



ATI Pulse™

Predictive Model Overview

January 27, 2016

Historically, indications of eventual NCLEX-RN/NCLEX-PN¹ success or failure have been restricted to end of program assessments like Assessment Technology Institute's (ATI) Comprehensive Predictor. Although a highly predictive instrument that provides individualized recommendations for student remediation, ATI's Comprehensive Predictor is not designed to dynamically follow a student through his or her academic career and inform of potential NCLEX-RN/NCLEX-PN remediation needs. To address this need and provide indications of whether a student is on track to pass NCLEX-RN/NCLEX-PN, ATI developed the ATI Pulse™ model.

The ATI Pulse model is designed to follow a nursing student throughout the duration of his or her academic career. During this progression through nursing school, the ATI Pulse model will provide individual students with a predicted probability of passing the NCLEX-RN/NCLEX-PN, associated risk categories, and highlight remediation needs. This document outlines several key features and considerations related to the ATI Pulse predictive model.

To develop the Pulse model, ATI conducted an analysis of a limited set of students using ATI products. The analysis represented 47,545 students in 1,280 ADN and BSN programs and 29,057 students in 894 PN program. Furthermore, all RN students in the analysis were actively preparing for the 2013 blueprint of the NCLEX-RN and all of the PN students were preparing for 2014 blueprint of NCLEX-PN.

The goal of this analysis was to determine whether performance on ATI products² (other than the Comprehensive Predictor) might be used to provide students and faculty with earlier indicators of "at risk" status with regard to NCLEX-RN/NCLEX-PN performance. Results of ATI's large scale analysis expand upon similar, program-level, efforts exploring how ATI products are predictive of later NCLEX-RN performance (e.g., McCarty, Harris, & Tracz, 2014; Penprase, Harris, & Wu, 2013). The result of ATI's national-level analysis was the creation of the predictive model: ATI Pulse™, which is capable of identifying students who are at risk of NCLEX-RN/NCLEX-PN failure both early and throughout their nursing program of studies.

The ATI Pulse model provides a predicted probability of passing the NCLEX-RN/NCLEX-PN that is based on a student's current and historic performance across several proctored ATI assessments. Predicted probability of passing the NCLEX-RN/NCLEX-PN is a function of a student's predicted later performance on ATI's Comprehensive Predictor assessment and the Comprehensive Predictor's associated predicted probabilities of passing the NCLEX-RN/NCLEX-PN. These predicted probabilities of passing the NCLEX-RN/NCLEX-PN were evaluated by a team of nurse educators and categories of risk status were qualitatively derived. Specifically, nurse educators viewed students with predicted probabilities of passing the NCLEX-RN/NCLEX-PN greater than 90% as "on track" and therefore "low risk." Nurse educators further categorized students with predicted probabilities of passing NCLEX-RN/NCLEX-PN between 80% and 89.9% as having "moderate need of remediation" and at "medium risk." Lastly, nurse educators deemed students with predicted probabilities of passing NCLEX-RN lower than 80% as having "high need for remediation" and at "high risk" for NCLEX-RN/NCLEX-PN failure (see Table 1).

Table 1. Nurse educator categorization of predicted probability pass, risk categories, and resulting remediation needs

Predicted probability of pass groupings	Risk category	Remediation Needs
0% to <80% probability of pass	High	"High Need for Remediation"
80% to <90% probability of pass	Medium	"Moderate Need of Remediation"
90% to 100% probability of pass	Low	"On Track"

The ATI Pulse product is designed to provide early indications of whether students are on track to pass the NCLEX-RN/NCLEX-PN. As with any early indicator, it is important to understand how accurately risk categories, remediation needs, and predicted probabilities of passing NCLEX-RN/NCLEX-PN align with actual NCLEX-RN/NCLEX-PN performance. To explore ATI Pulse's relationship with later NCLEX-RN performance, a comparable predictive model was developed for the 2010 NCLEX-RN blueprint and historical students' NCLEX-RN pass/fail status (supplied by partnering nursing institutions) was examined (see Table 2). This examination of performance within an earlier population of NCLEX-RN examinees is ideal in that it provides a unique insight into a population of students that were not afforded ATI Pulse's early warnings or identification of remediation needs. As can be seen in Table 2, the ATI Pulse predicted probabilities of pass and risk categories correspond with observed NCLEX-RN outcomes³. Similar efforts to collect students' actual NCLEX-RN pass/fail experiences for the 2013 blueprint are currently underway. Once enough sample is achieved, analysis of ATI Pulse's relationship with 2013 NCLEX-RN blueprint outcomes will be summarized.

