

## **Tracking Student Progress in a Baccalaureate Nursing Program: Academic Indicators**

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Repérer les étudiants «le plus susceptibles de réussir» est depuis longtemps le but des établissements scolaires. Il s'agit en même temps d'élaborer des critères d'admission qui soient valides et fiables, et de diminuer le pourcentage d'abandon au sein du programme. Dans la présente étude, on a examiné les résultats scolaires avant l'admission au programme de baccalauréat en sciences infirmières et on les a comparés avec les résultats au niveau des cours et la progression des étudiants au cours des deux premières années du programme. Bien que les moyennes aient montré que les deux classes d'étudiants présentaient un «risque moindre» d'échec à l'université, seulement 60 % des 89 étudiants des deux classes progressaient sans interruption. Les étudiants qui avaient de bons résultats à la fin du secondaire avaient tendance à continuer d'avoir de bons résultats dans les cours préalables pour l'université et ensuite en sciences infirmières. Les étudiants ayant des résultats médiocres à la fin de la première ou de la deuxième année en sciences infirmières avaient des moyennes plus basses dans le secondaire et dans leurs cours préalables pour l'université. Ces résultats ont des conséquences logiques pour l'admission et l'orientation des étudiants, et ils mènent à la recommandation que des études similaires soient menées dans tous les programmes en sciences infirmières et qu'une éventuelle étude longitudinale au sein du programme pris comme exemple soit menée afin de valider et de développer les résultats de l'étude.

Identification of students "most likely to succeed" has long been a goal of educational institutions, from the perspective of both identifying valid and reliable admission criteria and decreasing attrition rates within a program. In this study, scholastic performance prior to admission to a baccalaureate nursing program was examined in relation to students' level of achievement in courses and their progression in the first two years of the program. Although their incoming averages indicated that both classes of students were at "low risk" for failure in university, only 60% of the 89 students in the two classes were progressing without interruption. Students who did well in high school tended to continue to do well in prerequisite university courses and later in nursing. Students who were behind in their class at the end of Year 1 or Year 2 in the nursing program had significantly lower mean averages on high school credits and on prerequisite university courses. These findings have implications for the admission and counselling of students and lead to the recommendation that similar studies across nursing programs and a prospective longitudinal study within the sampled program be carried out to validate and expand upon study findings.

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Identification of students "most likely to succeed" has long been a goal of educational institutions, from the perspective of both identifying valid and reliable admission criteria and decreasing attrition rates within a program (Clemence & Brink, 1978; Higgs, 1984; Oliver, 1985; Seither, 1980; Stronck, 1979; Wold & Worth, 1990). Economic constraints in nursing education and limited workforce openings are exerting added pressures on educational institutions to streamline programs and to invest their resources in those students who are most likely to complete the program and obtain licensing (Oliver). To reach these goals, numerous cognitive and noncognitive variables have been examined as possible predictors of achievement in nursing courses and/or indicators of students' potential to complete their programs. Although numerous studies have been done, many questions remain with respect to predicting which students will do best in nursing (Higgs).

Among cognitive variables examined in previous studies, students' grade point averages (GPAs) on admission to nursing programs and in prior university coursework consistently have been the best single predictor of later academic success in nursing (Clemence & Brink, 1978; Hayes, 1981; Higgs, 1984; Sharp, 1984; Stronck, 1979; Wold & Worth, 1990; Yocum & Scherubel, 1985). The only other indicators consistently found to predict student success reliably were the verbal portion of the Scholastic Aptitude Test (SAT) (Hayes; Higgs; Kissinger & Munjas, 1982; Wold & Worth), and the composite scores from the American College Test (ACT) (Felts, 1986; Jenks, Selekman, Bross, & Paquet, 1989; Lengacher & Keller, 1990). Added power was noted when both the GPA and standardized test scores were considered together. Most American colleges and universities require the SAT or ACT for admission. There is no requirement for universal, standardized preadmission testing for Canadian universities.

High school performance also has been examined in relation to achievement in nursing programs. Biology and mathematics grades and high school rank were positively correlated with later academic success in nursing (Oliver, 1985; Seither, 1980). In a Canadian study, Weinstein, Brown, and Wahlstrom (1980) used discriminant analysis to examine the transcripts of 1169 nursing students. They found that only senior-level courses predicted academic success in college-based nursing programs in Ontario. They also found that (a) the number of pure and applied science courses completed in high school was the best overall predictor of academic success in nursing, (b) a combined science grade was a better predictor than individual grades in each subject, and (c) students' averages in English and mathematics were also reliable predictors of academic success.

