RESEARCH ARTICLE

The comparison of the different adjustment factors for admission to the University of the Philippines College of Medicine

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ABSTRACT

Background: Among the different criteria, the General Weighted Average Grade (PMGWAG) holds the biggest bearing on admission to the UP College of Medicine. However, GWAs are not comparable across different courses, different batches, different UP units, and different schools. An Adjustment Factor is necessary to make PMGWAGs comparable and to level the playing field.

Objectives: This study covering a 24-year period aimed to compare various proposed Admission Adjusted Factors of %PMGWAG (Pre-Med GWAG) in terms of Pearson's Correlation, Linear Regression Models and Mean Differences with %MGWAG (Medical GWAG), Class Rank, and Board Rating as Outcome variables.

Methodology: Various proposed Adjustment Factors were applied to %PMGWAG of medical students from Class 1990 to Class 2014 and Pearson's Correlation, Linear Regression Models and Mean Differences with %MGWAG, Class Rank, and Board Rating were derived and analyzed.

Results: Adjustment Factor A3 as applied to %PMGWAG correlates best with Board Rating and Class Rank while Adjustment Factor A6 correlates best with %MGWAG. On Linear Regression, A3 likewise bested other Adjustment Factors in predicting %MGWAG and %Board Rating while A6 on predicting Class Ranking. Among the various adjustments, A3 exerted the most impact on the outcome variables based on mean differences.

Conclusion: The A3 Adjustment Factor is the preferred and most ideal among the various proposed adjustment factors. Its application on %PMGWAG, correlated best with, was most predictive of, and most influential to %MGWAG, Board Rating, and Class Rating.

Keywords: *medical college admission, medical education, academic performance, UP College of Medicine.*

Introduction

The General Weighted Average (GWA), the summarization of a student's grades throughout a course, has generally been deemed an important parameter for evaluation of academic achievement. It may be the most important factor in evaluating and predicting student performance. However, the use of raw GWA scores in assessing students poses the risk of incorrectly assuming that grades are comparable across all courses, all departments, and all instructors. Bailey *et al.* (2014) reported that in many educational settings, students may have an incentive to take courses that are perceived to be easier and in which high grades are easier to achieve [1]. In such cases, the raw GWA would overstate the performance of a student who chooses a relatively easy course of study over another who chooses a more difficult course [2]. Indeed, raw GWA as a previous academic performance indicator is by itself a good but not perfect predictor of achievement of medical training [3]. Furthermore, it is considered as the predominant and most consistent independent predictor of success in medical undergraduate courses [4]. Likewise, academic or cognitive ability was proven to be a moderate predictor of success in undergraduate medical training [5].

Since GWAs and grades represent the currency of education and perform an accountability function on a number of levels, grade inflation and a lack of precision in the grading process can have a profoundly negative influence on higher

education [6]. The admission process in medical education as higher education must consider and take into account these institutional grade norms and biases to ensure fairness [7]. Otherwise, applicants who attend rigorous institutions with stringent grading policies can be at a disadvantage.

As in other areas of education, students who aspire to become future physicians may also choose such a strategy to earn a higher GWA to gain entry into highly competitive medical schools. In the current setting, this has been supported by previous studies that revealed a proportion of students who performed below par academically in medicine, graduated from courses that were known and perceived to be relatively easier and that gave consistently higher grades in comparison to other courses [8]. Grades, thus, should be interpreted with caution. Although they are objective and numerical, they may still represent different levels of achievement for students of different courses and from different institutions.

Given these potential confounding factors, the standardization of GWAs is one of the difficulties that a medical school's admissions committee faces. What is needed is a method by which applicants are compared objectively despite differences in pre-medical courses, schools, and grading systems. Such method should account for this heterogeneity in the population of aspiring applicants. Thus, an adjustment procedure that is capable of standardizing grades across institutions must be formulated and adopted.

