

**CONTINUING PROFESSIONAL DEVELOPMENT OF MEDICAL  
LABORATORY PROFESSIONALS**

Literature review

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## ABSTRACT

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The aim of the bachelor study was to find out what kind of experiences continuing professional development (CPD) has received in medical laboratories and how it has been implemented through a literature review. The purpose of the study was to find and compile the literature review as up-to-date research data on the importance of continuing education in medical laboratories.

The literature review has been carried out by adapting a systematic literature review. The literature review material was obtained utilizing nursing reference databases from CINAHL, PubMed, Ovid Medline, Scopus, Medic and a few international journals. Research material (n = 8) was selected for the material, whose main subject was continuing professional development and medical laboratory.

CPD is used to improve knowledge and skills with various categories and tools but there is similarities and differences in CPD implementation. CPD must be continuous throughout the professional career and it should be based on time- cycles of reasonable duration. Medical laboratory professionals with dozens of years of experience feels that they need less CPD activities than recently qualified laboratory professionals. The laboratory professional keeps important to increase their learning and development of their skills with continual encouragement.

Research has shown that CPD has been recognized as an important part of professional development and the use of various tools, such as internet- based, makes it effective. The use of a systematic CPD program should be constantly evaluated to identify the most effective ways of developing professional skills. CPD should be time bounded but there is variation in duration and volume. The use of time and experience years will affect the successful implementation of the CPD.

Key words: continuing professional development, continuing education, medical laboratory, healthcare, further education.

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# 1 INTRODUCTION

Care practices are constantly changing with the rapid development of medicine, health sciences, life sciences and technology, which underlines the increasing importance of continuing education in healthcare. The changing health care context will require a vastly different approach to fostering the continuing development of health care professionals (Cervero etc. all. 2017). Biomedical scientist is able to practice safely and effectively within their scope of practice. They are also able to practice within the legal and ethical boundaries of their profession. It is also important to practice as an autonomous professional, exercising own professional judgement and at the same time reflect and review the practices constantly. (Health and Care Professions Council 2018). According to the law of the health care professionals, healthcare professionals have a duty to maintain and develop their professional skills, and the employer must create the conditions for participation in training. (STM 2004:17).

Continuous Professional Development (CPD) is a way for health professionals to continue their learning and development throughout their career so that they can keep their skills and knowledge up to date. There is some variation in the literature regarding the terminology around CPD. For example, CPD, CME (continuing medical education), CE (continuing education), LLL (lifelong learning), PPD (personal and professional development). (Wareing etc. all. 2017). CPD activity is activity whereby health profession can learn and develop. For example, it can be work- based learning, professional activity, formal education or self- directed learning. Continuing professional development is a key construct in health professionals upholding their expertise and know-how. (Health and Care Professions Council 2018, Stevens& Wade 2016).

Continuing professional education can be organized by several different producers and different forms. Training can be roughly divided into internal, organization itself organize, and external training. External training can be ordered from an outsider for example from another healthcare unit, association or company (Statistics Finland 2017). Professional learning that underlies CPD needs to include an understanding of how knowledge is constructed, how it can be transferred to professional practice, and how the overall context of health care affects the process. (Cervero etc. all. 2017). The primary feature of CPD activity should be the resulting impact to the service, the

patients, the profession and the individual with all stakeholders working in partnership. CPD activity must be flexible to support the changing growth workforce. (Wareing etc. all. 2017.) The use of various CPD methods and activities repeatedly has been proven to be effective and it also provides the best opportunity for healthcare professionals to develop themselves (Bluestone et.al.2013, Cervero& Gaines 2015). Studies show that management and planning of continuing education should be based on approach concentrating on healthcare professionals needs. The goal can be better achieved by formation of an educational committee in hospitals, as well as in planning and evaluation teams. For example, educational courses logbook should be prepared in which healthcare professionals already passed courses can be recorded. According to that, planning can be made for the individuals. (Eslamian etc. all. 2015).

The aim of the study was to find out what kind of experiences CPD has received in laboratories and how it has been implemented through a literature review. At the same time the purpose was to find and compile the literature review as up-to-date research data on the importance of continuing education in laboratories.

## **2 CONTINUING PROFESSIONAL EDUCATION (CPD) OF HEALTHCARE PROFESSIONALS IN FINNISH MEDICAL LABORATORY**

Health care professionals are regulated by law, which aims to promote patient safety and the quality of health care services. Continuing education is an important tool for professional development and lifelong learning (Goulet et.al. 2013.) According to the Ministry of Social Affairs and Health (1194/2003) continuing education means systematic training based on population's health needs and changing care practices and it is based on the assessment of continuing training needs of healthcare personnel. Internationally, Continuing Education is often referred to as Continuing Professional Development (CPD). This means continuous professional development that refers to an individual's continuous professional experience learning and skills development and strengthening. (Pool et.al. 2013). By going through the literature, it is a sequel that both terms are used extensively in international publications.