Table 2. Student NCLEX-RN performance as a function of Pulse predictive grouping

Predicted probability of pass groupings	Risk category	Actual NCLEX-RN % Pass
0% to <80% probability of pass	High	62.9% (n=377)
80% to <90% probability of pass	Medium	87.8% (n=974)
90% to 100% probability of pass	Low	97.0% (n=2,580)

Note: 2010 NCLEX-RN % Pass n = 3,931. Predicted probability of pass is based on ATI Pulse model.

For the PN program, a similar predictive model was developed for the 2011 NCLEX-PN blueprint, and historical students' NCLEX-PN pass/fail status was examined (see Table 3). Although sample size is low, nevertheless "shows a similar trend" as in NCLEX-RN. The NCLEX-PN success rate is higher for the students identified under "Low" risk category

Table 3. Student NCLEX-PN performance as a function of Pulse predictive grouping

Predicted probability of pass groupings	Risk category	Actual NCLEX-RN % Pass
0% to <80% probability of pass	High	64.2% (n=106)
80% to <90% probability of pass	Medium	89.1% (n=230)
90% to 100% probability of pass	Low	97.8% (n=945)

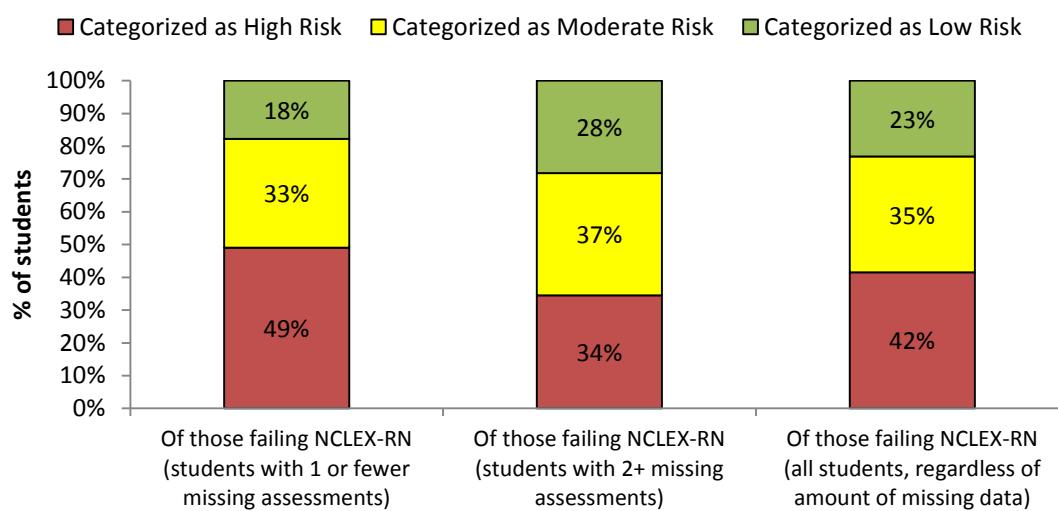
Note: 2011 NCLEX-PN % Pass n = 1,281. Predicted probability of pass is based on ATI Pulse model.

By the end of a student's academic journey, he or she will have ideally provided the ATI Pulse model with values associated with the following proctored assessments: ATI's Test of Essential Academic Skills (TEAS V) and ATI's Content Mastery Series Assessments (Fundamentals, Adult

Medical Surgical, Leadership, Maternal Newborn, Mental Health, Nursing Care of Children, Community Health, and Pharmacology). Depending on the academic tenure of a nursing student, more or less data will be available to be entered into the ATI Pulse predictive model. Although the ATI Pulse model will maintain a high degree of accuracy when data from only a few assessments are available, the predictive accuracy is made more precise when all Pulse related tests are administered.

