Use Of Biostatistics Among Practicing Doctors In Penang, Malaysia
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Citation

Abstract
Introduction: The understanding of the fundamentals of statistics is important because statistics is used to analyse data, report results and interpret published findings.Aim: To determine the use of biostatistics among practicing doctors in Penang, Malaysia, and their opinion concerning undergraduate biostatistics teaching.Methods: This descriptive cross sectional survey was conducted in Penang, Malaysia among doctors working in two major government hospitals in the state and among the members of the Malaysian Medical Association (MMA) Penang branch using a self-administered questionnaire.Results: Most of the respondents in this study used very few basic statistical measures and then only to read journals. However, less than half read journals regularly probably because most of them were not confident in interpreting the results of the published studies. This is not surprising, considering only about a third were involved in research, and even fewer had published an article in a medical journal. This could be explained by the fact that most admitted that what was taught to them during the undergraduate years was inadequate, and they couldn’t remember what was taught to them. Most admitted that statistics was important and helpful in their careers and it is also important for reading journals and because of that doctors should learn statistics. Most did not have additional training in statistics, but did not wish to attend any additional short courses, possibly because they considered statistics to be a difficult subject or undergoing the training to be time-consuming.Discussion: Biostatistics is important for medical research and evidence based medicine, and doctors must upgrade their knowledge in the field of biostatisticsConclusion: Lack of knowledge in biostatistics could be an important reason for the lack of participation in research among doctors in Penang, Malaysia.

INTRODUCTION
There are numerous definitions of biostatistics, and few help to explain the utility of biostatistics. Concisely defined, biostatistics is the science of managing medical uncertainties [1]. A statistic is the answer to a question, and the art of choosing the right statistics is to match it to the question [2]. Statistics is mostly used by doctors to explain risk to patients, accessing evidence summaries, interpreting screening test results and reading research publications [3].

It is common to find that most physicians admit that they do not take biostatistics seriously. This could be because statistics is usually perceived to be mathematically-based, and involves calculations, and also because doctors are usually less motivated to learn anything else other than medicine [4,5,6,7]. Similarly, medical students do not take biostatistics seriously during undergraduate years because they are not motivated to study subjects which are different from the medical subjects taught to them, especially one that involves mathematical calculations. In addition, most students do not perceive statistics to be relevant to medical practice possibly because most have not planned their future medical careers yet [4,5,6,7,8,9].

Most medical schools, whether in the North America [10], Africa [11] or Asia [12] (including Malaysia [13]) have formal basic statistics concepts in their courses. This usually involves formal lectures, tutorials, exercises, workshops using statistical software, etc.

‘Tomorrow’s doctors’ is a document in which the General Medical Council’s outcomes and standards on what a new United Kingdom (UK) graduate must be able to demonstrate are laid down. Emphasis is placed on the importance of the fundamentals of statistics for the use of research skills to develop a greater understanding, and to influence practitioners’ practice [14].

In the USA, the Accreditation Council for Graduate Medical Education’s practice based learning and improvement competency requires that residents should be competent at
locating, appraising and assimilating evidence from clinical journals [15]. However, most students do not perceive the importance of the subject in medical schools due to the nature of the subject which make lectures uninteresting, and also due to the lack of practical exercises and using data which are not relevant to them [13].

In most medical schools in Malaysia, biostatistics is not taught as a separate discipline. It is taught as an undergraduate subject, usually in the earlier years of medical school. Here, students are taught about the measures of central tendencies and dispersion, inferential statistics, sampling techniques, and organization of data etc. Students are also taught how to use a statistical software programme like PASW or Epi Info. In some medical schools, the students are encouraged to undertake some form of research and to analyse the obtained data.

Recently, with the importance placed on research, evidence based medicine, increase in the use of sophisticated statistics in medical journals and the development of statistical software has made statistics more attractive [16,17,18,19]. Despite this increased focus on statistics, there still exists some common misunderstanding about the basic concepts of statistics among medical practitioners, and, with the advent of statistical software, many doctors take short cuts and wrongly interpret the results which have been churned out by the computers. This is evident by the finding that almost 50% of the medical article have statistical errors [4]. Doctors admit that it is important to understand the statistical concepts, but studies show that clinical doctors and students lack in the knowledge of biostatistics and interpretation of medical literature [20,21,22], and most of the published work on statistics is usually done by statisticians and not by practicing doctors [23]. It is important to understand the fundamentals of statistics, because statistics is used to analyse data, report results and interpret published findings. If the fundamental concepts of statistics are wrong, then the scientific evidence at hand will be misinterpreted and the conclusions reached will be wrong.

