

STATISTICS AND THE WORKING NURSE

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ABSTRACT

Recently, Bellarmine University's Nursing department introduced two new programs: a bachelor's degree for registered nurses, and a professional doctorate in nursing practice. These programs enroll working nurses, who have substantially different needs than the traditional undergraduate population. This paper discusses how statistics course offerings have adapted to the demands of the other profession. More specifically, this paper considers several topics. Funding differs, since the employer pays most costs. Because participants have full time jobs, course meetings must become less frequent and longer, leading to substantial challenges. The topics and examples need to balance customary choices with the rapidly changing demands of the medical profession. Students' experience and computer availability shift computing requirements. Finally, the students have different demographics and personalities; this alters how classes are conducted, including the perplexing problem of perfectionism.

INTRODUCTION

While increasing life expectancy within a country has mostly positive aspects, it also requires changes to the country's workforce. As the population ages, demand increases for health services, which shifts more workers into health professions. Many countries experience shortages of skilled professionals; the World Health Organization identified 57 countries with critical shortages (2006). Even relatively wealthy countries have deficiencies. In recent years Australia has expanded school programs and opened immigration (Preston, 2009), while Britain struggles with recruitment and retention (Finlayson, Dixon, Meadows, & Blair, 2002). As a large, relatively unhealthy country, the United States situation is acute; estimates of the 2020 shortage range from 300,000 to 500,000 registered nurses (Buerhaus, 2008).

The US situation is complicated by a deficit of nurses with higher-level degrees. Unlike other regions such as Australia, New Zealand, and the European Union, a bachelor's degree is not mandatory before employment. Listing common qualifications from least to greatest education:

1. Licensed Practical Nurse (LPN), requiring one to two years of study after high school. This is considered a limited vocational degree, generally with no academic rank.
2. Registered Nurse (RN), an associates' degree earned after two or three years of tertiary study. This is the initial degree of slightly over half of US nurses (Aiken, Cheung, & Olds, 2009).
3. Bachelor of Science in Nursing (BSN), a four-year degree including RN status. This is the minimum degree required for most specialist and management positions. BSN holders are in much higher demand than RNs or LPNs. Recently, an Institute of Medicine report recommended increasing the proportion of RNs with a BSN from the current 50 percent to 80 percent (2011). This will include conversions from RN to BSN, as well as more direct BSN programs.
4. Masters of Science in Nursing, a two-year program beyond the BSN suitable for expert clinicians, managers, and independent specialists.
5. Doctor of Nursing Practice (DNP), a two to three year program beyond the MSN. While not a research degree like a PhD, this allows nurses to become faculty. Because nursing programs suffer from a faculty shortage, which causes them to turn away qualified applicants (American Association of Colleges of Nursing, 2011), programs granting this degree have rapidly expanded over the past decade.

BELLARMINE'S NURSING PROGRAM

Bellarmino University is a small private school located in Louisville, Kentucky, USA. Founded in 1950 as an all-male Catholic college, it merged with an all-female college and became independent in 1968. In fall 2011, about 2,450 undergraduates and 800 graduate students studied there ("Bellarmine Fast Facts", 2011). Bellarmine's first nursing program was established in 1975, a RN to BSN completion program; the second nursing program was an RN associate

degree. Over time, these programs were discontinued and Bellarmine introduced direct BSN and MSN programs. In 2010, the university restarted its RN to BSN program and initiated a DNP curriculum (“Nursing History at Bellarmine”, 2011). Corporate funding plays a role in these new programs. Almost all working students receive tuition reimbursement. For the RN to BSN program, the Norton Healthcare system also provides classrooms in their training center.

