**Original Article**

# The Reading of Journals by Biomedical Scientists in Relation to Evidence-Based Practice

**Liikanen Eeva Kaarina*, Ahonen Sanna-Mari**

*Department of Health Sciences, University of Oulu, Finland*

**The aim of this study was to analyze Finnish biomedical scientists' (BS) reading of journals in relation to evidence-based practice (EBP). Sources of information, reading activities and related factors were examined. A web-based survey was sent to 925 BSs in three university hospital laboratories, producing a response rate of 36% (n = 337). The BSs read a total of thirty-six different scientific journals. Fifty four percent of the BSs did not read scientific journals at all. The BSs surveyed read more professional than scientific journals. The most important sources of information related to work were: reported practice in the workplace,; individual's own experience; knowledge acquired during degree-level education; instructions from clinical biochemists and/or laboratory doctors; and knowledge learnt from fellow employees. BSs with higher level education read all types of journal more often than BSs educated to diploma level. BSs who had participated in research projects were more likely to read journals. BSs who considered their knowledge to be 'better' than others in their profession or who valued research read scientific journals more often than others. BSs who discussed research with their colleagues also read more scientific journals than those who did not discuss research. The findings highlight the importance of encouraging BSs to read scientific journals and making this possible both at work and in their free time.**

***Key words*: evidence-based practice, journal, biomedical scientist, read**

## Introduction

Health care and clinical laboratory practices are constantly changing, as are laboratory methods and technology. Such developments lead to the need for evidence-based practice (EBP) on the part of all laboratory-based professionals. EBP is a cornerstone of health care reform. BSs play a very important role in clinical laboratory practice. In the field of health care, clinical laboratory practice defines the pre-analytical, analytical and post-analytical work of BSs, whose main role is to obtain reliable laboratory results. Education and the development of laboratory work are also part of clinical laboratory practice [1]. Today, EBP is essential in health care because it provides a framework for the solution of practical problems that all health care professionals (HCP) can use. In this study, evidence-based clinical laboratory practice (EBCLP) is defined as clinical laboratory practice based on the combination of clinical expertise and the best research evidence, patient preferences, and available resources (see Havslund [2]). EBP effectively prepares BSs for managing their responsibilities and challenges, and supports decision-making within their field. BSs have an important role in health care as they take samples, analyze them and report the results of the laboratory tests. There are a few studies about the use of EBP by other HCPs, notably concerning physicians, nurses and radiographers [2-7], but there are no studies concerning BSs.

A knowledge of current research in appropriate fields is a prerequisite for EBP. Other essential prerequisites include information need, relevant skills, cultural

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Corresponding author : Dr. Liikanen Eeva Kaarina, Department of Health Sciences, University of Oulu, FIN-90014, Finland
eeva.liikanen@oulu.fi Fax +358-85375606

considerations, and attitudes [8]. HCPs often have a positive attitude towards research [8-10] and this can be enhanced by work-based training [11-12]. Despite this, there are many barriers to the use of newly-acquired scientific knowledge. These barriers include a lack of time [5], a lack of research knowledge, a lack of training, a lack of funding, and a lack of self-confidence [6, 12-14]. HCPs tend to have little knowledge about EBP and statistical terminology [9]. However, many HCPs, especially physicians, use the internet regularly for professional development, and they have been found to experience difficulties finding and using the Cochrane Library website [16]. When implementing EBP, organizational support and motivation are critical factors [11, 17]. Few HCPs use databases to search for the information they need for their work [8, 18].

The education of BSs changed substantially in Finland during the 1990s. Diploma level degrees were changed to Baccalaureate level degrees, taught initially at polytechnics and more recently at the universities of applied sciences. It takes three and a half years to study biomedical science to Baccalaureate level, which equates to 210 ECTS (European Credit Transfer and Accumulation System) points. One ECTS point corresponds to 27 hours of work. The Baccalaureate, for example, includes English language, statistics and research methods in its curriculum, unlike the Diploma. These studies have enabled BSs to read scientific journals with a greater understanding than before. BSs can continue their studies by specializing in a particular area of biomedical laboratory science e.g. Hematology, Point-of-Care Testing (30 ECTS credits) or by taking a Master's degree in applied sciences at a university in subjects such as Health Promotion, or Development and Leadership in Health Care and Social Services (90 ECTS credits).

With laboratory practice changing all the time, reading scientific journals is essential [19]. HCPs are rarely able to completely understand the most relevant journal in their field [20-21]. Textbooks are widely used in the education of HCPs, although these are often outdated [22]. Reading journals requires knowledge of the English language, as well as rigorous knowledge of statistics and research methods. There is only one scientific journal (*KliinLab*) published in the Finnish language in Finland; other Finnish journals are either professional publications (*Bioanalyytikko)* or published by an establishment that organizes External Quality Assessment Services (*Moodi*). Hence BSs need to be able to read English. HCPs must exercise objectivity and fairness towards the papers that they read in journals. Critical reading is the starting point for EBP because all studies have the potential to contain errors. The aim of the current study was to investigate how effectively Finnish BSs read journals in relation to EBP. Sources of information, reading activities and related factors were studied.