Since the NCLEX-RN's inception, predicting students' later performance on the assessment has been the focus of both small and large scale research studies. Although successfully predicting which students will pass NCLEX-RN has been repeatedly achieved with relative ease, successfully identifying which students will fail the NCLEX-RN has proven more difficult (e.g., Seldomridge, & DiBartolo, 2004; Spurlock & Hunt, 2008) and commonly only results in between 33% and 50% of future NCLEX-RN failures being correctly identified. When evaluating ATI's Pulse model's efficacy using a historical sample of students individual predicted probabilities of passing the NCLEX-RN/NCLEX-PN were aligned with specific risk categories (i.e., low, medium, and high risk). Based on these risk categories, we can see that between 71% and 82% of the students that failed the NCLEX-RN were identified as either moderate or high risk (see Figure 1). This means that, had ATI Pulse been in place within these students' programs of study, potential earlier remediation interventions could have been identified and implemented to improve student outcomes on the NCLEX-RN. Also of note, between 18 and 28% of students failing the NCLEX-RN were categorized as being low risk for NCLEX-RN failure. It is important to note that "low" risk does not imply "no" risk or a predicted probability of passing the NCLEX-RN equaling 100%. As such, it is completely within expectations that some students failing the NCLEX-RN were previously categorized as low or medium risk.

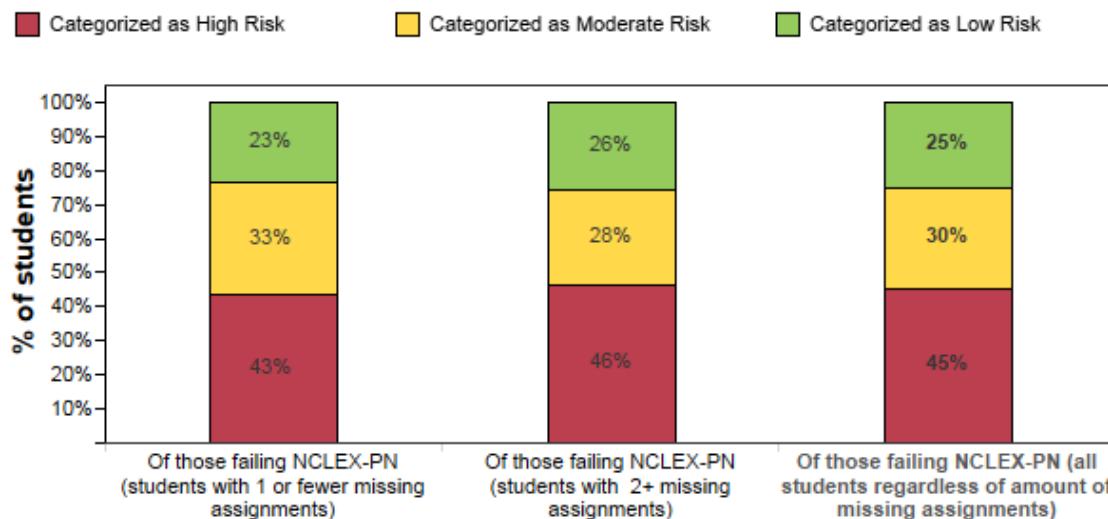
Figure 1. ATI Pulse risk categories for students that went on to fail the NCLEX-RN.



Note: Fail status is based on NCLEX-RN 2010 blueprint and its associated ATI Pulse predictive modeling. Fail status was collected by participating institutions. Overall n=337; 1 or fewer missing assessments n = 163; 2+ missing assessments n = 174 students failing NCLEX. 2013 blueprint pass fail status is currently being collected.

Risk category analysis on historical NCLEX-PN fail status is shown in Figure 2. 75% of student failing NCLEX were categorized under moderate or high risk.

Figure 2. ATI Pulse risk categories for students that went on to fail the NCLEX-PN.



Note: Fail status is based on NCLEX-PN 2011 blueprint and its associated ATI Pulse predictive modeling. Fail status was collected by participating institutions. Overall n=84; 1 or fewer missing assessments n = 30; 2+ missing assessments n = 54 students failing NCLEX. 2014 blueprint pass fail status is currently being collected.