Predictive validity studies on academic performance utilizing measures such as pre-admission GWA and standardized test scores like NMAT were the focus of recent researches conducted [9]. The validity of these predictors should be enhanced by appropriate GWA conversion and adjustments to make them more comparable. Non-comparability of college grades is a significant factor in the diminished reliability and predictability of medical student performance based on GWA.

Grade adjustment methods for improving the prediction of academic performance have been studied as early as 1913 by Starch and Elliott [10]. Since then, several other methods have been developed and used to make grades from different courses and instructors more directly comparable. Each method is based on a different statistical methodology and assumptions about the data and has been empirically tested on real data sets.

No less than the University of the Philippines adopts a particular adjustment factor in its admission process to equalize the chances of high school applicants who come from a heterogeneous variety of secondary schools. The University Predicted Grade (UPG) is the sole criterion for admission to the University of the Philippines and considers the applicant's UPCAT (University of the Philippines College Admission Test) score and his/her high school grade point average. The adjustment factor is applied to the latter (high school grade point average) as this is the number that is not standardized [11].

This study compared six adjustment factors as applied to the GWA (%PMGWAG- Pre-Med General Weighted Average Grades). Four of these were formulated by the authors and one was formulated by the Dean's commissioned group and currently being adopted by the Admissions Committee of the UP College of Medicine (UPCM). Comparison was made in terms of its strength of correlation. Specifically, the study compared the strength of Pearson's Correlation of the different adjustment factors as applied to %PMGWAG, with student performance namely %MGWAG (Medical General Weighted Average Grades), Graduation Rank, and Board Rating. Secondly, the study described the linear regression models derived with the different adjusted %PMGWAGs as the independent, predicting variables with %MGWAG, and Graduation Rank and Board Rating as outcome variables. Lastly, mean differences between Adjusted (A1, A2, A3, A5, and A6) and Non-Adjusted (A4) %PMGWAG in predicting the outcome variables were derived and described.

Definition of Terms

Pre-medical General Weighted Average Grade (PMGWAG): The overall grade computed from all grades obtained from the academic subjects taken in the undergraduate or pre-medical course weighted according to their corresponding units. These are prepared by the University Registrar's office and submitted by the applicants to the UPCM Admissions Office. This grade covers the three and a half years (7 semesters) of academic performance of the student as an undergraduate. The grading scale follows that of the UP system, wherein the highest grade is 1.0 while the lowest is 5.0 (Failed). The %PMGWAG is computed by converting the PMGWAG to percentage using the equation %PMGWAG = 25 x (5-PMGWAG).

Class Rank or Graduation Rank: The student's percentile ranking out of the total number of students in the graduating class. This is based on the student's MGWAG (Medical General Weighted Average Grade) and is determined prior to graduation. Like the MGWAG, these are computed by the Office of Students Records of UPCM and kept as part of the student's permanent record. For uniformity of the scales in

the linear regression analysis, this ranking is also converted to percentile.

Medical General Weighted Average Grade (MGWAG): The overall grade computed from the grades of the subjects taken during the medicine proper program, weighted according to their corresponding unit-hours. This is computed prior to graduation by the Office of Students Records of UPCM and kept as part of the student's permanent archival record. The scale follows the UP grading scale, with 1.0 being the highest and 5.0 the lowest (failed). The %MGWAG is likewise computed by converting the MGWAG into percentage by the equation: %MGWAG = 25 x (5 – MGWAG)

Medical Board Rating: The overall score (in percentage) of the medical graduate in the nationally administered Physician Licensure Examination conducted by the Philippine Regulatory Commission. This is the average of the individual scores in the areas covered by this board examination namely: Anatomy, Biochemistry, Physiology, Pharmacology, Surgery, Internal Medicine, Pediatrics, Obstetrics and Gynecology, Legal Medicine, and Medical Jurisprudence.