## Materials and Methods

### Questionnaire development

This questionnaire was part of a larger questionnaire entitled 'Readiness of Evidence-Based Practice by biomedical scientists', and focused on the reading of journals. It was developed for this study on the basis of previous studies [6,8,14] and a panel of three experts established the validity of the questionnaire's content and formulated the questions and statements. Members of staff at three university hospitals were invited to participate in the survey through an e-mail message that contained a hyperlink to the survey, which was hosted by the company Webpropol. The web-based questionnaire consisted of eight demographic questions, six multiple-choice questions, ten Likert-type scale statements, and one open-ended question. The Likert scale allowed respondents to rank the importance of the statement from one to five, where one meant 'not important at all' and five meant 'very important'.

### Sample and data collection

The survey was distributed to a convenience sample of all the BSs (n=925) working in three university hospitals in Finland. Data were collected during three weeks in September 2008. In total, 257 BSs returned their questionnaire, a response rate of 28%. The survey was sent out again in October 2008 and the BSs who had not responded in September were asked to participate. The final response rate was 36% (n=337). In the data analyses, a $P$ value of $\leq 0.05$ was considered statistically significant. Any missing values for variables were substituted with the mean values of those variables. Question-specific response rates varied slightly and are presented in the results section. The number of respondents varies in the results tables because four of the questions were multiple choice and not all of these questions were answered by all the respondents.

## Data analysis

Quantitative data were analyzed using Statistical Package for Social Sciences (SPSS) for Windows version 16.0. Descriptive statistics (i.e. frequencies and percentages) were calculated using SPSS. Factor analysis was undertaken in the previous phase of the research project to create sum variables (factors). Ten variables were removed because they did not fit contextually to the sum variables. There were twenty-five variables in the final analysis. Factor analysis was used to identify clusters of related variables, which comprised four sum variables (knowledge, relevance of research, support and research discussion). Alpha coefficients (i.e. Cronbach's alpha coefficient) were generated to determine the internal consistency of each sum variable. The statistical significance of each of the sum variables was examined using both t-tests and ANOVA.

## Ethical issues and Approval

The proposed study plan was submitted to the hospitals' institutional review boards and was approved as an expedited study. Invitations to participate in the survey were sent out via e-mail; they described the study and explained the voluntary nature and confidentiality of the survey.

# Results

## Demographics

Table 1 shows the respondents' (n=337) demographic characteristics. The typical respondent was female (98%, n=328), 50 to 59 years of age (34.7%, n=113), worked in the metropolitan area (university hospital 1), held a diploma degree (61.7%, n=208) and had not conducted any scientific research except that undertaken as part of her degree studies (37.1%). Most of the respondents (84%) were in permanent employment.

## Reading of journals

The most important sources of information relevant to work were: reported practice in the workplace; knowl-

**Table 1** Demographic profile of respondents

| | | n | % |
|---|---|---|---|
| Organization | Hospital 1 | 137 | 41.1 |
| | Hospital 2 | 97 | 28.8 |
| | Hospital 3 | 99 | 29.7 |
| Age (n=326) | <30 years | 50 | 15.6 |
| | 30-39 years | 64 | 19.6 |
| | 40-49 years | 87 | 26.7 |
| | 50-59 years | 113 | 34.7 |
| | 60 and over | 11 | 3.4 |
| Gender (n=336) | Male | 8 | 2.4 |
| | Female | 328 | 97.6 |
| Degree (n=335) | Diploma BS | 208 | 61.7 |
| | Baccalaureate degree | 111 | 32.9 |
| | Master's or PhD degree | 11 | 3.3 |
| | Other degree | 5 | 1.5 |
| Role (n=330) | Biomedical scientist | 275 | 83.3 |
| | Department head or comparable | 45 | 13.6 |
| | Other | 10 | 3.0 |
| Research studies excluding degree (n=323) | Open university | 31 | 9.6 |
| | Specialized studies at a university of applied sciences | 45 | 13.9 |
| | Further studies at a university of applied sciences | 6 | 1.8 |
| | In-service training | 103 | 31.9 |
| | Other | 19 | 5.6 |
| | No extra studies in research | 120 | 37.1 |

edge from one's own experience; knowledge acquired from studying for a degree; instructions from clinical biochemists and/or laboratory doctors; fellow employees. BSs considered scientific research a less relevant source of information than those mentioned above (Table 2).

