

Peer reviewed ORIGINAL ARTICLE

VARIOUS DIMENSIONS ASSOCIATED WITH THE PASS RATES FOR INTERN MEDICAL TECHNOLOGIST THAT HAVE AN IMPACT ON THE NATIONAL BOARD EXAMINATIONS IN SOUTH AFRICA

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ABSTRACT

Background: A study was conducted in South Africa on the performances of Intern Medical Technologists related to the National Board examinations. For the past decade, concerns have been raised regarding the high failure rates of Interns in these Board examinations.

Objective: This study aimed at identifying possible reasons for the high failure rates in the four main disciplines in the National Board examination for Biomedical Technology these being: Clinical Pathology, Haematology, Chemical Pathology and Microbiology.

Method: Quantitative and qualitative data were triangulated to investigate the pass rates of Interns writing these examinations. The National Board examination results were analysed for statistical significant differences using the ANOVA and the Pearson Chi-square test. The key role players involved in the Internship training of Interns at training laboratories and examinations of Interns were asked to complete an electronic survey regarding the quality and adequacy of training offered by training facilities.

Results: Statistical data from the analysis confirmed that the pass rates were extremely poor. Possible reasons for this were identified from the data obtained from the surveys.

Conclusion: This study added invaluable information to various problematic elements related to the education and training of Medical technologists. Recommendations and suggestions on how to improve the poor pass rates are discussed.

KEYWORDS:

National Board examinations, Intern Medical Technologists, training laboratories, HEI (Higher Educational Institutions), SMLTSA (Society of Medical Laboratory Technologists of South Africa).

INTRODUCTION

This is an original study as there is no literature available on the overall performances of Intern Medical Technologists in South Africa or for that matter, in other African countries regarding National Board examinations. Although there have been endless discussions about the National Board examination pass rates at various academic advisory meetings for the past few years, no research has been published to date.

After more than five years of Intern Medical Technologist training experience, the researcher felt an individual need to conduct this study. Although students have successfully passed and obtained their university qualification in Biomedical Technology, most students find it exceedingly difficult to pass the National Board examination at their first attempt. This has resulted in an increased number of repeat Interns in the system and this in turn has also resulted in a number of Interns that eventually give up and fail to complete their National Board examination.

The three-year qualification in Biomedical Technology is unique to South Africa. The programme includes six months of experiential training in the work place, referred to as work integrated learning (WIL) for student Medical Technologists (MTS). On

completion of this University programme, Intern Medical Technologists complete twelve-months of Internship training at a registered training laboratory, in preparation to sit the National Board examination in a chosen discipline.^[1]

These examinations are co-ordinated by the Society of Medical Laboratory Technologists of South Africa (SMLTSA) (founded in 1951) on behalf of the Health Professions Council of South Africa (HPCSA) and the Professional Board for Medical Technology (PBMT). The examinations are available in the following disciplines: Clinical Pathology (which includes three disciplines, Haematology, Chemical Pathology and Microbiology) or mono-specialised fields such as Blood Transfusion, Histopathological Technique, Chemical Pathology, Cytology, Cytogenetics, Haematology, Immunology, Microbiology, Virology and Pharmacology. Passing the National Board examination allows candidates the right to independent practice as a registered qualified Medical Laboratory Technologist in South Africa.^[1]

During the 12-month internship training period, the training is based on a discipline specific syllabus guide provided by the SMLTSA. All aspects of the syllabus content should be completed during this internship period as the National Board

examination is based on the entire discipline specific syllabus for internship training.^[1]

The high failure rates for Intern Medical Technologists (MTINs) in the National Board examinations is a serious concern for both academic staff from Higher Educational Institutions (HEIs) that provide the academic training of the students and the laboratory training staff who supervise the skills training of Interns in preparation for these examinations. To date, no formal research has been conducted regarding the reasons for these high failure rates. Literature regarding outcomes of the National Board examinations is very limited. This fact is highlighted by the researcher using various databases such as: Nexus, Google scholar, EBSCO and academic search complete. This study obtained quantitative National Board examination results from the SMLTSA database for the period 2008 to 2012 and qualitative data from key role players (laboratory trainers, supervisors, examiners and moderators) through a structured and open-ended multi-response electronic survey.