The objective of this study was to determine the use of biostatistics among practicing doctors in Penang, Malaysia and their opinion concerning undergraduate biostatistics teaching.

METHODS

Setting: This study was conducted in one of the 13 states in Malaysia, Penang. Respondents were recruited from two main government hospitals (Penang Hospital and Seberang Jaya hospital), and from among the members of the Malaysian Medical Association (MMA), Penang branch.

There are six government and 10 private hospitals in the state. Penang hospital is the largest hospital in the state and is located on the island, whereas Seberang Jaya hospital is the second largest hospital and is located on the mainland. There were 32 979 doctors serving in the country in 2009, with 22 429 of them working in the public sector. The doctor to population ratio was 1:827. The doctor population ratio for Penang was 1:740 [24]. MMA is the main national organization representing the medical doctors in Malaysia, and has many branches throughout the country, including Penang.

Study design: A descriptive cross sectional study design was used to meet the objectives of this study which was conducted from June 2011 to February 2012.

Sample: According to the biennial report from the Malaysian Medical Council, 23 055 annual practicing certificates were issued in 2010, of which 1677 were issued to doctors practicing in Penang [25]. Questionnaires were also posted to 170 members of the MMA, Penang branch who were not working in the two hospitals where this study was conducted. The human resources training unit of Penang Hospital helped to distribute 400 questionnaires to their doctors and another 150 questionnaires were distributed in Seberang Jaya hospital. The human resources training units of the two hospitals helped to collect the completed questionnaires whereas the MMA members were requested to return the questionnaires to the investigators using prepaid envelopes given to them with the questionnaires.

Instrument: A self-administered questionnaire was prepared. This questionnaire had three sections including: (a) baseline profile of the participants concerning their demographic information including data concerning practice and history of conducting research; (b) ‘how often’ and ‘for what purpose,’ if any, of the numerous different statistical elements were used for data organization, measures of central tendencies and dispersion, inferential statistics, correlation and regression and sampling; (c) participants opinion concerning biostatistics including the emphasis and the elements needed in the undergraduate syllabus. The responses for section (b) for ‘how often’ included never, seldom, fairly, regularly and always whereas for the ‘purpose’ the responses were read journals, research and practice. The responses for section (c) the ‘opinion’ responses ranged from strongly agree, agree, neutral,
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disagree and strongly agree whereas for the ‘emphasis and elements needed in the undergraduate syllabus’ included no emphasis, mild emphasis, moderate emphasis and total emphasis.

Analysis: Data were analysed descriptively using SPSS Version 18. The results were tabulated and depicted graphically using MS-Excel.

Ethics: Prior to starting the survey, ethical approval was obtained from the department’s ethics committee. A detailed explanation concerning the purpose of the study and the potential benefits and what was required from the participants was given to them along with the questionnaire. The anonymity of the participants was assured. Each subject was given a unique identifier number which was used in all handling of data.

RESULTS

From the 720 questionnaires distributed, a total of 318 valid replies were received by the end of February 2012. Table 1 shows the baseline profile of the respondents. The majority of the respondents were female (52.5%) and Chinese (52.2%). The mean age of the respondents was 34 years old, and the mean number of years since graduation was 9 years. The majority were medical officers (50.3%), had clinical post graduate qualifications (54.4%), were practicing in urban areas (72.3%), employed by the Ministry of Health Malaysia (84.0%). Most were interested in a non-academic clinical career (61.9%). The majority did not have any training in statistics (58.8%), did not read medical journals regularly (53.1%), and were not confident in interpreting medical literature (70.8%). Most were not interested in a career in research (54.7%) and were not involved in research (66.7%) at the time of this study. Among those who were involved in research, most were in the field of clinical research (77.4%) mostly clinical trials (14.2%). Only 67 (8.8%) respondents had published an article in medical journals, and only 30.2% had used a statistical package.

