

Statewide At-Risk Tracking and Intervention for Nurses: Identifying and Intervening With Nursing Students at Risk of Attrition in Texas

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Abstract

AIM The purpose of this study was to identify students at risk of attrition and implement interventions to decrease the risk.

BACKGROUND The ability to identify and intervene with students deemed at risk of attrition can be a valuable tool for increasing the RN workforce. “Statewide At-Risk Tracking and Interventions for Nurses” (SATIN) involved students from 27 initial RN licensure nursing programs in Texas.

METHOD At-risk status of each nursing student was identified, and each nursing program provided interventions based on students’ needs.

RESULTS The Weaver Reading Program was the most effective of the six intervention strategies used with SATIN participants. Lack of utilization of the interventions was the number one limitation of the study.

CONCLUSION Use of the Weaver Reading Program as well as personal engagement with students, one-on-one mentoring, and continued time investment are recommended to all programs.

KEY WORDS Nursing Student Attrition – Nursing Student Retention – Nurse Workforce in Texas

The health care industry in the United States is currently experiencing a multifaceted shortage of RNs brought about by several factors, including an aging American population, an aging RN workforce, and an aging faculty workforce (Buerhaus, Staiger, & Auerbach, 2009; Juraschek, Zhang, Ranganathan, & Lin, 2012). One way to alleviate the shortage is to ensure that students admitted to nursing programs graduate successfully and become members of the workforce. Nursing students who do not graduate or require more than the prescribed length of the program to graduate (off-track) increase the funding revenue burden. For public nursing programs, this means that taxpayers pay more for each RN produced by the program. The ability to identify and intervene with students deemed at risk of attrition can be a valuable tool for increasing the RN workforce.

The Texas Higher Education Coordinating Board (THECB), at the request of the Texas Legislature, presented a report (THECB, 2006) that assessed factors related to the nursing shortage in Texas. The

2005 THECB report found that only 56 percent of all nursing students graduated on time. When considering *persisters* (students who graduated within 150 percent of the graduation time frame), the rate increased to 69 percent compared to the national rate of 60 percent for all degree programs at US universities (Kena et al., 2016).

Since 2003, East Texas nursing programs have worked collaboratively to identify and intervene with at-risk students. The study, “Advising Nurses in East Texas” (ANET), involved collaboration among two associate degree programs, one BSN program, and the local Area Health Education Center. It used Jeffrey’s conceptual framework to identify the academic, background, and environmental variables associated with students being off-track in a nursing program (Jeffreys, 2004). Academic variables focused on grades in prerequisite science courses and nurse entrance test scores (HESI, ATI). Background variables included ethnicity and being a first-generation college student. Environmental variables involved areas such as family and peer support.

The ANET study was expanded in 2007 to include nine nursing programs (seven ADN and two BSN) in East Texas. The study, “Identifying & Intervening With At-Risk Nursing Students,” again used Jeffrey’s conceptual framework. All students entering nursing programs at the nine institutions who agreed to participate completed an online survey. Students who were identified as “at risk” were provided support services that addressed the identified risk factors. The researchers found that reading comprehension scores on entrance exams were the single most important predictor of student attrition ($p < .0001$). Two other highly predictive variables were entrance composite scores ($p = .027$) and a student’s grades in anatomy and physiology ($p = .005$; Walker et al., 2011).

The 2009 to 2010 grant, “Intervention with Re-defined at-risk nursing students” (RDAR), continued refining the regression model for predicting at-risk students ($n = 1,200$). Another major goal of the

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RDAR study was to test a specific intervention for students with low reading comprehensive scores on the HESI or ATI nursing entrance test. An online reading program called Rocket Reader was prescribed for students flagged as at risk because of low reading comprehensive scores; the program did not significantly alleviate students' at-risk status (Walker et al., 2011).

Based on these studies, the THECB recognized the importance of the research for all Texas nursing programs and sponsored the first statewide replication of a nursing research study grant, based again on Jeffrey's conceptual framework. The "Statewide At-Risk Tracking and Interventions for Nurses" (SATIN) grant, which involved 27 initial RN licensure nursing programs, focused on improving the predictive power of the regressive model. The second goal was to evaluate the effectiveness of interventions in reducing the at-risk status of nursing students.