Methodology

This is both a descriptive and inferential study that applied the different models of grade adjustment to a population of 2,533 medical students, which comprised lateral entry students (graduates of a 4-year baccalaureate degree) of the UP College of Medicine from Class 1990 to Class 2014. This was out of the total of 2,936 lateral entry students during that timeframe. This covered all those who were graduates of the top 5 most frequent pre-medical courses namely BS Biology, BS Molecular Biology and Biotechnology (BS MBB), BS Psychology, BS Public Health, and BS Zoology.

The six admission adjustment factors were as follows:

$$A1 = \sqrt{\frac{NMAT}{\%PMGWAG}} \qquad A3 = \frac{\%PMGWAGlc}{\%PMGWAGsc} \qquad A6 = \frac{\%PM\widetilde{GW}AGlc}{\%PM\widetilde{GW}AGsc}$$

A4 = 1 (No Adjustment Factor)

$$A2 = \sqrt{\frac{\%PMGWAGlc}{\%PMGWAGsc}} \qquad A5 = \sqrt{\frac{\%PM\widetilde{GW}AGlc}{\%PM\widetilde{GW}AGsc}}$$

Where:

$NMAT$ – The Mean NMAT score of a particular pre-medical course

$\%PMGWAG$ - The Mean %PMGWAG of a particular pre-medical course

$\%PMGWAGlc$–The Lowest Mean %PMGWAG among the different pre-medical courses

$\%PMGWAGsc$– The Mean %PMGWAG of a specific course

$\%PM\widetilde{GW}AGlc$–The Lowest Median %PMGWAG among the different pre-medical courses

$\%PM\widetilde{GW}AGsc$ - The Median %PMGWAG of a specific course

Rationale and Basis of the Different Proposed Adjustment Factors

Adjustment factor A1 is currently the adjustment factor being adopted by the admissions committee of UPCM. Formulated by the UPCM Dean's special Commission for the Amendment of the Admissions Policies, A1 adjusts %PMGWAG of the different courses based on the general performance of their graduates on the NMAT and their %PMGWAG. NMAT being in the numerator assumes that a better performance in the test reflects a better assessment of the course. On the other hand the %PMGWAG being in the denominator assumes that the higher %PMGWAG of graduates in a particular course could connote grade inflation or the ease of getting higher grades or the ease of the course *per se*. Thus, if the ratio of average NMAT over the average %PMGWAG of the graduates of a particular course is greater than one, it favorably adjusts the %PMGWAG of applicants from that course. The reverse also holds true.

It was also decided that the square root of the ratio be utilized to moderate or lessen the impact of the ratio on% PMGWAG upon adjustment.

The formulation of adjustment factor A1 was patterned after the adjustment index of UPCAT in the computation of the University Predicted Grades (UPG).

Adjustment factors A2 and A3 utilize the ratio of *%PMGWAGlc* and *%PMGWAGsc*. These adjustment factors assume that UP students are generally homogeneous in terms of intellectual capacities across all pre-med courses. Thus, what differentiates UP applicant for each other is their particular pre-med course and the ease as well as the difficulty of getting high grades. A2 and A3 adjust %PMGWAG by giving equal chances for UP applicants with the same academic standing in their respective pre-med courses. This imputes that a top-notch UP applicant from a particular pre-med course will have almost the same adjustment factor as with the other top-notch UP applicants from other pre-med courses. Or simply put, the top one of a particular pre-med course has an equal adjustment factor with all other top-notchers from different pre-med courses. In A2, square root was applied to the said ratio to observe the effect of lessening its impact on the %PMGWAG.

Adjustment factors A5 and A6 utilize the same ratio except that they use the median instead of the mean, in order to minimize the effect of extreme outliers in the entire

range of %PMGWAG. The square root of the ratio is applied to A5 to likewise lessen the impact on the %PMGWAG and to observe subsequently its effect.

Adjustment factors A2, A3, A5, and A6 were all formulated by the authors. A4 uses no adjustment factor thus it is arbitrarily assigned a value of 1.