The statistical data on Intern performances indicated that the overall observed mean performance scores for the periods 2008 to 2012 were poor and several statistical significant differences were found in the overall education and training of these Interns. The respondents indicated that the overall education and training of students and Intern Medical Technologists was not always adequate and that the variation in the quality of training had a direct impact on the pass rates of the National Board examinations.

The findings in this study were triangulated and suggestions are presented with recommendations that are a valuable starting point for action that could be used to improve the performances of Intern Medical Technologists in the National Board examinations.

METHODOLOGY

Ethical considerations

Prior approval was obtained from the Academic Ethics Committee of the Faculty of Health Sciences, University of Johannesburg, RSA – (No. AEC01-08-2014), Society of Medical Laboratory Technologists of South Africa (SMLTSA) and heads of training laboratories to conduct this study. Standard practice confidentiality was maintained throughout this research and electronic consent was obtained from participants in the survey who remained anonymous throughout. Access to the data was limited to the researcher, statistician, supervisor and co-supervisor. The data was coded and stored electronically in a password-protected file.^[2]

Data analysis

The study consisted of three phases: firstly, a statistical analysis of the performances of Intern Medical Technologists related to the Board examinations and secondly, a structured and open-ended multi response survey to determine possible reasons why Interns performed poorly and finally, the third phase was the triangulation of data.

Quantitative data analysis

National Board examination results of Intern Medical Technolo-

gists were accessed from the SMLTSA database. A total of 11583 examination results for the different scopes of practices (Technologists, Technicians and Laboratory Assistants) were assessed using Microsoft Excel. The results were for all the disciplines (eleven Board available categories), the laboratories involved and HEIs, all from various provinces in South Africa.

Data was filtered and sorted and the final sample consisted of 1212 National Board examination results for Clinical Pathology, Haematology, Chemical Pathology and Microbiology for the periods 2008 to 2012. These 1212 results also included the examination results of three Gauteng HEIs, three private sector laboratories and one government sector training laboratory.

The National Board examination results were statistically analysed using the Statistical Package for the Social Sciences (SPSS). The One-way analysis of variance (ANOVA) was used to measure the variances in mean performances of Interns between different groups (Interns who completed their Internship at any of the four selected training laboratories, students who obtained their qualification from any of the three selected Higher educational institutions and in the four main disciplines) related to their examination scores. The hypothesis tested was if the mean performances of Interns between the different groups were equal: H_0 . Differences were considered significant at a p-value of <0.05 . The results were also analysed using the Pearson Chi-square test to compare the proportion of cases of repeat and non-repeat students for the period 2008 to 2012. The observed frequencies and cross-tabulation were used to identify statistical significant differences between these two groups indicated at the p-value of <0.05 .

Qualitative data analysis

The surveys were completed by laboratory trainers, and supervisors from two private and one government sector training laboratory as well as the examiners and moderators involved in Clinical Pathology, Haematology, Chemical Pathology and Microbiology for the periods 2008-2012.

The respondents were asked for their views and opinions about the adequacy of training and evaluations offered at HEIs and training laboratories and the challenges associated with preparing interns for the National Board examinations. The survey consisted of three sections: the qualifications and training experience of participants; their perception of the adequacy of higher education training and Internship training and lastly possible reasons for Interns failing the National Board examinations. A multiple response analysis with frequency counts and cross-tabulations were used to present the data.

Triangulation of data

The findings of the statistical data and surveys were triangulated. The qualitative data was used to explain the quantitative findings. This was achieved by examining the quantitative and qualitative results for convergence of findings and analysing a research question from multi perspectives.

Suggestions are presented with recommendations that are a valuable starting point for action that could be used to improve the performances of Intern Medical Technologists in the National Board examinations.

