possible outcomes and their wider impact.*

4. Student presentation of new information in area of study. The preceptor evaluates the correctness of the information presented. This counts for 5% of the grade.

The **Statistics for Midwives** course is divided into four parts. Readings for the course are included on this CD-rom (see list below). Students may also require a comprehensive statistics textbook. Or- NCM has a statistics course on video available for loan. Please call to be put on the waiting list.

Part I: Fundamentals of the Scientific Method and the Implementation of Research Agendas

Part I (click on the links to open the readings):

1. [Definitions](#)
2. [Introduction to the scientific method](#)
3. [L. Cheney Lab 1](#)

Study Questions for Part I:

1. Define the Scientific Method.
2. List and describe the four main steps of the scientific method.
3. Explain the importance of the predictive powers of hypotheses or theories in the scientific method.
4. Explain the difference between hypotheses, theories, models, laws, faith, and facts. Explain how some of these terms have been misapplied in popular usage.
5. Explain the importance of repeatability in the scientific method.
6. Explain why scientists argue that theories must be falsifiable. Provide one example of a theory that is falsifiable. Provide an example of one that is not falsifiable.
7. Explain the difference between laws of nature and moral laws. Why is the conflation of these categories considered problematic by scientists?

8. Define the principle of Occam's Razor. Explain how it is used in scientific inquiry.
9. Describe the phenomenon known as "the experimenter effect" and explain how it can introduce error into a study.
10. Define the blinder argument (sometimes also called the blinker argument). Explain how this has affected clinical studies on midwifery outcomes.
11. List and describe two sources of error in experimental study. Explain how scientists attempt to compensate for these.
12. Discuss three examples of common mistakes made when applying the scientific method. Explain two ways these may be avoided.
13. Define the term "variable." Explain the differences between discrete and continuous variables and provide one example of each that is pertinent to maternal and infant health research.
14. Define "hypothesis."
15. Explain the difference between the active and the null hypothesis and provide an example of each that is pertinent to maternal and infant health research.
16. Define a predictive statement. Which kind of hypothesis is used to generate a predictive statement? Write an example of a predictive statement based on a hypothesis from above (objective #15).
17. List and explain the three main goals in developing a controlled experiment.
18. Explain the difference between dependent and independent variables. Identify the dependent and independent variables in the following statement:
If multiparous and primiparous women with occiput anterior presentations are compared, then there will be no effect on length of active labor.
19. Define the Hawthorne effect. Differentiate between blind and double blind studies. Explain the rationale for each. State whether the following is an example of a blind or double blind study. Explain your answer.
A new method of labor induction is ready for human testing. A group of 200 low risk primiparous women at 40 weeks gestation as calculated by LMP whose cervixes are less than or equal to one centimeter dilated with no perceived uterine contractions are randomly assigned to either a treatment or a control group. Those in the control group are to receive a placebo so that neither group knows which is receiving treatment. The obstetricians involved in the study evaluate each mother hourly to determine the presence or absence of active labor. The doctors are not

told who receives the active drug and who receives the placebo. Does the time to onset of active labor differ significantly for each group?

20. Explain the role of confounding variables in scientific inquiry. Is the following experiment effectively designed to protect against confounding variables?

Explain your answer.

A study is carried out to see which of two methods of teaching statistics to Direct-entry Midwives is most effective. Method A is presented by Teacher I in two randomly selected classes, and Method B is presented by Teacher II in two randomly selected classes. At the end of the study, an examination is administered to the students of each class and the exam scores are recorded. Does exam score depend on the teaching method, i.e. are exam scores significantly different when methods of teaching are compared?