BSN students can meet the mathematical sciences requirement with two options. Math 205, Elementary Statistics, covers typical topics for an American first course, following the text *Introduction to the Practice of Statistics* (Moore, McCabe, & Craig, 2009). Math 200, *Statistics and Society*, is a less mathematically demanding alternative designed for nursing, communication, and humanities students, using the book *Seeing through Statistics* (Utts, 2005). Because Math 200 meets three hours per week, while Math 205 requires four, most prospective nurses take Math 200. We decided to offer an evening section of Math 200 for the RN to BSN program. I led this class during summer 2010, with 11 students, and summer 2011, with four.

The DNP program required a new offering. Accreditation standards include the ability to “Analyze epidemiological, biostatistical, environmental, and other appropriate scientific data related to individual, aggregate, and population health” (AACN, 2006, p. 16). The DNP program requires a “masters level” statistics course for entry. The nursing dean asked me to teach the advanced Nursing 808 in fall 2010, providing the topic list: ANOVA, repeated measures analysis of variance, correlation analysis, and multiple linear regression. This course enrolled 18 students.

LESSONS FROM THE EXPERIENCE

While many things could be said about structure, composition, and topics, this paper focuses on four key takeaways. In summary:

1. Teaching schedules must be like academics, not continuing education.
2. The languages of maths and technology are not the same for adult students.
3. Choose nursing topics, but not all nursing examples.
4. In statistics, unlike nursing, you can’t kill someone quickly.

SCHEDULES LIKE ACADEMICS, NOT CONTINUING EDUCATION

Many business training courses are scheduled as what I call “Continuing Education”, a small number of long time blocks. For instance, a class might meet four Saturdays from 8 AM to 4 PM, or nine Thursdays from 5 PM to 8 PM. This minimizes the number of trips and/or days off work. Academic courses are sometimes structured this way, with fewer instructor contact hours and substantial assignments between classes. Pedagogically, this ignores the spacing effect, that repeated distributed presentations of material yield better learning than massed presentations (Emptier & Farris, 1990). Practicality is considered more valuable.

The original course schedules followed this pattern. In 2010, Math 200 received just 21 hour over 7 consecutive Wednesday evenings, even though the semester course takes 35 hours (through 40 classes of 50 minutes). Nursing 808 was also planned for 7 three-hour sessions, roughly every other Saturday. Protests resulted in some changes; Math 200 added an eighth session, while the advanced course expanded to five hours per Saturday.

While expansion helped, the Continuing Education schedule was flawed. Students (and the instructor) had trouble concentrating for long periods of time. Then, the lack of close spacing meant a large amount of learning was lost from meeting to meeting. To help counteract this loss, assignment due dates were changed from the start of each class to before the next gathering, and each meeting began with review from the prior class and assignment. This was still not sufficient. Course schedules for adults should look like usual academic schedules, with meetings of 90 minutes or less held frequently, and sufficient total time with the instructor. (After the failure, the 2011 Math 200 section expanded to 13 Wednesday evenings, and went much, much better.)

DIFFERENT LANGUAGES OF MATHS AND TECHNOLOGY

Any relatively homogeneous group shares some characteristics. As an example, conventional Bellarmine BSN students generally have above average but not outstanding high school records. Roughly 90 percent are female, similar to the 92 percent female rate of American registered nurses (US Department of Labor, 2010). They take Math 200 during sophomore year,

meaning they have completed algebra within the last five years. They have worked with spreadsheets and web applets, and as Millennials are friendly to technology.

All 33 working students were female, so that remained similar. However, their math and technology experiences were quite different. About one-third of the working adult students had last taken an algebra course over 20 years ago, before the conventional students had been born. Computer skills were generally weaker; some had never used Microsoft Excel, while SPSS was very, very foreign. Facebook and web applets were less familiar, and their attitudes toward technology were not as affectionate.

Because the adult pupils had distinct histories, I modified some tasks. After noticing the BSN students' errors with formulas, I began the 2011 course with an hour on order of operations. In all courses, I allocated extra time for technology demonstrations (under the tight schedule), and wrote more extensive guides. Because the students did not enjoy technology, in Math 200 we found normal distribution probabilities with book tables instead of a Java applet.