RESULTS

Detailed descriptions of both quantitative and qualitative data analysis and findings were published in two separate articles.^[3,4] In this article the summary of triangulated data for the National Board examinations for Intern performances will be presented for each section related to the: adequacy of Higher education; adequacy of Internship training and possible reasons for poor Intern Medical Technologist performances related to these examinations in four main disciplines: Clinical Pathology, Haematology, Chemical Pathology and Microbiology.

The role of higher educational institutions in the training of student Medical Technologists

Quantitative results

National Board examination results of a total of 628 students who studied at three selected HEIs in SA were statistically analysed. Students who obtained their qualification from HEI 1 had a mean performance score of 53% in the Board examinations, those from HEI 2 obtained 49% and students from HEI 3 also obtained 49%. The ANOVA between groups analysis of variance indicated a statistically significant difference at the $p < 0.05$ level in the performances scores between HEIs 1, 2 and 3 ($F(2, 625) = 6.1, p = 0.03$).

Students from HEI 1 achieved a higher score compared to those from HEIs 2 and 3. Consequently, the H_0 which stated that the mean performances of Interns from three Higher HEIs were equal was rejected. Students from HEI 1 were better prepared for the National Board examination.^[3]

Qualitative results

The respondents (laboratory trainers, supervisors, examiners and moderators) identified possible reasons for the poor Intern performance related to their preparation based on University training.

The majority of respondents agreed that students lacked certain fundamental skills for example, basic understanding of concepts and methodologies. They indicated that they felt that certain aspects of the technologist syllabus is covered very rapidly in a short period of time and this resulted in students lacking the necessary fundamental skills. Some of the respondents were of the opinion that the practical training at a HEI was lacking and that Interns did not have the necessary practical skills relative to the National Board examination. One respondent commented that students did not know how to approach an examination and/or test and were unable to study in an independent manner. Some were of the perception that the overall standard of Higher education was not adequate.^[4]

The role of the training laboratories in the Internship training of MTINs

On completion of a three-year National Diploma in Biomedical Technology, student Medical Technologists are required to complete a twelve-month internship training programme, within a chosen discipline. Internship training programmes are offered by registered training laboratories, which are accredited by the Health Professions Council of South Africa (HPCSA) and approved as laboratories for student internships training

The mean performances of the MTINs in the National Board

examinations who did their Internship at three private and one government sector training laboratories in South Africa for the periods 2008 to 2012 were investigated in four disciplines: Clinical Pathology, Haematology, Chemical Pathology and Microbiology.

Quantitative results

National Board examination results of a total of 854 students who did their internship at these different training laboratories were statistically analysed. MTINs from Laboratory 1 had a mean performance score of 47%, those from Laboratory 2 obtained 46%, while those from Laboratory 3 obtained 51% and the ones from Laboratory 4 obtained 50%. The ANOVA between groups analysis of variance indicated a statistically significant difference at the $p < 0.05$ level in the performances between laboratory's 2 and 4 ($F(3, 850) = 7.9, p = 0.00$). Laboratory 4 ($M = 50.25, SD = 11.59$) achieving a higher score compared to that of laboratory 2 ($M = 45.65, SD = 11.87$). Therefore, the H_0 which stated that the mean performances of MTINs in the National Board examination at three private sector and one government sector training laboratory were equal was rejected.

The performances of MTINs from the different training laboratories for the periods 2008 to 2012 indicated average performances ranging from 46% to 51% for the pass rates.^[3]

Qualitative results

A multitude of reasons were given by the respondents in the survey as to why they thought the Interns performed poorly.