The respondents read scientific journals when they: had time (72%, n=238); were interested in reading the journal (66%, n=217); had sufficient understanding of the journal's subject (33%, n= 108); had easy access to the journal (70%, n=231); and had sufficient knowledge of the language the journal was written in (56%, n=185). The reading of scientific journals was prevented by: lack of time (82%, n=273); lack of motivation (21%, n=70); lack of knowledge (23%, n=98) ; lack of knowledge of the language the journal was written in (29%, n=98); unavailability of the journal (2%, n=6); stilted writing style in the journal (0.5%, n=2). Twenty-three respondents reported no obstacles.

Almost all of the BSs (96%) read national professional journals (e.g. *Bioanalyytikko*) at least once a year. Half of the BSs did not read any international professional journals (e.g. *Biomedical Scientist*), and 54% did not read any scientific journals of any kind (Table 3). The BSs read thirty-six different scientific journals (e.g. Clinical Chemistry, Scandinavian Journal of Clinical Laboratory Investigation, and Blood). BSs read both professional and scientific journals mainly for self-development and to keep abreast of new practices (Table 4).

**Table 2** The importance to biomedical scientists of information sources for work

| Information source | Very important | Fairly important | Can't decide | Not very important | Not important at all |
|---|---|---|---|---|---|
| Knowledge acquired in degree education | 59.5% | 31.4% | 3.3% | 5.8% | 0% |
| | n=72 | n=38 | n=4 | n=7 | n=0 |
| Scientific research | 29.4% | 48.7% | 16.8% | 4.2% | 0.8% |
| | n=35 | n=58 | n=20 | n=5 | n=1 |
| Text books in own scientific field | 50.4% | 39.7% | 5.8% | 4.1 | 0% |
| | n=61 | n=48 | n=7 | n=5 | n=0 |
| Medical literature | 42.5% | 43.3% | 10% | 3.3% | 0.8% |
| | n=51 | n=52 | n=12 | n=4 | n=1 |
| Unreported workplace practice | 26.1% | 48.7% | 14.3% | 10.1% | 0.8% |
| | n=31 | n=58 | n=17 | n=12 | n=1 |
| Reported workplace practice (e.g. quality | 69.7% | 23.8% | 4.1% | 2.5% | 0% |
| manual and terms of reference) | n=85 | n=29 | n=5 | n=3 | n=0 |
| Own experience | 63.9% | 32% | 3.3% | 0.8% | 0% |
| | n=78 | n=39 | n=4 | n=1 | n=0 |
| Fellow employees | 51.7% | 40.8% | 6.7% | 0.8% | 0% |
| | n=62 | n=49 | n=8 | n=1 | n=0 |
| Instructions given by clinical biochemists | 52.5% | 36.9% | 9% | 0.8% | 0.8% |
| and/or laboratory doctors | n=64 | n=45 | n=11 | n=1 | n=1 |
| Refresher courses | 34.4% | 45.9% | 10.7% | 8.2% | 0.8% |
| | n=42 | n=56 | n=13 | n=10 | n=1 |

**Table 3** Reading different journals and frequencies of reading by biomedical scientists

| Reading frequency | National professional journals (n=329) | | International professional Journals (n=333) | | Scientific journals (n=333) | |
|---|---|---|---|---|---|---|
| | n | % | n | % | n | % |
| Every week | 18 | 6 | 1 | 1 | 2 | 0,6 |
| Once a month | 166 | 50 | 18 | 5 | 14 | 4 |
| A few times a year | 122 | 37 | 84 | 25 | 73 | 22 |
| Once a year | 10 | 3 | 66 | 19 | 67 | 20 |
| I don't read | 15 | 4 | 166 | 50 | 179 | 54 |

**Table 4** Reasons given by biomedical scientists for reading journals

| Reason | Professional journals (n=331) | | Scientific journals (n=296) | |
|---|---|---|---|---|
| | n | % | n | % |
| Colleagues read as well | 2 | 0.6 | - | - |
| Keeping up to date with new practices | 208 | 63 | 93 | 31 |
| Self-development | 213 | 64 | 119 | 40 |
| Part of being a professional | 155 | 47 | 69 | 23 |
| Other | 9 | 3 | 10 | 3 |

## Factors related to the reading of journals

Table 5 shows the factors (demographic and other) related to the reading of journals. BSs with a Baccalaureate, Master's or PhD degree from a university or university of applied sciences read all the types of journals more frequently than BSs with diploma level education ($p < 0.001$). If BSs had previously participated in research projects, they were more likely to read journals ($p < 0.010$). BSs who considered their knowledge 'better' than others in their profession read journals more often than other BSs ($p < 0.001$). The respondents evaluated their knowledge themselves. BSs who considered research to be relevant (Factor 2: Relevance of research activities) read scientific journals more often than others ($p < 0.001$). There relationship between the factor "Support" and the reading of national professional journals was significant (p=0.045). BSs who discussed research with their colleagues also read more scientific journals than those who did not discuss research ($p < 0.016$).