Based on results displayed in Table 2 and Figure 1&2, it can be concluded that the ATI Pulse model accurately classified the majority of remediation needs for students based on their historical performance on ATI proctored assessments. Specifically, 97% of students within the low risk category went on to successfully pass the NCLEX-RN on their first attempt. Furthermore, up to 82% of students that went on to fail the NCLEX-RN on their first attempt were classified as “moderate” to “high risk” and in need of NCLEX-RN related remediation. These findings suggest that ATI’s Pulse Model is an effective approach for gaining earlier insights into later NCLEX-RN performance. As ATI Pulse functions as an early indicator of later Comprehensive Predictor performance, it is important for students to receive a final Comprehensive Predictor based probability of passing NCLEX-RN/NCLEX-PN⁴. In addition to providing a final probability of passing the NCLEX-RN/NCLEX-PN (vs. a predicted probability), the Comprehensive Predictor also provides students with NCLEX style questions and targeted study materials that are mapped to individual knowledge gaps immediately prior to taking the NCLEX-RN/NCLEX-PN assessment.

ATI recognizes its unique ability to understand key indicators of academic performance across tens of thousands of nursing students annually. We are proud to continue to be able to provide students and faculty better tools by which successful remediation can be achieved. Through ATI Pulse, we are confident that we can help empower students to act earlier in order realize their NCLEX-RN/NCLEX-PN goals!

Notes:

¹ NCLEX, NCLEX-RN and NCLEX-PN are registered trademarks of the NCSBN.

² ATI assessments included were ATI's Test of Essential Academic Skills (TEAS V) and ATI's Content Mastery Series Assessments (Fundamentals, Adult Medical Surgical, Leadership, Maternal Newborn, Mental Health, Nursing Care of Children, Community Health, and Pharmacology).

³ As Pulse usage increases, more data will become available. This document's analyses represents a snapshot in time and analytical optimization of Pulse prediction will be ongoing. As ATI continues with Pulse development, enhancements, new features, and different functionality may be introduced.

⁴ The primary purpose of ATI Pulse is to provide additional prediction and validation of nursing student performance, as well as continuous opportunities to offer targeted remediation. Accordingly, Pulse is not intended for use in a "high stakes" fashion, nor should it be used to screen students out of a program or to penalize students for their lack of ATI product use. Of course, as with all testing and predictive tools, ATI Pulse findings and indicators come with a margin of error that is both common and expected and results from a variety of factors. Administration of ATI's TEAS assessment and all of ATI's Content Mastery Series proctored test subjects will lead to more accurate Pulse predictions. While the predictive analysis of Pulse will offer meaningful data to school faculty and administrators, it should never be used as a sole criterion for evaluating student performance.

Frequently Asked Questions

1. Are there different ATI Pulse models for students enrolled in a BSN vs. in an ADN program?

Although the same methodology and analytical processes were used to create BSN and ADN versions of the ATI Pulse model, separate predictive algorithms exist for students enrolled in ADN vs. BSN programs. The different predictive algorithms emphasize or deemphasize certain predictors of later NCLEX-RN success as a function of how they perform analytically within these two different student populations. Despite ATI Pulse's program-specific weighting of predictors, comparable predictive accuracy is achieved for both ADN and BSN program types.

2. Does the ATI Pulse model include students' GPA or course grades?

Although frequently found to be a predictor of later NCLEX-RN/NCLEX-PN performance, GPA and/or course grades are not part of ATI's Pulse predictive model. The reason for not including these grade based metrics is two-fold. First, distribution of course grades (and therefore GPA) are likely to vary as a function of faculty grading difficulty. As a result, course grades highly predictive of NCLEX-RN/NCLEX-PN success at one institution may only be marginally predictive at another institution. The second reason for not including GPA or course grades is that ATI does not have broad access to students' grades or overall GPA data. Combined, these analytical hurdles prevent GPA or course grades' inclusion into the Pulse product.