Laboratory training challenges encountered during internship

The majority of respondents stated that students lacked knowledge regarding the basic skills of laboratory techniques and methods. Some indicated that not all WIL students completed their WIL manuals as per the requirements set out by the HPCSA during their training. The respondents were of the opinion that the internship training programmes were not standardised across all disciplines. The majority commented on the shortages of experienced qualified training staff at their training facilities. Some of the respondents were of the opinion that inadequate time was allocated towards the training of Interns during the training period and a few stated that the Interns showed poor commitment towards their studies and subsequent examination preparation.^[4]

Reasons for poor Intern performances in the National Board examinations

The majority of respondents agreed that Internship programmes were not always adequate, especially at branch laboratories due to inadequate training support and this impacted on the preparation of students for the Board examination. Some students were placed in non-accredited training facilities for Internship. The respondents commented once again on the student's lack of knowledge regarding the basic skills of laboratory techniques and methods. Some felt that the examination questions were either set above the level(s) required to qualify as a Medical Technologist or that questions were somewhat ambiguous. The majority commented on student's poor writing and communication skills in English. A few were of the opinion that the time the Interns spent on their preparation to sit the National Board examination was totally inadequate.^[4]

A trend of significant concern was that a number of students attempted these examinations between 2 to 9 times. For example, a total of 238 students who repeated the examinations in the periods 2008-2012 the following results were shown: 212 (n=238, 51%) students repeated twice; 55 (23%) students repeated three times; 34 (14%) students repeated four times; 10 (4%) students repeated five times; 10 (4%) students repeated six times; 6 (3%) students repeated seven times; 1 (0.4%) student attempted the examination for the eighth time and 1 (0.4%) student repeated the examination nine times. It is general practice in the profession that Interns are allowed a maximum of four attempts to write the National Board examination/s. Unfortunately, no current HPCSA guideline or policy regarding this is available.

DISCUSSION AND RECOMMENDATIONS

The qualitative and quantitative data were triangulated to formulate the following recommendations. These recommendations are aimed at improving the future education and training for MTSs during their WIL and subsequent internship.

Higher Education Institutions (HEIs)

The Biomedical Technology programme at HEIs consists of twenty four modules completed over a three-year period. Students from the second year of studies at the HEI start with four core modules. The core modules are: Chemical Pathology, Haematology, Microbiology and Cellular Pathology. The Biomedical Technology programme is currently offered by eight HEIs in South Africa. HEIs play a major role in the education of student Medical Technologists by teaching fundamental theoretical knowledge, in the evaluation of student competence and in the preparation of the student for the profession.

The respondents to the survey identified the following problems:

- Students lacked basic insights in the understanding of concepts and methodologies and did not receive adequate practical experience at HEIs. The course modules at HEIs are structured to contain 80% theoretical knowledge and 20% practical skills. It is therefore important that students gain full practical experience during their WIL and Internship programme. A pre-WIL training and assessment programme is recommended to include the core module contents before students commence their WIL training.^[5] Practical skills, for example, test principles, good laboratory practices (GLP) should be applied and reinforced in the laboratories during the WIL and Internship programmes of Medical Technologists, as HEIs are academic training institutes and not diagnostic facilities.
- Students did not know how to approach an examination and/or test. At risk students should be identified early and additional support offered. Mentoring and tutoring programmes for students should be implemented at HEIs.^[6]
- Students are unable to study in an independent manner. HEIs should identify and encourage students from their first year to participate in support/study groups and to go to academic centres for development, which support students in learning and writing skills. These centres should be available at all HEIs to assist

students that may need additional aid with academic learning difficulties.

- Some respondents questioned the standards of education received by students at HEIs. These supposed lack of standards resulted in the student's inability to comprehend and interpret important theoretical information. Regular reviews and updates of all module contents should be performed in order to align the curriculum with the practice Medical Technology. It is also recommended that a standardised student selection and admission criteria across all HEIs in South Africa should be implemented. These might include aptitude tests, interviews and job shadowing before students are admitted into the Biomedical Technology programme.^[7]
- Academic staff should have a minimum of a Master's degree. Regular competency evaluations of academic staff should be performed including peer review, student and Head of Department (HOD) evaluations.