METHOD

Institutional review board approval was obtained by the lead institution, and each student gave informed consent to participate in the grant prior to completing any online surveys. Several of the programs also obtained institutional review board approval through their institutions.

In 2011, 27 initial RN licensure programs were approved by the THECB to participate in the SATIN study. Each nursing program was responsible for administering surveys to students, implementing interventions, and reporting to the oversight team of researchers. Researchers at the oversight institution were responsible for providing the surveys, developing the interventions and reporting forms, and entering data into a master database. The lead statistician was responsible for determining at-risk status and notifying each school of every student's risk as well as maintaining the database (Donnell, 2015).

Administration Methods

The student survey was administered on the campus of each participating program. Typically, students completed the survey in groups. Students who did not wish to participate in the study were instructed to use the computer and access the Internet for their own use. Students usually entered and exited the computer lab in groups.

Survey responses were downloaded by the oversight team and checked for completeness and/or obvious errors. At-risk determination statistical models were then applied to the survey results, and students were categorized as "at-risk" or "not-at-risk."

Data collection began on June 2, 2011, and was completed on May 31, 2013. All data, with the exception of the Weaver Reading Program, were self-reported by the project director at each program. The Weaver data were taken directly from the website by the project director at the lead institution.

Procedure

An at-risk determination form was prepared for each school listing the student roster and which students had been judged as at-risk. The form also indicated individual flags on key attributes such as low reading, mathematics, and composite nursing entrance test scores. Low anatomy and physiology grades were also flagged. Flags were based on the thresholds for variables, which minimized misclassification. English-as-a-second-language (ESL) students and those who were first in their family to attend college were noted on the forms in anticipation that these students may have special needs.

After the at-risk determination form was sent to the school, the semester shifted into the intervention phase. Schools used the detailed

information on the form and their own observations to generate intervention strategies for students. Interventions included the Weaver Reading Comprehension program, the Missildine Exam Diagnostic Tool (EDT), skills lab, counseling, nursing student support websites, and the Professor Nightingale website. The interventions were encouraged to contain a mix of activities. Those students who were flagged as at-risk based on entrance exam reading comprehension scores were provided a code that could be used to access the online Weaver Reading Program. Codes were also provided during the second year of the grant to a majority of ESL students along with others who requested reading assistance.

During the semester, faculty at each school, after receiving training from the oversight team, were required to chart intervention activities on Faculty Weekly Logs sent to the project coordinator of the oversight team. Some students not initially judged at-risk presented with at-risk symptoms, such as failing exams or demonstrating a need for counseling. Such students were encouraged to join the intervention population and were added to the weekly logs. Logs were checked for correct usage, and schools were notified if reporting errors were found.

At the end of the semester, all schools were required to indicate the status of each SATIN student on their campus. Faculty recorded students as either on-track, off-track (but still in the program), or completely out of the nursing program. The above cycle was repeated semester by semester, including summers, for the two-year duration of the grant.

Description of Interventions

The SATIN study used a combination of face-to-face and online interventions to address factors contributing to at-risk flags/identification of students. The following is a brief description of the interventions.

SKILLS LAB The use of skills labs constituted a face-to-face intervention technique. Labs could include general comprehensive assessment of patients, Foley catheter and/or intravenous insertion techniques, medication calculations and administration, charting, and simulations along with other topics, all in addition to course requirements. Participating students either practiced during open lab time or met with course faculty for individualized instruction.

COUNSELING Another face-to-face intervention used was counseling (nontutorial) for students who exhibited a need for such interaction. Counseling could be used in response to students with social issues, anxiety, need for support groups, personal problems, and/or the need for stress management. Students needing this intervention were referred to counselors at the university or college.