Table 1 Baseline profile of the participants

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<th>Variable</th>
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<td>Data were analysed descriptively using SPSS Version 18. The results were tabulated and depicted graphically using MS-Excel.</td>
<td>Figure 1 shows the frequency of use of some of the common statistical elements. Tables, bar graph, histograms and pie charts were the commonly used figures for data organization whereas frequency polygon, dot plot, box and whisker, stem</td>
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and leaf and scatter diagrams were less frequently used. All the three common measures of central tendencies were commonly used whereas quartiles, interquartiles, variance and standard deviation were among the measures of dispersion which were less frequently used. A substantial number of respondents did not use or seldom used the measures of inferential statistics, correlation and regression and sampling.

**Figure 2**

![Figure 2: The purpose of use of some common biostatistics measures](image)

As shown in Figure 2, most of the measures used for the organization of data, measures of central tendencies and dispersion, common tests used for inferential statistics, correlation and regression and sampling were used for reading journals followed for their practice purposes and very few for research purposes.

Most of the respondents agreed that all the fundamentals of biostatistics should be emphasized during the undergraduate years. A substantial number of participants felt that biostatistics was not an easy subject and what they were taught in school was inadequate. Because biostatistics is seldom used, most don’t remember it. Most participants agreed that the subject is important for evidence based medicine, to understand medical literature, that it would benefit their career if they understood biostatistics better, that it is a requirement for anyone conducting research, and, hence, doctors should learn statistics (Figure 3). The majority felt that biostatistics should be taught in the 4th year (42.8%) followed by 3rd year (19.5%), 5th year (16.0%), 2nd year (13.5%) and 1st year (8.2%) of medical school.

**Figure 3**

![Figure 3: Opinion concerning biostatistics](image)
As shown in Figure 4, most felt that more emphasis should be placed on problem-based learning followed by hypothesis testing, critical appraisal skills, descriptive statistics, sampling and study designs and statistical packages.

**Figure 4: Emphasis on biostatistics for undergraduate syllabus**

The majority of the respondents would not prefer to have any additional short courses (64.2%). Most of the participants considered that the short courses in biostatistics were relevant and useful (60.7%), but some felt that it was time consuming (22.0%), expensive (13.8%) and not useful (3.5%). Among those who would choose to attend a short course in biostatistics if given the opportunity, preferences were for: the use of statistical software packages (35.8%), review of the fundamental concepts on biostatistics (29.5%), methodological concepts (21.1%) and critical appraisal skills (19.2%).

**DISCUSSION**

Poor knowledge in biostatistics and the skills to interpret medical literature is usually as a result of insufficient training. Most of the respondents in this study used very few basic statistical measures and then only to read journals. However, less than half of them read journals regularly, and this could be because most of them were not confident in interpreting the results of the published studies. This is not surprising, considering only about a third of them were involved in research and even fewer had published an article in a medical journal. This could be explained by the fact that most admitted that what was taught to them during the undergraduate years was inadequate, and that they could not remember what was taught to them.

Studies have shown that clinical doctors’ performance in the knowledge of biostatistics is not satisfactory, and most lacked skills in the interpretation of medical literature. Bernwick et al. administered a statistical skills self-assessment questionnaire to 281 subjects including medical students, interns, residents, physicians engaged in research and practice to explore their understanding of the terms and rules of inference. Most of the respondents showed lack of consensus on the meaning of the terms and were willing to draw conclusion unsupported by available data [26]. A study at Yale University [20] involving 277 residents in primary care specialities found that residents managed to get only 41% correct answers when tested on their statistical knowledge and ability to interpret results. Fellows and general medicine faculty with research training scored better with 72% correct answers. Three quarters of the respondents indicated that they did not understand all the statistical concepts they encountered when reading journal articles, and, thus, lacked confidence in interpreting medical literatures. Similarly a study done to evaluate the importance and understanding of bio-statistics among post graduate students in Lahore, Pakistan, revealed that the basic knowledge of biostatistics among them was not satisfactory [22]. In Denmark, 148 doctors who were assessed for their knowledge of elementary expressions like ‘SD’, ‘SE’, ‘P’ and ‘r’ found that the statistical knowledge of most of the
respondents was so poor that it was improbable that they could draw the right conclusions from the statistical analyses found in medical articles [27].