WIL and Internship at training laboratories

As Interns lacked basic knowledge of laboratory techniques and methods. The theoretical contents of courses offered should be reinforced during the 6 months of WIL and the 12 months of Internship training, as it takes time for Interns to retain a vast amount of information studied at a HEI.^[8,9]

Work integrated learning (WIL)

Students did not complete the required practical guidelines set out in the WIL manual during their six months at the laboratories and therefore immediate policies on the requirements, monitoring and evaluation of WIL students are required. A structured pre-approved HPCSA WIL programme manual covers the full scope of practical requirements. These manuals should be updated and reviewed regularly by the HPCSA and all HEI to ensure current and up to date technologies are utilised. Both student/s and supervisor/s should complete these manuals during the WIL training and facilities should comply with these requirements in order for students to successfully graduate. Student clinical co-ordinators are to be appointed and regular site visits and communications between HEIs and training facilities are considered a crucial aspect in this regard.^[10]

The WIL is the final module which students complete before successfully graduating. It is recommended that this module should be externally moderated similar to all the other HEI's exit level modules. Quality assurance of student WIL manuals need to be re-enforced and incomplete manuals should result in a student not being able to graduate.

Internship training

- The laboratories were often short staffed and did not have dedicated training staff monitoring and evaluating the Interns. Training facilities should appoint sufficient and experienced qualified supervisors in all disciplines. Job descriptions should include clear roles and responsibilities for both training staff and supervisors.^[10]
- Interns were used in the laboratories to relieve staff shortages, which in turn impacted on the training time

of Interns. The HPCSA policy regarding MTINs supervision should be available to all training facilities and the ratio of student/s to supervisor/s should be clearly stated. Facilities should make the necessary arrangements to have sufficient qualified relief staff.^[10]

- Participants reported on the inadequacy of time allocated for Internship training at the training laboratories. A minimum requirement of 12 months Internship is stated by the HPCSA. MTINs may not work over-time/night shift or be used to replace staff shortages. Training laboratories should have study schedules in place that effectively provide students with structured teaching and learning as well as study times that effectively covers the required content of the examination during the 12 month period. Time management is a big part of the planning process involved during internship training and a lack in this essential area may well be the reason that students are unprepared when writing the Board Examinations.
- Internship training programmes are not standardised, which resulted in a variation in the quality of training received by the Intern/s. Structured training and rotation programmes, which cover all disciplines, should be implemented at the organisational level and across all training facilities.^[10,11]
- MTINs showed poor commitment towards their studies. Continuous mentoring and support programmes should be available during WIL and Internship training.^[10] Guidelines in the form of policies that have clear directives on the processes for performance evaluations in all disciplines and how to deal with transgressions including counselling and disciplinary action when the need arises, should be implemented.

National Board examinations

Regarding the National Board examinations the following recommendations are made:

- As MTINs were poor in communicating and in writing English. English pre-assessment tests should form part of student selection and admission criteria to the programme.^[12] In addition HEI's should refer students to their academic writing and learning centres.
- As there is a perception that questions were set above the level(s) required for Medical Technologists, there should be clear objectives of what is required and open lines of communication should be available with examiners and moderators through the assistance of the SMLTSA. This is an adjunct of the Board examination standardisation programme.
- There is also a perception that MTINs at branch laboratories were compromised due to a lack of training support provided. It is suggested that structured standards and guidelines for all facilities be made available to ensure comparable training throughout an organisation are in place. The role of training staff and supervisors should also be unambiguous.^[10,11]
- Some MTINs were placed in non-accredited training laboratories. The HPCSA has clear guidelines for the

application of training laboratory status. A list of accredited training facilities should be made available to all HEI's and training facilities. The numbers of HPCSA auditors and accredited training laboratories should be increased so that there are sufficient numbers of training laboratories available.