MISSILDINE EDT This face-to-face intervention has been effective in increasing exam scores in nursing courses in past studies. The EDT is a faculty-led coaching tool that consists of an intense exam review after a student has performed poorly on a test. EDT coaching consists of reviewing content and nursing processes and investigates more productive test-taking strategies for the student. Faculty assess the factors that affect exam performance and provide tailored coaching to aid in future success.

NURSING STUDENT SUPPORT WEBSITES A special website was created for the study grant. It had a set of "course lifelines" with information specific to areas of nursing, such as pediatrics, as well as study aids and personal study solutions available to students. The personal solutions section of the site contained many different topics that could be relevant to students as they pursued success in their nursing curriculum. This tool, which is no longer active, was met with

moderate success as noted from ad hoc testimonials in the previously funded study. The website was funded by the oversight team during the SATIN study.

PROFESSOR NIGHTENGAL This online resource was also available to students at SATIN participating schools. It included a series of videos along with other supplemental material to review test-taking strategies. Students accessing the site logged their preference for various content areas and reported their usage times to faculty at their respective schools.

WEAVER READING PROGRAM This online program assists students in improving reading comprehension skills. Students complete an assessment and are assigned lessons based on their assessment results. Lessons guide students through reading comprehension activities and are leveled based on public school grades. Students can complete lessons up through the 12th grade.

Data Analysis

At the midpoint of the grant and again at the end of the final SATIN semester, the oversight team created intervention databases containing all of the Faculty Weekly Log data. These intervention databases were then mapped to the at-risk status and on/off/out category for each student. The result was a large set of information with the following items recorded in one coherent package: student survey results, at-risk status, on/off/out status, and interventions applied. Master data sets were then converted into formats suitable for uploading into statistical software.

Large-scale general linear logistic regression modeling was used to investigate intervention efficacy. Ultimately, each student was classified as either on-track or not. This variable regressed against both their predicted status and intervention usage.

RESULTS

One of the major research questions for the SATIN study was the following: Which interventions are most effective in decreasing attrition of nursing students?

Sample Description

Out of 6,560 students who agreed to participate, 61 did not submit enough survey information to be screened. At the end of the grant period, 285 students were not assigned a final status by their respective schools. The final sample size for the SATIN study was 6,275 nursing students in initial licensure programs in Texas. Within the sample, 84 percent of the students were female; the majority, 56 percent, were single; 61 percent worked during school; and 73 percent received financial aid. Further description of the sample is shown as Supplemental Digital Content, <http://links.lww.com/NEP/A54>. At-risk status and final reported status are cross-tabulated in Table 1.

Skills Lab

The most frequently used intervention was skills lab at 40 percent for at-risk students. The average amount of time spent by at-risk students in the lab was 9.4 hours. Participation in skills lab was not significantly correlated with being on-track in the nursing program.

Counseling

Some statistical evidence exists that counseling can be effective in the retention of at-risk students. Students could increase their rate of being on-track approximately 10 percent above baseline by participating in roughly 2,000 minutes (33+ hours) of counseling over the

Table 1: Tabulation of At-Risk and Final Status
(*n* = 6,217)

Final Status	Initially Screened		Total
	At-Risk	Not-At-Risk	
On track	798	4,005	4,803
Off track/out	457	957	1,414
Total	1,255	4,962	6,217

life of the grant. Counseling services of 16+ hours were statistically shown to raise on-track rates from 5 percent to 10 percent over baseline.

Missildine EDT

When the amount of EDT participation was regressed against final status of the student, the variable pertaining to EDT usage was non-significant. There is a simple explanation for this as students who were not failing in the first place should not be expected to see sizeable gains in scores. In effect, the effort required to administer the EDT (which is high) does not produce a gain due to the amount of time involved in intensely tutoring a student who has previously shown acceptable performance.

Of the 2,447 usages of the EDT across the life of the grant, only 30 percent were done in the fashion prescribed by the EDT instructions. That is, only 30 percent of all EDT effort was concentrated on students who had failed an exam. Among those students who had the intervention after failing a test, the average score on their next exam rose from 69 percent to 76 percent, results that were essentially equivalent to past findings. Because of its use in SATIN and in previous grants, the EDT has now been studied extensively. Used properly, it has shown an average increase in exam scores of 7 points.