The findings and implications of studies that examined the influence of noncognitive variables on students' progress in nursing programs have been varied. In several of the studies examining noncognitive variables, demographic variables and/or standardized personality test scores have been shown to differ between "successful" and "non-successful" student groups (Alichnie & Belluci, 1981; Hayes, 1981; Kissinger & Munjas, 1982; Wall, Miller, & Widerquist, 1993; Yocum & Scherubel, 1985). The implications of these findings raise concerns. Firstly, factors such as age, ethnic background, or scores on personality tests cannot ethically be used as selection criteria for admission or progression in a program. Secondly, universal testing is expensive and impractical. Thirdly, the relative contribution of these variables beyond the prediction possible based on GPA and SAT (or similar standardized testing) scores has been negligible (Alichnie & Belluci; Hayes).

Several of the studies reviewed used completion of the nursing program as a measure of success (Clemence & Brink, 1978; Horns, O'Sullivan, & Goodman, 1991; Mills, Sampel, Pohlman, & Becker, 1992; Schwirian & Gortner, 1979; Seither, 1980; Yocum & Scherubel, 1985). The best indicators of senior-level achievement and/or successful completion of licensing exams were grades in the previous semester or year. This was acknowledged as a very late point to be identifying student difficulties, and it is obviously far too late to be helpful in establishing criteria for ranking admission candidates (Fowles, 1992; Horns et al.; Jenks et al.; Mills et al.).

The majority of the studies reviewed used an entire population of students as the sample; thus, findings were powerful indicators within that population. As admission criteria, curricula, and student populations vary according to program, the generalizability of findings is limited to the program studied. All of the researchers recommended cross-validation of their findings in different programs and student populations. Generalizability of previous findings is further limited by the age of the findings. The majority of studies were published in the 1970s and early 1980s and examined the progress of students in nursing programs between 1968 and 1982.

Although most university nursing programs in Canada consider applicants entering from high school, the sole baccalaureate nursing (BN) program in Newfoundland has, for the past several years, required at least one year of university studies – to complete 10 prerequisite courses. In September 1996, the university school of nursing and the hospital schools will implement a collaborative baccalaureate curriculum, which will not require university courses before admission. As

the prerequisite year for the BN program is phased out, it will be important to learn whether academic success can be predicted from high school grades. It is critical that student progress be monitored and that predictors of student success be identified, in order to (a) establish valid admission criteria, (b) identify the need for remedial intervention, and implement programs to address such needs, and (c) counsel students prior to admission and throughout the program with a view to decreasing the rate of attrition.

The purpose of this study was to examine the academic progress of students during the first two years of the BN program using data from their academic records. The high school averages of the two consecutive classes were higher than those for the whole group of students entering Memorial University of Newfoundland (MUN) during their respective admission years. These higher averages would indicate that both classes of students were at "low risk" for failure in university (Wilson, 1991). However, only 60% of the students in the two classes progressed without interruption.

### Conceptual Framework

Higgs' (1984) *Model for the Study of Prediction of Success in Nursing Education and Nursing Practice* and a review of the literature provided direction for selecting the variables examined in this study. Higgs identified a number of pre-major variables that influence nursing major variables. In this study, the pre-major variable of scholastic performance was examined in relation to the nursing major variables of level of achievement in courses and progression in the program. Several researchers suggest that grades on course work within a program may be used to predict success in the program (Griffiths, Bevil, O'Conner, & Wieland, 1995; Hayes, 1981; Higgs; Horns et al., 1991; Mills et al., 1992). Such knowledge can help identify high-risk students needing academic assistance. Thus, relationships between grades on first- and second-year courses were also examined.

### Research Questions

A descriptive correlational study was conducted to address the following questions:

1. Are the high school grades of baccalaureate nursing students related to their grades in prerequisite university courses and in the nursing program?

2. Are there relationships between the grades of baccalaureate nursing students in university courses and in nursing?
3. Is there a relationship between the grades of baccalaureate nursing students in the first and the second year of the nursing program?
4. Can differences in the academic backgrounds of groups of baccalaureate nursing students account for different levels of progress in the nursing program?