- MTINs lacked knowledge in basic laboratory techniques and methods. During the internship it is essential to ensure that theoretical knowledge is correctly applied.^[7] Policies on continuous evaluations of MTIN's performances in all disciplines are thereby required.^[9,10,11] These policies should outline the role of WIL and Internship training programmes in all the training laboratories and should include the HEI's key business processes and systems for the respective disciplines and activities. Policies should also refer to the different types of assessment methods and evaluations of students during their training in preparation for the National Board examinations.
- Policies should include poor performance strategies and this should be addressed and intervention measurements put in place to monitor students continuously during these training periods. This will ensure consistency in training and act as an internal check to ensure standardisation for student training across all disciplines. This will hopefully reduce the number of errors contributing to failures in performance.
- The standard of the National Board Examinations should be reasonable in the sense that it assesses the correct level of competency for interns. Some respondents were of the opinion that current standards were extremely low and should in fact be much higher. The SMLTSA syllabus for each discipline is available which states the scope of practice, theoretical knowledge and practical skills necessary and required for the profession. The examination should thus be set accordingly. The syllabus for each discipline should be reviewed regularly by the HPCSA and aligned to these examinations so that a reasonable standard is achieved.^[13]

Recent studies on the development of standardised internship training programmes highlight that there should be an improved clinical experience, in order to enhance the success and outcome of the training. The preparation of students during WIL and Internship is particularly important in order to achieve a balance between work-based learning and their education.

The results of this study indicated that the overall education and training of students and MTINs are not always adequate to prepare them for the National Board Examination. This is indicated when comparing results for the MTINs who came from the different universities and training laboratories. The results reveal the need to underpin the training of student and MTINs and to resolve the issues discussed as soon as possible.

CONCLUSION

This study presented typical results of the performances of MTINs for the periods 2008 to 2012. The study revealed that the overall performance was generally poor. Several reasons were

identified that contributed to the poor National Board examination pass rates.

The past and current state of affairs may well be the result of inadequate action on the part of HEI's, training laboratories and the HPCSA which resulted in a cascading affect that contributed to these poor pass rates for the National Board Examinations for Medical Technologists. Very little has changed during the past decade to improve the current situation in the education and training of MTS and MTINs. Over the years, it has become exceedingly difficult to solve the poor pass rates as each HEI, private and government sector training laboratories tended to blame each other for these high failure rates. To date, as Medical Technologists we have failed to resolve these challenges.

One proposal emanating from this study is that immediate action should be taken by having regular communication and meetings with the major role players i.e. the Professional Board for Medical Technology, HPCSA, SMLTSA, HEIs, private and government sector training laboratories. In order for reasonable success these meetings should be conducted on an urgent and regular basis. As a profession we need immediate productive solutions to improve the overall training, quality and competency of MTSs and MTINs for Biomedical Technology so that effective and efficient service provision is possible.

Laboratories should consider increasing their staff volumes to include more experienced trainers and supervisors to ensure constant assistance and monitoring of MTINs. The internship plays a major role in the preparation of MTINs towards the National Board examinations and towards their future careers. Regular monitoring and documented evaluations of MTINs progress during Internship is essential. Structured WIL and Internship programmes are required to avoid inconsistencies in the training offered by the training laboratories in each disciplines. The training laboratories should offer workshops for MTINs to reinforce their theoretical and practical skills.

It is also recommended that documented policies be made a priority by the HPCSA and that these policies should include a clear set of criteria regarding the number of allowable attempts the students can write the National Board examinations.

It is crucial that the major stakeholders get involved in improvement plans in order to correct the current situation of education and training for Medical Technologists in South Africa. The HPCSA should be at the forefront and take action by re-evaluating student admission and selection processes by HEI's and in the training statuses of training laboratories. Unannounced site visits to both HEI's and training laboratories should be conducted. It is also suggested that urgent productive meetings should be held by the HPCSA and that the minutes from these meetings are shared with all the staff from HEI's and supervisors as well as all training laboratories, for transparency. The HPCSA should ensure that all the training policies and procedures are available and are regularly updated. These policies should be uploaded onto the HPCSA webpage so that all qualified Medical technologists have access. These issues need to be resolved

urgently in order to determine not only the short-term but long-term future of our profession.

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Authors' contribution

Author contributions: W.K. conception and design of research; W.K. performed experiments; W.K. analysed data; W.K. interpreted results of experiments; W.K. drafted manuscript; S.E. edited and revised manuscript; S.E. approved final version of manuscript.

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