Proper EDT usage a single time showed gains within the entire two-year SATIN data set. An additional one to two percentage points over and above the expected 7-point gain was seen in multiple uses of the EDT, but this gain was not statistically significant. After one proper application of the EDT, the upper quartile of test score gains was 14 points (15 points after two applications). There were cases of students experiencing EDT coaching between 5 and 15 times over the life of the grant, but such usage was not shown to significantly raise exam scores over and above the gains seen in using the tool two or three times (7 to 9 points).

Despite the EDT's demonstrated ability to increase test scores, no statistical correlation can be stated regarding the tool's effect on increasing on-track rates in programs. Heuristically, increasing test scores leads to increased probabilities of passing an isolated class (or two). Again, increasing the chance of passing a class would casually lead one to the conclusion that it may, in turn, raise retention rates in programs; this connection was not statistically supported by the SATIN data. Among all students using EDT as directed, the fraction who were at-risk and retained was not larger than the fraction who were at-risk and retained by other means.

The fact that EDT usage was implemented in one of the many courses a student takes per semester does not rectify the problem of students to become off-track via poor performance in non-EDT

supported courses. Some of the 27 programs have elected to continue to use the EDT even after the formal end to the SATIN grant.

Concerning actual utility of the EDT tool, 25 percent of all SATIN nursing students had the tool applied at least once during the life of the grant. At some point, 31 percent of students judged at-risk came in contact with the tool compared to 23 percent of students who were initially judged not-at-risk. Proper usage of the EDT appears to have a localized effect on student performance in isolated classes; it cannot be generalized to state that proper EDT usage statistically increases on-track rates in nursing programs. Due to the intensity of time required to properly use the tool, it appears as though the tool should be used only with failing students as it was originally devised. Precious intervention resources (faculty time) should not be forfeited to apply the EDT many (5+) times to a student and/or across entire classrooms of students in blanket fashion. In addition, to have any potential for increasing on-track rates in programs, EDT usage should be carefully chosen, administered in targeted fashion over one or two exams after a failing grade is seen and in concert with additional intervention techniques.

Nursing Student Support Websites

The websites were not frequently used by SATIN participants. The utility rate of 15 percent was the second lowest among all forms of intervention offered during the grant period. However, 37 percent of all students judged at-risk did report utilizing the websites at some point during the life of the grant (only 10 percent of those not-at-risk used the website). Among students using the nursing student support websites, the average time (self-reported) on these sites was 5.5 hours. The upper 10 percent of website users accessed the site 12 hours or more over the course of at least one calendar year. Concerning the SATIN population as a whole, website usage was not statistically tied to predictive power of the intervention tool to affect on-track rates.

Professor Nightengale

Among all intervention techniques available to students, Professor Nightengale was the least used; only 9 percent of all SATIN participants reported using the website. The utility rate for at-risk students was just shy of double, at 17 percent.

Among students who reported using the website, the average total time of utility was two hours; only 10 percent of users logged more than three hours total. Because of the lack of usage, only an extreme effect could register as statistically significant in any models related to increasing on-track rates. In conclusion, usage of Professor Nightengale in high amounts (2,400 minutes = 40 hours) across the life of the grant may have the potential to increase retention rates up to 10 percent above baseline for at-risk students, but efficacy remains inconclusive due to low usage.

Weaver Reading Program

Previous research concerning at-risk nursing students has identified lack of reading comprehension as the prime correlate to attrition (Walker et al., 2011). During the SATIN grant, the Weaver program was made available to all students flagged on low reading ability. During the second year of SATIN, due to an adequate supply of Weaver online licenses, the program was made available to schools who desired its use for ESL and/or Hispanic students.

Without question, the Weaver Reading Program was the most effective intervention tool used with SATIN participants. When Weaver

participation is regressed against student final status, the variable pertaining to usage is seen as statistically significant in increasing the rate at which a student can stay on-track in the nursing program ($p < .001$). In Figure 1, the curves arc and ascend at a *faster* rate than those of other interventions, illustrating the potential for Weaver to impact retention rates at smaller dosages than the proportionally equivalent dose of either counseling or Professor Nightengale. Furthermore, both curves in Figure 1 rise well over their baseline (at-risk, 63 percent; not-at-risk, 81 percent).