## Discussion

Less than half of BSs (46%) who were Finnish read scientific journals. There are no scientific journals written in Finnish, and the English language now has a dominant role in science. Today, English is the language of science. It is, therefore, important for all BSs to be able to read in English. Less than one third (29%) of the BSs were of the opinion that a lack of knowledge of a language prevented them from reading scientific journals in that language.

Nearly all BSs (96%) read national professional journals. Such publications are often easily accessible to BSs and thus frequently read. Approximately one in four respondents (23%) did not find any obstacles to reading scientific journals. They read journals because they had an interest in developing their professional abilities. Some of the reasons for reading scientific journals were given by respondents who did not read scientific journals themselves, and this is shown in the number of respondents to that question. However, only 29% of BSs con-

**Table 5** The relationship between some of the demographics and factors, and reading different types of journal: figures are statistical probabilities according to t-test and ANOVA

| | Reading scientific journals | Reading international professional journals | Reading national professional journals |
|---|---|---|---|
| Age | 0.321 | 0.427 | 0.611 |
| Organization | **0.023** | 0.110 | * |
| Degree | **0.011** | **0.001** | **0.048** |
| Participation in research projects | **0.001** | **0.010** | * |
| Factor 1: Knowledge | **0.000** | **0.000** | **0.021** |
| Factor 2: Relevance of research activities | **0.000** | 0.051 | 0.051 |
| Factor 3: Support | 0.665 | 0.737 | **0.045** |
| Factor 4: Discussion of research | **0.016** | 0.0l83 | 0.083 |

* statistical tests could not be undertaken

Significant relationships are indicated by figures in bold

sidered scientific research to be a very important source of information. Almost all other sources, such as textbooks and experience, were considered more important than scientific research. Textbooks are widely used in HCPs' education [22]. Textbooks are the most accessible source of information for BSs, but are frequently out of date and are usually opinion-based. The accessibility of journals was a valid variable in this study since journals are essential for finding out information. All BSs at university hospitals should be able to access online databases, such as Medline.

Time is a key requirement for reading journals. As shown in a previous study, BSs considered that sufficient time should be made available for reading scientific journals [5]. Basic tasks take most of the time in their working day in the laboratory. Many factors (organization, level of education, participation in research projects, knowledge of research activities, relevance of research activities and discussing research) affected whether scientific journals were read or not. Experience and research skills improve the understanding of research activities. BSs who read more scientific journals as a result of their experience and research skills have a more profound knowledge of the contents of the journals.

Critical reading of journals is a fundamental ability that HCPs should have. This is certainly one of the abilities that BSs are taught during their education. Since the 1990s, BSs in Finland have been able to obtain a degree from a university of applied sciences, which has helped to raise their level of education. In particular, the English language, statistics and research are taught in more detail at baccalaureate degree level compared to diploma level studies, which is why BSs are quite well prepared for critical thinking and reading. Thus, it is natural that BSs with a higher level of education (i.e. a Baccalaureate or higher degree) read more scientific journals than BSs with a lower level qualification (i.e. a diploma). Education has a significant role in improving students' abilities to use scientific knowledge. It can help overcome barriers that are often encountered, such as the lack of research knowledge and training [12-14]. Knowledge increases self-confidence. BSs with diploma level education should be encouraged to read journals. Journal clubs could be established in the workplace. These clubs could focus on papers related to practical research, thus encouraging BSs to participate in this kind of activity.

## Limitations of the study

The response rate was quite low (36%), but response rates for e-mail surveys tend to be lower than those for mailed questionnaires [23]. The rate was, however, higher than found in studies of strategies for web-based surveys, where response rates ranged from 20.7% to 31.5% [24]. The response rate could be improved by using mailed questionnaires, because some people have traditionally chosen to be surveyed through the mail [23]. Individuals were more likely to respond to a questionnaire if they are encouraged to do so by someone whose name or position they recognize [23]. This study was only conducted in Finland, which limits the generalization of the results. Although the work of BSs is, in many ways, similar around the world, the level and content of education that Finnish BSs receive differs to some extent.

## Conclusions

Currently, it is not common for BSs to read scientific journals. However, it is important to encourage BSs to do so because knowledge of a scientific procedure is not complete without knowledge of the research that developed that procedure, which is a core prerequisite for EBP. Research knowledge, relevance of research activities, and participation in research projects all encourage BSs to read scientific journals. According to this study, the key elements required for reading scientific journals are having the time, having access to relevant databases and having language skills. If BSs are interested in self-development in their free time, they will learn the English language and spend some of their free time finding relevant work-related information. Laboratories could allow them to spend some of their time at work reading scientific journals, particularly as these are generally available in university hospital laboratories.

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