Results and Discussion

As seen in Table 1, among the top five most frequent pre-med courses, BS MBB had the highest mean NMAT and % PMGWAG upon admission. BS Public Health had the lowest Mean %PMGWAG upon admission while BS Psychology had the lowest mean NMAT. BS Zoology was included in the said top five most frequent pre-med courses despite being dissolved two decades ago as a baccalaureate degree in the UP system because this study covered a 24-year time span. BS Zoology prior to its dissolution was a very popular and frequently chosen pre-med course.

In Table 2, all adjustment factors, when applied to %PMGWAG, manifested nearly the same strength (moderate) of correlation with %MGWAG. A6%PMGWAG showed the highest correlation with %MGWAG. Both A1%PMGWAG and A3%PMGWAG showed better correlation with %Board Rating and Class/Graduation Ranking compared to other applied adjustment factors. A3%PMGWAG had a slightly higher correlation with %Board Rating and %Class/Grad Ranking than A1%PMGWAG. All of the above correlations based on their respective p-values were statistically significant. Also

Table 1. *Mean NMAT, %PMGWAG and NMAT: %PMGWAG ratio among the Top 5 Most Frequent Pre-Med Courses*

Pre-med Course	Count	$NMAT_{Mean}$	$\%PMGWAG_{Mean}$
BS Biology	1433	96.1	82.1
BS Psychology	635	94.8	83.3
BS Public Health	185	95.6	80.5
BS Zoology	159	95.2	80.6
BS MBB	121	96.5	84.5
	2533		

given in the above table are their specific 95% confidence intervals, as in the enclosed within the parenthesis.

Although the above correlation did not show an outright superiority of any particular applied adjustment factor, the preference leans toward A3 since it is purely a ratio of %PMGWAG scores. Unlike the currently adopted A1, which factors in NMAT performance as numerator in the ratio (direct positive effect on %PMGWAG). The higher the mean NMAT of a given course, the higher its corresponding adjustment.

It should be noted that NMAT *per se* is already a separate and independent criterion of the admission process with a thirty percent (30%) weight and unaffected by the adjustment factor. To use an adjustment factor that utilizes the NMAT score again (as in A1) is tantamount to a redundancy in the admission criteria.

Furthermore, the mean %PMGWAG in this adjustment factor (A1) presumes the existence, the certainty, and even the pervasiveness of grade inflation in ALL courses. This assumption is contestable. As the mean %PMGWAG is

Table 2. *Pearson's Correlation between Different Proposed Adjustment Factors Applied to %PMGWAG and %MGWAG, Board Rating and Class Rank*

	%MGWAG	%Board Rating	%Grad Rank
A1%PMGWAG ($p < 0.05$)	0.515 (0.485,0.544)	0.400 (0.355,0.444)	0.541 (0.512,0.569)
A2%PMGWAG ($p < 0,05$)	0.509 (0.479,0.538)	0.390 (0.345,0.435)	0.535 (0.506,0.563)
A3%PMGWAG ($p < 0.05$)	0.511 (0.481,0.540)	0.400 (0.332,0425)	0.543 (0.515, 0.571)
A4%PMGWAG ($p < 0.05$)	0.504 (0.473,0.533)	0.378 (0332, 0.423)	0.523 (0.494,0.552)
A5%PMGWAG ($p < 0.05$)	0.512 (0.482,0.541)	0.283 (0.233,0.331)	0.526 (0.506,0.563)
A6%PMGWAG ($p < 0.05$)	0.516 (0.486,0.545)	0.293 (0.244,0.341)	0.535 (0.515,0.572)

placed in the denominator of the ratio, the higher the mean %PMGWAG of a given course, the lower is its adjustment factor. This questionably presupposes an inverse relationship between performance and evaluation tool (%PMGWAG) which is ironic. It is quite difficult to understand and harder to accept that better-performing graduates of a particular course, having had a high aggregated mean of %PMGWAG would suffer and bear the burden of a low adjustment factor.