Further analysis strikingly indicates that 2,000 minutes (33+ hours) of Weaver usage by an at-risk student raises the expected on-track rate to be equivalent to the not-at-risk baseline of 81 percent. No other SATIN intervention technique was statistically shown to have the ability to do this, which is a major finding. Said geometrically, in other profile plots for the general population (like Figure 1), the highest point of the bottom curve (at-risk) always lies below the point of origin for the top curve (not at-risk). Therefore, in those cases, it is not possible to neutralize the effect of being judged at-risk by using those interventions (no matter the dosage). However, enhanced use of Weaver has the ability to substantially mask the label of being initially judged at-risk.

In addition, notice the eventual level to which the curves in Figure 1 plateau. In both the at-risk and not-at-risk cases, these plateau values are well above 90 percent. Hence, particularly intense reading intervention can increase expected on-track rates to over 90 percent. To accomplish this, the recommended usage for the Weaver Reading Program is over 60 total hours of usage in at-risk students. Table 2 lists the average number of minutes of Weaver usage required to increase the on-track rate of at-risk students to a nominal rate above their group baseline. To accent this information, specific investigations into Weaver times show that the program needs to be used for at least four hours before there is *any* measurable average effect on retention probabilities. Students using the program less than four hours have no average gain in their chance of remaining on-track in the program and are considered equivalent to nonusers.

Despite the strong evidence of both the ability of the Weaver program to increase reading comprehension grade levels and affect on-track rates in nursing programs, the tool was overlooked by many

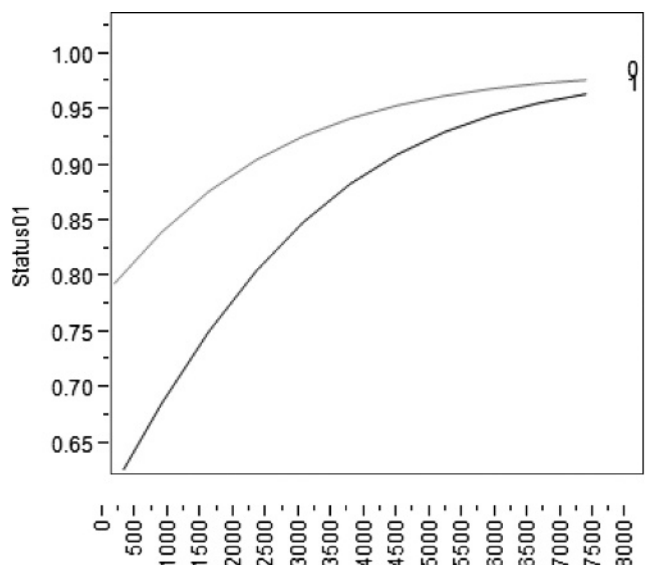


Figure 1. Profile curves for expected on-track rates versus minutes of weaver usage.

Table 2: Average Weaver Time Required to Increase On-Track Rates for At-Risk Students

Percentage Raised Above Baseline (63%)	Required Weaver Time
5% Above baseline	6 hours
10% Above baseline	14 hours
15% Above baseline	23 hours
18%-20% Above baseline (equal to not at-risk baseline)	34 hours

SATIN schools and students. Of all the at-risk students in the SATIN population, only 14 percent utilized a Weaver license; more than half of the Weaver licenses secured during the SATIN time frame were never activated. Of all those students flagged as having low reading nursing entrance test scores (and specifically provided a Weaver license), only 24 percent used the program. Among at-risk students, Weaver was the most effective but least utilized intervention technique. It is strongly recommended that the program be utilized with at-risk nursing students, particularly those flagged on the reading comprehension variable associated with their nursing entrance test.