Part II: Overview of Commonly Applied Statistical Tests in Health Research

Part II (click on the links to open the readings):

1. [Murphy, Patricia Aikins, and Albers, Sarah L. Evaluation of Research Studies. J. of Nurse Midwifery. Vol 37, No. 4. 1992.](#)
2. [Flint, Caroline. The Know Your Midwife Scheme.](#)

Study Questions for Part II:

21. Describe the two main types of studies in medical research.
22. Define clinical trials.
23. Define random allocation or randomization. Explain why this is so important for statistical testing of experimental data.
24. Define volunteer bias. Explain how this can influence the outcome of a study.
25. Define response bias and placebo effect. Explain how these may be avoided.
26. Read the “Know your Midwife Report” (Flint and Poulengeris 1986) in your course packet. Explain how the women knowing the type of care they were receiving may have influenced outcomes. Explain what comparison should be made to test whether KYM has an effect on method of delivery. Discuss the ethics involved in randomizing women without their knowledge.
27. Define observation study. Explain the benefits and problems associated with this approach.
28. Distinguish between census and sampling in data collection. Explain the benefits of sampling.
29. Define statistical population and explain how it is related to a sample.

30. Define random sampling. Select one method of random sampling and describe how it is carried out. Explain why random sampling is so important to statistical analysis.
31. Sampling in clinical and epidemiological research is often far from ideal. Explain why this is and whether and under what condition these studies may still provide valuable insights.
32. Describe what is meant by a cross-sectional study. Explain the relative benefits and shortcomings associated with this type of study.
33. Define prevalence and incidence rates. Provide an example of each that is pertinent to childbirth research.
34. Define cohort study. Explain the benefits and shortcomings of this type of research.
35. Describe the differences between prospective and retrospective studies. Explain the benefits and shortcomings of each.
36. Define longitudinal study. Explain the benefits and shortcoming of this method of analysis.
37. Define questionnaire bias in observational studies. Review the following examples of hypothetical questions and discuss the answers you might expect from questions worded like these. Reword each question to help reduce questionnaire bias.
 - a. *Example 1: Do you think people should be free to access the best possible obstetric care possible for themselves and their families, free of interference from state bureaucracy?*
 - b. *Example 2: Should the wealthy be able to buy a position at the head of the line for obstetric care, pushing aside those with greater need, or should obstetric care be available based solely on need regardless of socioeconomic status?*
38. Explain the differences between qualitative, discrete quantitative and continuous quantitative data.
39. Define frequency, relative frequency and frequency distribution of a variable. State the most common method of displaying a frequency distribution. Draw a histogram based on the following data set.

Frequency of one minute Apgar scores for births completed at home
Total n = 581

<u>1 minute APGAR score</u>	<u>frequency</u>
10	178
9	304
8	51
7	22
6	9
5	4
4	3
3	3
2	0
1	7

40. Define mode, median and mean.
41. Define outlier. Explain the significance of outliers?
42. List the two measures of central tendency. Name and define the other measurement that should always be given when a measure of central tendency is reported. Explain why this is so important.
43. Define range.
44. List and describe the two most common measures of dispersion around the mean. (Do not worry about the formulas for calculating these. All current statistical programs calculate them for you. You just need to know what they measure, how to read them and why it is so important to remember to report them).
45. Explain what large and small standard deviations indicate, respectively, about a sample.
46. Define probability. Distinguish between probability for discrete and continuous variables.
47. Define binomial distribution.
48. Define normal distribution. Provide one example of a variable that tends to be normally distributed. Explain one approach that can be used to transform data to a normal distribution. Explain why it is important to transform data to a normal distribution before analyzing it.
49. Define sampling distribution. Explain what a standard error measures. Is the sample mean more likely to estimate the population mean when your sample is large or small?

50. Explain what it means when we say that for 95% of confidence intervals it is true that the population value lies within the interval.
51. Provide the symbols used to denote the following commonly reported calculations or variables:
- Population mean =
 - Sample mean =
 - Population variable =
 - Sample variance =
52. List the five general principles of significance tests (You may want to go back and review null and alternative hypotheses here). If the data are not consistent with the null hypothesis (i.e. you reject the null hypothesis) the difference is said to be _____. If the data do not support the null hypothesis we say we have _____.
53. Define “p-value” or significance level (remember that the p-value does NOT mean the probability that the null hypothesis is true).
54. Describe the differences between type I and type II errors.
55. State the most commonly used guideline (p-value/significance level) used to determine when differences should be considered significant. Explain what this value means.
56. Summarize what the following p-values indicate about the strength of evidence.
- Greater than 0.1:
 - Between 0.05 and 0.1:
 - Between 0.01 and 0.05:
 - Less than 0.01:
 - Less than 0.001:
57. Explain what is meant by the power of a test.
58. Explain the differences between one- and two-tailed tests. Which one is preferred when analyzing biological data?
59. Define meta-analysis. Explain the main strengths and weaknesses of this method.
60. Define measurement error. List two sources of it.
61. Explain the difference between sensitivity and specificity.
62. Explain positive and negative predictive values.