From a different perspective, one can easily argue that since the criterion of interest in adjustment is %PMGWAG, it is only logical and ideal that the basis of adjustment be based solely on %PMGWAG. Thus, for the foregoing, A3 seemed preferable.

Generally (Table 3), all the models derived from linear regression analysis show similarities with very close values of Beta-coefficient and R2 (Coefficient of Determination) using the various adjustment factors. Furthermore, the coefficient of determinations (R2) in all models were small, which connotes that these models will cover only a small percentage (10%-30%) in terms of predicting the outcome variables. These models could provide quantitative explanation on the relationship between the predicting variable (%PMGWAG) and dependent variables (%MGWAG, % Board Rating, and Class Rank) only in 10%-30%. This is probably because there are a lot of other factors that influence the %MGWAG, %Board Rating, and Class rank beside the %PMGWAG.

However, in terms of sensitivity based on the outcome variables, %MGWAG and Board Rating, A3%PMGWAG bested other applied adjustment factors. This means that both the %MGWAG and Board Rating are most sensitive on A3%PMGWAG than the rest of the adjusted %PMGWAG. The influence on those outcome variables is strongest with A3%PMGWAG. A3%PMGWAG can delineate small changes on %MGWAG and %Board Rating, as compared to other adjustment factors. All of the aforementioned is based on comparing the beta-coefficients of the different regression models. In this light, the beta-coefficients of A3%PMGWAG in predicting %MGWAG and Board Rating were the highest among the different adjusted %PMGWAG.

Likewise, the R-squared (coefficient of determination) for the different regression models for predicting %MGWAG and Board Rating, were relatively high and highest respectively with A3%PMGWAG. This indicates that regression model involving A3%PMGWAG has a relatively stronger relationship with the outcome variables (%MGWAG and Board Rating). In the same model, the variability in %MGWAG and Board Rating is explained most by the variability in A3%PMGWAG. Simply put, the extent by which the model explains and predicts %MGWAG and Board Rating is highest with the model that involved A3%PMGWAG as input variable.

On the other hand, the regression model that predicts % Class Rank has the highest beta-coefficient and coefficient of determination (R-squared) was observed in the model

Linear Regression

Table 3. *Linear Regression Models predicting %MGWAG, %Board Rating, and Class Rank with the different Adjustment Factors Applied on %PMGWAG*

	%MGWAG	%Board Rating	%Grad Rank
A1%PMGWAG ($p < 0.05$)	y= 0.5048x + 24.682 R^2=0.2657	y=0.1805x + 64.844 R^2 = 0.16	y=2.213x – 145.95 R^2 = 0.2933
A2%PMGWAG ($p < 0.05$)	y=0.5452x + 25.271 R^2=0.2588	y=0.1924x + 65.267 R^2 = 0.1526	y=2.3918x – 143.47 R^2 = 0.2859
A3%PMGWAG ($p < 0.05$)	y=0.5565x + 24.997 R^2=0.261	y=0.2008x + 64.816 R^2 = 0.1603	y=2.4697x – 146.96 R^2 = 0.2952
A4%PMGWAG ($p < 0.05$)	y=0.5282x + 26.034 R^2=0.2537	y=0.1817x + 65.915 R^2 = 0.1432	y=2.2899x – 137.87 R^2 = 0.2737
A5%PMGWAG ($p < 0.05$)	y=0.5313x + 26.442 R^2=0.2621	y=0.1741x + 66.701 R^2 = 0.08	y=2.3948x – 143.59 R^2 = 0.2863
A6%PMGWAG ($p < 0.05$)	y=0.5447x + 26.012 R^2=0.2665	y=0.1839x + 66.127 R^2 = 0.0861	y=2.4757x – 147.19 R^2 =0.296

that involved A6%PMGWAG as the predicting variable. This observation was made deriving %Class Rank from %MGWAG.

All of the above regression models were statistically significant as shown by their p-values.