In a study conducted among internal medicine teaching faculty at the Mayo Clinic College [21] to evaluate clinicians’ attitudes towards biostatistics, only 20% of the respondents felt their biostatistics coursework was taught effectively and was adequate for their needs. Windish et al. reported that most of the participants in her survey did not receive any training on statistics, and among those who had received training, many lamented that most of their training was during undergraduate years and not during their residency [20]. The longer the length of time after graduation, the lesser the knowledge on the subject; this is possibly due to forgetfulness and lack of reinforcement [20,26]. Biostatistics has only been recently emphasized in medical schools; hence, older doctors who graduated earlier had less training in epidemiology and statistics, and, thus, have a poor understanding of statistical measures, resulting in difficulty in critically analysing medical literature [26,27,28].

In the present study, most participants admitted that statistics was important and was helpful in their careers and was important to read journals and because of that doctors should learn statistics. A study to elicit the opinion of 130 practicing doctors on statistics taught to medical undergraduates in United Kingdom found that most of the doctors did not recognize the importance of statistics in their undergraduate years, but had found the skills to be relevant to their career [23]. Similarly, in a study at Yale University [20], although the residents in primary care specialties did not understand all the statistical concepts they encountered when reading journal articles, 95% of them felt that it was important to understand such concepts. Although most clinicians agree that biostatistics is important to doctors, there has been little improvement in the knowledge in the past decades [21].

In the present study, most participants did not have additional training in statistics over and above what was taught to them during undergraduate years, but they did not wish to attend short courses in statistics. This is possibly because they considered statistics to be a difficult subject or the training time consuming. Studies have shown that additional training in statistics can help in improving knowledge in the subject. A survey to assess the knowledge of biostatistics and epidemiology among internists and medical house officers at a teaching hospital showed that the scores of the respondents who reported prior training in epidemiology and biostatistics were higher [28]. A survey among 127 post graduate orthodontic students showed those respondents who attended a biostatistics / epidemiology course had better knowledge in biostatistics [29].

Time could be an important reason for the lack of motivation to attend additional training in biostatistics. A study among general practitioners in the United Kingdom showed that lack of time was the main reason for not practicing evidence based medicine [30]. Another reason could be that the traditional teaching of biostatistics involving usage of formulas in a set of given data doesn’t help the clinician to relate it to the care of patients.

Biostatistics is important for medical research and evidence based medicine, and doctors must upgrade their knowledge of biostatistics. Most doctors read only summaries of reports [30] which are inadequate, and commonly make the mistake of using the same method of analysis they know for every kind of data sets [31]. Even though most doctors do not carry out research, it is important for them to be able to read medical journals because doctors depend on current medical information which is available in medical journals. However, doctors who do not understand statistics will have problems evaluating published reports. These reports are the key to a physician’s lifelong learning, [32] and this will indirectly affect their ability to use the information for better patient care.

The Ministry of Health Malaysia (MOHM) encourages medical research to determine the extent of health problems, its control measures and to meet the changing needs of the country [33]. However, according to the report of the 10th Malaysia plan, the MOHM acknowledged that, because of the country’s inability to create sufficient skilled researchers, there was a low yield in quality research outputs, and, because of this, there is a lack of expertise in certain fields of research in Malaysia [34].

There are several limitations to this study. Poor interest among the doctors in participating in the survey and the study design of the research are among the limitations. Because this study uses a self-reporting survey, there is a possibility that recall bias and misunderstanding of the questions may occur; this could contribute to inaccuracies in the data. However, every effort had been made to clear any ambiguity concerning the questions by attaching a document explaining what is required of the participants and the purpose of the questions along with the questionnaire.
CONCLUSION
A decline in research activities is a cause of concern. Practicing doctors show little interest in research and prefer to be generally clinical oriented physicians, and they do not recognize the importance of research. Because only few have any formal training in research methods, the lack of knowledge in biostatistics could be an important reason for the lack of participation in research among doctors.

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