63. List at least five important questions that should be asked when examining a clinical study.

64. List the information that should always be included in studies that report biomedical findings.

Optional questions:

For those of you who are interested in more sophisticated statistical analysis, it is important to know the following information for the tests listed below:

- Summarize what the test is used for and what it tells the researcher
- Explain the main strengths and weaknesses for each
 - a. t-tests
 - b. Regression
 - c. Correlation
 - d. Differences between parametric and nonparametric tests
 - e. Cross tabulations
 - f. Chi-square test

Part III: Sample Study Practice

Part III (click on the links to open the readings):

1. [Mehi-Madrona, Lewis and Morgaine. Physician and Midwife-Attended Home Births. J. of Nurse Midwifery. Vol 42, No. 2. 1997.](#)
2. [Cheyney Definitions-Mortality Statistics](#)
3. [Induction, Misoprostol Controversy](#)
4. [Planned Home Births in BC, Janssen](#)
5. [Washington State Planned \(Pang\)](#)

Study Questions for Part III:

65. Read the article and book excerpt by Goldberg and Wing (2003) and Gaskin (2002), respectively, on the controversial use of misoprostal (cytotec) as an induction agent. Summarize the main arguments of each. Given the highly sensitive nature of the debate over the above's use, we might expect to see widely varying interpretations of the available data. Can you tell where each researcher stands in terms of their own beliefs about cytotec? Were precautions taken to guard against the effects of researcher bias? Critique their respective analyses focusing on how data was collected, the role of confounding variables, and the strength of interpretations made from observations. Calculate the neonatal mortality rate for the data Gaskin presents. How does this compare to U.S. infant mortality rates? Provide an overall interpretation of these studies.

66. Read the Janssen *et al.* 2002 and the Pang *et al.* 2002 studies. Summarize the main findings of each. Critique the methods and outcomes reported in each study. Discuss the major problems or concerns associated with each approach. Describe the strengths (if any) of each. Are the results and

interpretations provided by each group of researchers reliable? Explain why or why not.

67. Read the Mehl-Madrona and Madrona (1997) study and summarize the findings. Explain how confounding variables initially influenced the outcomes of the study. Discuss how researchers were able to provide more accurate assessments by analyzing various sub-samples of homebirthers. Evaluate the overall findings of this study.
68. Read the information available on the multiple marker-screening test (see <http://www.babycenter.com/prenatal-tests>, for example). Distinguish between the sensitivity and specificity of this test. Explain the test's negative and positive predictive values. Write a short summary of this information that you could use to explain the multiple marker test to a mother in your practice.

Part IV: Introduction to Spreadsheet Use, Commonly Cited Maternal and Infant Health Variables, and the Calculation of Descriptive Statistics

Part IV (click on the links to open the readings):

1. [Cheyney Spreadsheet](#)
2. [CMSC-MANA Stats Form](#)

Study Questions for Part IV:

69. List and define the main maternal and infant statistics collected and analyzed by MANA and NCHC, respectively.
70. Explore the vital statistics website for your state (a sample from Oregon is provided in the course packet). Define crude birth rate, live birth, and low birthweight infant.
71. Distinguish between fetal death ratio and infant death rate.
72. Explain how maternal death rate is calculated.
73. Define and distinguish between the following terms: neonatal death rate, postneonatal death rate, and perinatal death ratio. Explain the importance of conformity in reporting for the statistics.
74. List the variables that you would keep track of in your own practice if you wanted to be able to compare your outcomes to national samples.
75. Create a practice spreadsheet in EXCEL that incorporates the following data.