Table 4 shows the Mean Difference in the predicted outcome variables, %MGWAG, % Board Rating, and Class Rank between the various adjusted %PMGWAGs (A1, A2, A3, A5, and A6) with the non-adjusted %PMGWAG (A4). The mean difference of the predicted outcome variables derived from their respective regression models of adjusted and non-adjusted %PMGWAGs revealed that A3%PMGWAG had the significantly highest mean difference. This shows that in predicting %MGWAG, %Board Rating, and Class Rank, A3 adjustment of %PMGWAG had the greatest impact compared to all other adjustments (A1, A2, A4, A5, and A6). A3 adjustment exerts the biggest influence on Class Rank as the mean difference was more than thirteen (13) percentile.

Conclusion

As in previous studies, this study found that raw pre-medical GWA (%PMGWAG) was not as good as the adjusted GWAs in correlating with and predicting the outcome measures of class ranking, boards rating, and medical GWA. Adjusted pre-medical GWA better predicted and correlated with these outcome measures.

The study showed that A3 was the most ideal adjustment factor. It was found to be the most superior among the six proposed adjustment factors. This is grounded on the following: (a) when A3 was applied to %PMGWAG as an adjustment factor, it had the strongest correlation (Pearson's Correlation) with %Board Rating and %Class Ranking, (b) %MGWAG and %Board Rating on Regression analysis were most sensitive to A3%PMGWAG, and (c) A3 adjusted %PMGWAG had the greatest impact in predicting all the aforementioned outcome variables.

Furthermore, A3 is derived purely from batch %PMGWAG. When it is applied to individual %PMGWAG, it does not redundantly incorporate NMAT in its equation. In fact, as per admission policy, NMAT is a separate, weighted criterion (30%) and independent of the %PMGWAG.

The %PMGWAG and external test scores like NMAT are both measures of student performance. Although presumably similar and complementary, they more often give different results. According to Willingham (2005), grades represent how well students have performed based on a teacher's standard or internal institutional standard. This is as opposed to high-stakes tests such as the NMAT that represent an external standard or how well both teachers and students, or even the institution have performed based on the standards that apply across an educational system. Grades like %PMGWAGs have a special feature of being able to gauge individual assessment whereas external test (NMAT) scores represent a standards-

Mean Difference

Table 4. *Mean Difference between various Adjusted %PMGWAGs (A1, A2, A3, A5, and A6) with the Non-Adjusted % MGWAG (A4) in Predicting %MGWAG, %Board Rating, and Class Rank*

	%MGWAG	%Board Rating	%Grad Rank
A1%PMGWAG ($p < 0.05$)	0.369 (0.281, 0.458)	0.143 (0.116, 0.170)	1.658 (1.290, 2.027)
A2%PMGWAG ($p < 0.05$)	1.473 (1.366, 1.581)	0.535 (0.496, 0.573)	6.530 (6.057, 7.004)
A3%PMGWAG ($p < 0.05$)	3.002 (2.779, 3224)	1.114 (1.033, 1.195)	13.455 (12.466, 14.443)
A4%PMGWAG ($p < 0.05$)	0.0	0.0	0.0
A5%PMGWAG ($p < 0.05$)	0.213 (0.176, 0.249)	0.082 (0.070, 0.095)	0.977 (0.791, 1.163)
A6%PMGWAG ($p < 0.05$)	0.417 (0.342, 0491)	0.125 (0.105, 0.145)	1.919 (1.545, 2.294)

based assessment [12]. Knowing the differences between these two performance measures, it would be less ideal to incorporate one measure in the adjustment of another. The formulation of an adjustment factor of %PMGWAG must ideally be derived purely from previous %PMGAWGs and be independent of NMAT. Hence, among the equations for proposed adjustment in %PMGWAG, the ones which did not incorporate NMAT performed better in predicting outcome measures as opposed to the equation which did. It is in this light that the preference of A3 over the rest of the proposed adjustment is justified.

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