NURSING TOPICS, NOT ALWAYS NURSING EXAMPLES

Teaching relevant topics is a fundamental goal of good statistics programs, so important that David Cox called it the first goal of a new statistics department (Mehta, 2004). Portions of Math 200 are already constructed for nursing students, such as a unit on medical risk and odds, so the course already has focus. For the working nurses, I could focus more. Their practical experience let me eliminate the short unit on ethics, and their knowledge of personal finance allowed me to simplify a few probability topics. Instead, I added more practice constructing graphics and reading articles involving confidence intervals.

Adjusting the DNP course was more challenging, because I followed the syllabus topics: ANOVA, repeated measures analysis of variance, correlation analysis, and multiple regression. Covered in the course textbook, *Statistics and Data Analysis for Nursing Research* (Polit, 2010), these topics are fine for a second or third course after a strong foundation. Unfortunately, for about half the students, their "masters level" statistics course covered less than Bellarmine's undergraduate Math 205. We wound up closing knowledge gaps in confidence intervals and regression; while relevant, that eliminated time for extra techniques such as survival analysis.

For the adult BSN students, an interesting dilemma arose. Several students specifically asked me NOT to include solely examples in nursing contexts; they wanted other settings. I was very surprised, because standard advice for introductory courses is to "make sure questions used with data sets are of use to students" (American Statistical Association, 2005, p. 16). Examples in a student's field answer the frustrating question "Why do we have to learn this?"

The students explained that they already know about rationales, unlike younger students. Through their work history, they've seen risk, disease, reports, and chance. Even worse, when hearing a nursing example, sometimes they ponder how the topic applies in nursing practice and neglect the statistical issues. This was most apparent when we discussed group presentation ideas. I routinely suggest recent mammogram guidelines (US Preventive Services Task Force, 2009), a meta-analysis that met substantial controversy. When I offered that in summer 2011, one student starting talking about cancer data being collected at work, while another wanted to talk about a friend's recent diagnosis. While interesting, that's not exactly the point.

IN STATISTICS, UNLIKE NURSING, YOU CAN'T KILL SOMEONE QUICKLY

Not only do working adults have different backgrounds and experiences than day students, they have different personal lives. For instance, Florida vacations are more often Disney World than bikinis on a beach. In my early thirties, I am younger than them, not older. Trying for sympathy, one DNP student asked to be taught as I would instruct my mother. She didn't know my mother is a retired high school math teacher.

In academic matters, the working nurses generally had a perfectionist ethic. While I appreciate students who really complete the reading, this had an unforeseen consequence. After the first two DNP homework assignments, I asked the students for time estimates. I had planned 8 to 10 hour assignments. About half the students worked that much, but many reported 16 to 20 hours. Two study groups had arranged weekly conference calls. While this wasn't absurd, since the nurses worked at different hospitals across Kentucky, it bordered on excessive. Additionally, I

had received several questions about exploration and interpretation, but fewer about description and computation. This seemed strange, because I thought the interpretation questions were easier.

Putting the evidence together, I realized that the students were applying their exacting standards from work, where uncertainty can cause great harm. Nurse perfectionism is common enough that it appears in literature reviews (Melrose, 2011). Practitioners want to do something “just right” or not at all, then obsess over their mistakes. This is understandable, because a mistake with a nursing patient can kill that person.

Statistics does not have that instantaneous nature, fortunately. Statistical error causes harm when it leads to bad decisions, sometimes on a grand scale, but the modeling process includes patient analysis and review. Uncertainty is a fundamental assumption. Once I recognized the disparity, I reminded the nurses that we focus on statistical process, learn to live with variability, and that the immediate consequences were not as severe. As the heading says, “In statistics, unlike nursing, you can’t kill someone quickly.” The students relaxed, at least a little, and I learned another lesson about the differences between student populations.

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