Case #	Active labor (minutes)	Pushing (minutes)	birth weight (g)
001	240	40	3629
002	120	12	4082

003	912	135	3685
004	45	6	3203
005	768	67	3770
006	196	16	4111
007	871	200	3232
009	567	19	4564
010	314	22	3147

76. Using spreadsheet commands, calculate mean length of active labor, mean length of pushing, and mean birth weight. List your n values, ranges and standard deviations for each variable tested.

Clinical Skills (NARM Skills)

No clinical skills required for this course.

Core Competencies (MANA Core Competencies for Midwives)

VII. Professional, Legal and Other Aspects

The entry-level midwife assumes responsibility for practicing in accord with the principles outlined in this document. The midwife uses a foundation of knowledge and/or skill which includes the following:

7 C. The principles and practice of data collection as relevant to midwifery care.

Course Bibliography of Recommended Readings:

1. Albers, L., and P. A. Murphy. Evaluation of Research Studies. Part III: Statistical Significance Testing. *Journal of Nurse-Midwifery* 38: 51-53. (course packet)
2. Bland, Martin. *An Introduction to Medical Statistics*, 3rd edition. Oxford: Oxford University Press.
3. Cheyney, Melissa. Practice Laboratory. Part I: Fundamentals of the Scientific Method and the Implementation of Research Agendas. *Course Packet for Introduction to Statistics for Midwives*. National College of Midwifery. Taos, New Mexico.
4. Part IV: Some Notes on Spreadsheet Use, Commonly Cited Maternal and Infant Health Variables, and the Calculation of Descriptive Statistics. *Course Packet for Introduction to Statistics for Midwives*. National College of Midwifery. Taos, New Mexico.
5. Fowler, J., P. Jarvis and M. Chevannes. *Practical Statistics for Nursing and Health Care*. NY: John Wiley and Sons, Ltd.
6. Gaskin, Ina May. *Ina May's Guide to Childbirth*. NY: Bantam Books. Pp. 211-214. "The Prostaglandins."
7. Goldberg, A. and D. Wing. Induction of Labor: The Misoprostal Controversy. *Journal of Midwifery and Women's Health* 48(4):244-248. (course packet)

8. Janssen, P. *et al.* Outcomes of planned home births versus planned hospital births after regulation of midwifery in British Columbia. *Canadian Journal of Midwifery* 166(3):315-323. (course packet)
9. Mehl-Madrona, L. and M. Madrona. Physician and midwife-attended home births: Effects of breech, twin and post-dates outcome data on mortality rates. *Journal of Nurse-Midwifery* 42(2):91-98. (course packet)
10. Murphy, P. A. and L. Albers. Evaluation of Research Studies. Part I: Randomized Trials. *Journal of Nurse-Midwifery* 37:287-290. (course packet)
11. Murphy, P. A. and L. Albers. Evaluation of Research Studies. Part II: Observational Studies. *Journal of Nurse-Midwifery* 37:411-413. (course packet)
12. Pang, J. *et al.* Outcomes of Planned Home Births in Washington State: 1989-1996. *Obstetrics and Gynecology* 100(2):253-259. (course packet)
13. Zeiger, Mimi. *Essentials of Writing Biomedical Research Papers*. NY: McGraw-Hill.

Web Resources:

14. Flint, C. and P. Poulengeris. *The 'Know Your Midwife' Report*. London: Caroline Flint. Available at:
http://www.birthcentre.com/essays/the_know_your_midwife_scheme_2.htm
(course packet)
15. Midwives Alliance of North America Statistics Form:
<http://www.mana.org/statform.html> (course packet)
16. National Centers for Health Statistics 2002 report:
http://www.cdc.gov/nchs/data/nvsr/nvsr50/nvsr50_05.pdf
17. Oregon Vital Statistics Website Definitions Page:
<http://www.dhs.state.or.us/publichealth/chs/arpt/02v1/definit.pdf> (course packet)
18. Prenatal Testing Guide: <http://www.babycenter.com/prenatal-tests>
19. Scientific Method:
http://teacher.nsr.rochester.edu/phy_labs/AppendixE/AppendixE.html (course packet)
20. http://phyun5.ucr.edu/~wudka/Physics7/Notes_www/node5.html
21. http://home.xnet.com/~blatura/skep_1.html