Among all students flagged on reading and using a Weaver license, the average total time in the program was 11.2 hours. Obviously, the primary issue is not the amount of time Weaver users spent in the program but the actual percentage of reading flagged students who chose not to use the program (76 percent). Had all reading flagged students used Weaver at this average level, it would be expected that an additional 39 students (7 percent of 554) would have been retained as on-track in their program. Furthermore, similar calculations show that if all Weaver licenses had been used for 34 hours, then the 20 percent above baseline expectation would translate to an extra 146 students becoming on-track in their program. This change alone, without regard to any other intervention, would have raised the overall on-track rate from 77 percent to 80 percent. Several programs have continued the use of the Weaver reading program after the conclusion of the SATIN study.

DISCUSSION AND CONCLUSION

One way to alleviate the nursing shortage is by ensuring that students admitted to nursing programs graduate successfully and become members of the workforce. Nursing students who do not graduate with their admitting cohort result in a loss that can never be regained. That is, the empty seat within that cohort will always remain empty whether the student eventually graduates or not. This loss, or attrition, is a problem that has received much attention from people and organizations interested in health care. The SATIN grant researchers sought primarily to judge the efficacy of interventions implemented for at-risk students in Texas nursing programs. In addition, researchers wished to catalogue specific risk profiles and determine intervention strategies that might be more effective for the general nursing student population.

The Weaver Reading Program was the most effective intervention tool used with SATIN participants. Enhanced use of Weaver has the ability to substantially mask the initial label of being judged

at-risk. Counseling involvement was borderline statistically significant as it pertains to increased retention. Counseling engagement over many hours of face-to-face interaction was shown to raise on-track rates by 5 percent to 10 percent over baseline.

Used with students who fail exams, the Missildine EDT coaching tool was expected to show an average increase in exam scores by 7 points. Two or three consecutive uses of the EDT have the ability to raise average exam scores by 9 points. However, the EDT effect appears localized to courses; one cannot be generalized to state that proper EDT usage was directly correlated to increased retention rates.

Use of the Nursing Student Support website was not statistically tied to increasing on-track rates. Efficacy of Professor Nightengale remains inconclusive due to low usage (lowest of all SATIN interventions). There was some mild evidence that with increased use the tool may correlate to retention, but this link is only speculation and not scientifically justified based on collected SATIN data.

Despite skills labs being the most frequently used intervention technique with the at-risk population, the degree of participation in this intervention activity had no statistical impact on the rate at which students stayed on track. The number of interventions a student participated in was not statistically significant correlated to retention.

Summary of Intervention Utility

Lack of utility was the primary limitation of the SATIN study. No intervention technique had a 50 percent utility rate among the general population. In addition, 41 percent of all students who eventually became off-track or out of their program received no documented intervention. Only 24 percent of all reading-flagged students utilized the Weaver Reading Program, and only 30 percent of all documented EDT usage was completed on students who had failed an exam. Despite the demonstrated benefits of counseling, the average total time spent in counseling among those who utilized this service was four hours, well below the period of time statistically shown to raise on-track rates by 5 percent to 10 percent over baseline.

Recommendations

Among at-risk students, Weaver was the most effective but least utilized intervention technique. In addition to an overall increase in time spent for interventions, the Weaver Reading Program and reading remediation for at-risk students in general are highly recommended. A total of at least 14 hours in Weaver is recommended for all users.

If students require face-to-face counseling, it is recommended that this occur systematically across a semester. One or two short counseling meetings were generally found to be ineffective; 16+ hours in counseling was shown to produce retention rates in the general population at 5 percent to 10 percent above baseline.

Missildine EDT usage for those failing exams in designated courses is recommended. Blanketed use of the EDT extending to nonfailing students is not warranted based on the data collected and effort required. Two to three consecutive uses of the EDT should be an aim, but a larger number of sessions than this appear unnecessary as expected test gains plateau after two to three EDT sessions.

Finally, personal engagement with students, one-on-one mentoring, and continued time investment are recommended to all programs. A personal, empathetic touch blended with an intense time investment involving commitment by both student and faculty seems the best recipe for maximizing student success.

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