## **Method**

### ***Subjects***

Subjects ranged in age from 19 to 40 years with a mean age of 21.04 years ( $SD = 3.25$ ). There were 78 females and 11 males in the study, representing the entire population of full-time students in the two years. Students had completed an average of 20 ( $SD = 8.45$ ) university courses, including the 10 prerequisites, before being admitted to the school of nursing. All but one had completed high school in Newfoundland. Demographically, their backgrounds represented a wide range, with more than 50 communities and high schools of varied sizes recorded.

### ***Program***

The four-year (nine-semester) BN program comprises an established sequence of 39 required courses and five electives. First-year courses include the following: introductory nursing concepts and skills, teaching-learning, anatomy and physiology, health assessment, pathology, nutrition and pharmacology, and counselling. Second year comprises primarily six clinical courses arranged in pairs; one focuses on clinical theory and the other is a clinical practicum in one of three client groups: childbearing families, children, and adults. Other second-year courses include transcultural nursing, a second counselling course, and a three-week consolidated clinical practicum during the final weeks of the winter semester. As courses in Year 1 are prerequisite to those in Year 2, failure in or withdrawal from Year 1 courses constitutes an interruption of at least one year in a student's progress.

### ***Procedure***

The research protocol was approved by the school of nursing and the MUN Human Investigations Committee. The academic records of 89 BN students from two consecutive years were examined. Grades in required high school, prenursing, and nursing courses were recorded.



The variables examined consisted of (a) high school average, (b) prenursing average in prerequisites, (c) grades and yearly averages in the first two years of the nursing program, and (d) level of progress two years after beginning the nursing program. Variables were as follows:

**High school average.** The 11 high school credits required for university admission were averaged (Group mean  $[M] = 80.66\%$ ;  $SD = 7.68$ ). These were two mathematics, three English, two science, two humanities, and two electives. (A 65% average was required to be eligible for university admission.) A second high school average was calculated based on seven of the 11 prerequisites. This average comprised the grades in senior science, mathematics, and English ( $M = 78.18\%$ ;  $SD = 8.43$ ). These specific subjects, as well as the number of senior sciences completed in high school, were chosen for examination as they were found, in a prior Canadian study (Weinstein et al., 1980), to be the best indicators of later success in nursing programs.

**Pre-nursing average.** The students' combined averages in 10 prerequisite courses and their cumulative averages in all university courses prior to entering nursing school were calculated ( $M = 70.91\%$ ;  $SD = 4.50$ ). The 10 prerequisite university courses included two introductory courses in each of five subjects: biology, chemistry, English, mathematics, and psychology. Again, based on the findings of Weinstein, Brown, and Wahlstrom (1979) and Weinstein et al. (1980), and because the first two years of the BN program are strongly science-based, an additional average was calculated using four prerequisites: biology, chemistry, mathematics, and English ( $M = 69.53\%$ ;  $SD = 4.79$ ).

**Grades and averages in nursing.** Numerical grades attained in each of the nursing courses in the first two years of the program were recorded. Yearly averages were calculated based on the combined grades of all required courses in each year ( $M$  [Year 1] = 71.42%;  $SD = 4.61$ ;  $M$  [Year 2] = 72.54%;  $SD = 3.24$ ).

Grades in clinical practicum courses could not be included in the relationships among nursing grades examined. These courses are taught and evaluated in small groups; therefore, multiple instructors are involved in the grades allocated within each class. In addition, in one of these courses, during the years studied, different evaluation tools were used to grade clinical performance in the two class groups.

**Level of progress.** Student progress was defined in terms of completion of the required courses sequenced for the first two years of the

nursing program. The students were placed into one of three categories: progression without interruption, progression with interruption, and withdrawal from the program. Upon completion of the 21 courses comprising the first two years of the BN program, 53 (59.6%) of the 89 students were progressing without interruption, 24 (27%) were behind their entering classmates, and 12 (13.5%) had withdrawn.

### Analysis

Data were coded, grouped, and analyzed using an SPSS-X program. No significant differences were found between the two classes for the high school prenursing averages; therefore, the data were merged. Descriptive statistics, Pearson's R correlation, t-tests, and ANOVA were used to examine the data for relationships and group differences.

### Results

**High school average: Relationship to subsequent studies.** High school average based on the 11 university prerequisites was found to be positively correlated with both the students' average on the 10 prerequisite university courses and Year 1 average in nursing ( $r = .49$ ,  $r = .51$ , respectively;  $p < .01$ ). A similar relationship was noted between the average based on the seven key high school credits – in biology, mathematics, and English – and Year 1 average in nursing ( $r = .53$ ,  $p < .01$ ). Individually, biology had the highest correlation with Year 1 nursing average, followed by English and then mathematics ( $r = .51$ ,  $r = .48$ ,  $r = .34$ , respectively;  $p < .01$ ).