3. What if my program does not use one or more of the assessments that are part of the ATI Pulse model?

The ATI Pulse model's accuracy is negatively impacted by greater amounts of missing data; however, values for missing assessments can be estimated (i.e., imputed) and students are still provided with predicted probabilities of passing NCLEX-RN/NCLEX-PN. It is strongly recommended that ATI Pulse users strive to use all ATI products included within the predictive algorithm. Increased use of the designated ATI products will improve the predictive outcomes of ATI Pulse.

4. Does the ATI Pulse model require that proctored assessments be administered in a certain order?

Other than the Test of Essential Academic Skills (TEAS V) being administered as part of a broader admissions screening process, all other ATI assessments included in the ATI Pulse model can be administered in any order during the course of a nursing student's academic career.

5. Why don't ATI tutorials or practice tests factor into the ATI Pulse's predicted likelihood of passing the NCLEX-RN/NCLEX-PN?

Although significant positive outcomes are associated with ATI tutorials and practice tests, ATI actively chose to not include these products in this version of the ATI Pulse. Currently, the conditions under which tutorials and practice tests are used do not have enough consistency across programs or products. Although some programs will integrate tutorials and/or practice tests into coursework and graded assignments, other programs will not have any policy regarding tutorial or practice test usage. ATI is frequently unaware of the nuances associated with these faculty level decisions regarding product usage. As such, only proctored examinations were included in the ATI Pulse model.

6. How can students go about increasing the ATI Pulse computed predicted probability of passing the NCLEX-RN/NCLEX-PN?

ATI Pulse only uses a student's first attempt proctored score for each ATI assessment when computing the predicted probability of passing NCLEX-RN/NCLEX-PN statistic. Due to variability in nursing programs' policies regarding tutorials usage or 2nd or greater attempts on proctored assessments, ATI is unable to reliably model this type of data. Despite this analytical limitation, ATI encourages programs to build student remediation plans that include retesting on content mastery or TEAS assessments when lower than desired performance was achieved during the first proctored examination. In addition to potentially allowing students multiple attempts on proctored assessments, students and faculty can use the ATI Pulse dashboard to understand which remediation tools (e.g., tutorials) are available. Although subsequent remediation efforts are designed to increase students' nursing content mastery, these behaviors are not currently translatable into an analytical change in a student's predicted probability of passing NCLEX.

7. May I get a copy of the ATI Pulse methodologies and formulae?

Thank you for your interest in our model and the exciting promise it offers! Unfortunately, the ATI Pulse model, its methodologies, and its underlying analytical techniques are proprietary and may not be distributed.

8. Does student prediction in Pulse start with the first student data point that is available (e.g., TEAS V)?

Research studies have shown that the TEAS is predictive of early nursing program success when compared to students' performance on the ATI Fundamentals proctored assessment. Realizing that a number of factors influence nursing program completion and ultimate NCLEX success, TEAS data on its own cannot speak fully to a student's likelihood of NCLEX success. When the TEAS is placed within ATI's Pulse model an early predicted probability of passing the NCLEX-RN/NCLEX-PN is presented. It is important to understand this early prediction needs to be kept within the context of the Pulse model to allow for further completion of additional data points. This early prediction is to aid in supporting student program success, not meant to inform admission guidelines or trends.

ATI's Pulse model provides a predicted probability of passing the NCLEX-RN/NCLEX-PN that is based on a student's historic performance across several proctored ATI assessments. Predicted probability of passing the NCLEX-RN/NCLEX-PN is a function of a student's predicted later performance on ATI's Comprehensive Predictor assessment and its associated predicted probabilities of passing the NCLEX-RN/NCLEX-PN. Depending on the academic tenure of a nursing student, more or less data will be entered into the ATI Pulse predictive model. In cases where fewer data points are available for the model, a student's earlier performance on proctored assessments is used to proactively predict future performance. In cases where only one assessment is available (e.g., the TEAS V admissions assessment), relative performance on this single assessment will be used to predict later proctored assessment performance. As the student continues to progress through his or her program of study, missing data points in the Pulse model are gradually replaced with values reflecting actual student performance on ATI proctored assessments. As more data becomes available to the Pulse model, more precise prediction is achieved.

References

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- Spurlock, D. R. & Hunt, L. A. (2008). A study of the usefulness of the HESI exit exam in predicting NCLEX-RN failure. *Journal of Nursing Education*, 47, 157-166.