The study data were grouped to determine whether the number of pure and applied science courses completed in high school could predict academic success in nursing (Weinstein et al., 1980). Within the group, 79 students (88.8%) had completed senior-level biology in high school, 59 (66.3%) chemistry, and 43 (48.3%) physics. Seventeen students had completed one of these senior sciences, 46 (51.7%) had completed two, and 24 (27.0%) had completed all three senior sciences. However, no difference was found in nursing averages for either Year 1 or Year 2 based on the number of senior sciences completed in high school.

**Prenursing averages: Relationship to nursing grades.** Relationships between grades in prerequisite university courses and grades in nursing are outlined in Table 1. Grades in biology, mathematics, and chemistry, but not English, consistently were significantly correlated

with students' grades in first-year nursing courses and Year 1 nursing average. The averages of the 10 prerequisites and cumulative averages prior to admission to nursing were also significantly correlated with grades in nursing.

**Table 1**

*Pearson Correlation Scores between Prerequisite Courses and Year 1 Courses*

| Prerequisite University Courses          | Year 1 Courses    |                          |           |                |
|--|-------------------|--------------------------|-----------|----------------|
|  | Health Assessment | Pharmacology & Nutrition | Pathology | Year 1 Average |
| Biology                                  | .33*              | .40*                     | .33*      | .45*           |
| Chemistry                                | .33*              | .46*                     | .36*      | .49*           |
| English                                  | .09               | .23**                    | .07       | .15            |
| Math                                     | .27**             | .37*                     | .19       | .37*           |
| Average on combined 10 prerequisites     | .47*              | .51*                     | .43*      | .61*           |
| Cumulative prenursing university average | .37*              | .47*                     | .35*      | .60*           |

Note: \*  $p < .01$ ; \*\*  $p < .05$

*Within the nursing program: Relationship between course grades in Year 1 and Year 2.* There was a strong positive correlation between Year 1 average and Year 2 average in nursing ( $r = .74, p < .01$ ). First-year grades strongly correlated with clinical theory courses in Year 2 (see Table 2).

Using ANOVA, a significant difference in the Year 1 average was demonstrated based on the number of prerequisite university courses repeated before admission to nursing ( $F [2, 83] = 4.51, p < .01$ ). Students who repeated more than two courses had significantly lower grades in nursing courses than those who had not repeated any.

*Accounting for different levels of progress.* T-tests were used to determine whether a difference existed with respect to past academic performance between students who were progressing without interruption and those who were behind in their class after two years in nursing. Students who were behind at the end of Year 1 or Year 2 in nursing had significantly lower mean averages on high school credits and on prerequisite university courses (see Table 3).



**Table 2***Pearson Correlation Scores between Year 1 Foundation Courses and Year 2 Clinical Theory Courses*

| Year 1 Courses           | Year 2 Clinical Theory Courses |          |        |
|--------------------------|--------------------------------|----------|--------|
|                          | Nursing Care of:               |          |        |
|                          | Childbearing Families          | Children | Adults |
| Introduction to nursing  | .37                            | .48      | .48    |
| Pathophysiology          | .40                            | .46      | .49    |
| Health assessment        | .48                            | .71      | .54    |
| Nutrition & pharmacology | .44                            | .59      | .60    |
| Anatomy & physiology     | .32                            | .46      | .41    |

Note: All correlations are  $p < .01$ **Table 3***Means in High School and Prenursing University Averages by Level of Progress*

|                           | With Class |        | Behind Class |          |
|---------------------------|------------|--------|--------------|----------|
|                           | M          | (SD)   | M            | (SD)     |
| Year 1                    |            |        |              |          |
| High School               |            |        |              |          |
| 11 credits                | 82.68      | (6.44) | 76.48        | (8.55) * |
| 7 credits                 | 79.82      | (7.46) | 73.70        | (9.14) * |
| University prenursing     |            |        |              |          |
| 10 prerequisites combined | 71.76      | (4.67) | 68.20        | (2.58) * |
| 4 prerequisites combined  | 70.29      | (5.00) | 66.96        | (2.90) * |
| Year 2                    |            |        |              |          |
| High School               |            |        |              |          |
| 11 credits                | 83.22      | (6.61) | 78.56        | (6.49) * |
| 7 credits                 | 80.40      | (7.64) | 75.56        | (6.90) * |
| University prenursing     |            |        |              |          |
| 10 prerequisites          | 71.71      | (4.46) | 68.85        | (2.90) * |
| 4 prerequisites           | 70.29      | (4.87) | 67.53        | (3.34)** |

Note: Differences between the means are significant – \* $p < .01$ ; \*\* $p < .05$ .

Because of the small group size, and because of wide variation in the timing and reasons for withdrawal, the "withdrawal" group could not be included in the tests of difference completed. Reasons reported by students for withdrawing from the program were (a) switched directly to another program ( $n = 5$ ), (b) career choice no longer nursing ( $n = 3$ ), (c) failure of multiple courses ( $n = 2$ ), or (d) financial reasons ( $n = 2$ ). Of the 12 students who had withdrawn, 10 had completed the first year and eight had failed at least one nursing course prior to deciding to withdraw.

### Discussion

Consistent with the reviewed literature and the Higgs' (1984) *Model for the Study of Prediction of Success in Nursing Education and Nursing Practice*, students who had been high academic achievers in high school continued to do well in prerequisite university and nursing courses. Cumulative university average prior to entering nursing showed the same high correlation with success within the program as university GPA had shown in the previous studies (Clemence & Brink, 1978; Hayes, 1981; Higgs; Sharp, 1984; Wold & Worth, 1990). Consistent with the findings of Weinstein et al. (1979, 1980), biology and mathematics grades, in both high school and university, were correlated with course grades or yearly averages in nursing. English grades in high school, but not in university, were correlated with the nursing grades or averages. However, the findings of this study did not agree with those of Weinstein et al. (1979) in that the number of sciences completed in the final year of high school bore no relationship to academic success later in nursing.

The positive correlation of nursing grades/average with high school English, but not university English, may be explained by the nature of the required courses in high school: students must take both a senior language and a senior literature course prior to entering university, the former focusing on grammar, the structure of English, and writing skills. However, university courses have focused on academic review of varied forms of literature; students may not be required to write or to individually analyze literature. Stronck (1979) found similar discrepancies between English marks and success in nursing studies. He concluded that "the narrative skills of applicants correlate well with their future performance in the professional nursing college. Unfortunately, an applicant's grades in English courses are not necessarily any guarantee that he can write" (p. 607).

Students who progressed in their nursing class had significantly higher averages in high school and prerequisite university courses than those who were behind. This pattern lends support to the continued use of current admission criteria, which have focused on the average attained in the 10 prerequisite courses. Admission criteria for direct entry from high school may also be feasible with biology, mathematics and English as prerequisites.

The findings of this study have implications for the MUN School of Nursing. Firstly, problems in Year 1 of nursing are often reflected in Year 2 performance. Secondly, many students who wish to enter nursing repeat the prerequisites in order to increase their average across the 10 courses and thereby increase their competitive standing among the applicants. Students who repeated courses prior to admission, particularly those who had repeated more than two, were more likely to be behind their classmates at the end of Year 1 in nursing. This delay has two sources: failing courses, and dropping courses to lighten their workload in a respective semester. Remedial efforts could be made to help those students at risk or already having difficulties, thus breaking the pattern of sequential problems from one year to the next. These could include workshops in study skills or time-management, arrangements for peer-tutorials, and study programs focusing on areas of difficulty.

Advice to applicants should be based on the following findings: (a) repeating the requisite courses in order to gain admission to nursing does not correlate with academic success within the program, (b) difficulties at one level are often paralleled by difficulties in subsequent courses, and (c) grades in university biology and chemistry are strongly associated with grades in nursing courses. Students should also be encouraged to complete senior-level biology in high school.

Consistent with many previous studies, the primary limitation of the present research is the uniqueness of the school and the program, which limits the generalizability of findings. Additionally, the sample size did not allow for analysis beyond a descriptive level. The authors recommend that a prospective longitudinal study be undertaken, one that would add subjects with each incoming class and follow their progression through the nursing program and licensing process. Data collection should be broad-based and include academic, demographic, and personal data as new students enter the program, as well as interviews at various points in the program to identify students' personal perspectives of factors contributing to their progress. Achievement in both theory and clinical courses should be measured. Such a study design

would allow use of more components of the Higgs (1984) model in identifying key influences in student success and would help in cross-validating other findings. Although such knowledge will not aid in establishing or revising admission criteria, it could be very helpful in identifying needs for remediation and/or counselling among specific groups of candidates and students within the program.

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