### **2.1 Law of health care professionals and recommendations for continuing education**

The law of healthcare professionals implies that the health care professional has the training required for professional activity, other adequate professional qualifications and other skills required for occupational activity. In addition, the law requires the supervision of health care professionals in health and medical care and facilitates professionally justified co-operation and appropriate use of healthcare professionals. (Finlex 28.6.1994/559 1 §). A registered, authorized or nominated professional is entitled to use the relevant professional title and to work in the profession concerned. Other persons who are nominated, experience and professional skills may also be employed by qualified personnel. (Finlex 28.6.1994/559 7 2§).

According to the definition of "continuing education", its function is to maintain and develop skills. Further education can be divided into employment education, open university education and vocational qualification and further training. Continuing education may be broadly applicable to work assignments or to professional assignments. (STM 2004, 20). A healthcare professional is obliged to maintain and develop the skills and knowledge required for professional activities and to orient

themselves with the regulations and provisions that are part of the professional skills. The municipal or hospital district federation must ensure that health care staff, including staff employed by the private service provider, are adequately involved in continuing education in health care. (STM 2004).

The employer of a healthcare professional must follow the professional development of healthcare professionals. The employer must create the conditions for a healthcare professional to participate in the necessary continuing professional education, vocational training and other professional development methods to maintain and develop their skills and knowledge. In this case, a healthcare professional can exercise his profession properly and safely. (Finlex 28.6.1994/559 18 § (30.12.2015/1659)).

## **2.2 Medical laboratory requirements for CPD**

According to the healthcare quality management system, the organization must determine the knowledge required for its processes and the conformity of products and services. Knowledge must be maintained and accessible to the extent necessary. (ISO 9001:2015 7.1.6). The task of the organization is to determine what kind of qualifications the employees have, whose work affects quality management and performance. At the same time the laboratory must ensure that these persons are qualified on the basis of appropriate training, practicing or experience and, if necessary, obtain the requisite qualifications. The health care personnel must have received comprehensive and current training in their duties. (ISO 9001:2015 7.2).

The organization shall provide training for all personnel which includes the following areas: the quality management system, the applicable laboratory system, assigned work processes and procedures, health and safety, ethics and confidentiality of patient information. Personnel that are undergoing training shall be always supervised and the effectiveness of the training program shall be periodically reviewed. (ISO 15189:2012 5.1.5). In addition to the assessment of technical competence, the laboratory shall ensure that reviews of staff performance consider the needs of the laboratory. This improve and maintain the quality of service given to the users and encourage productive working relationships. (ISO 15189:2012 5.1.7).

According to the standard ISO 15189:2012 5.1.8:

Continuing education program shall be available to personnel who participate in managerial and technical processes. Personnel shall take part in continuing education. The effectiveness of the continuing education program shall be periodically reviewed. Personnel shall take part in regular professional development or other professional liaison activities.

The staff of the medical laboratory must have received comprehensive and current training in their duties requiring the organization of the laboratory to invest in continuous professional development. (ISO 15189:2012 5.1.2).

### **2.3 Recommendations for CPD given by the international organizations of medical laboratory professionals**

Institute of Biomedical Science in Great Britain (IBMS 2018) promotes best practice in biomedical science by providing professional guidance, forums and publications to support the development and sharing of best practice. To meet the CPD's quality requirements, IBMS members should continue using reflection-based learning and 'learning by doing'. They should reflect their good and bad everyday experiences in the workplace. IBMS provides a CPD scheme to members. This system supports achievement and maintenance of one's professional re-registration. The IBMS CPD program is electronic. To achieve CPD, 24 activities such as registration portfolio verifier or clinical pathology accreditation, must be completed and reflected on these activities in three categories such as professional and regulatory bodies, IBMS professional representatives or professional activities. Performing a IBMS CPD qualification develops improving knowledge and skills and identifying and achieving learning outcomes. IBMS CPD classes are work-based learning, professional activity, formal education, and self-directed learning. Each IBMS member can choose which CPD subfield to develop and perform different categories. IBMS also provides Journal Based Learning (JBL) which is an excellent way to learn about science development and techniques as part of continuous professional development. JBL is also great way to develop scientific reading, which is also considered to develop professional skills and up-to-date information of current research. (Institute of Biomedical Science).

The European Federation of Laboratory Medicine (EFLM) decided to enhance distance learning programs for laboratory professionals. For this reason, EFML formed a



working group in 2010 to make instructions concerning e-learning as a method of continuing professional development of laboratory professionals. According to the instructions the determination of educational needs and learning objectives of laboratory professionals is the first task when effective e-learning is planned. After this the content of e-learning must be planned and it must fulfill the defined needs and objectives. The active participation of a laboratory professional must be encouraged and made possible not only in different e-learning activities but also in the evaluation of e-learning programs. Additionally, continuing professional development credit system must be formed and used. The above-mentioned instructions also state that different international societies of laboratory professionals must develop e-learning programs and take care of the good quality of these programs. (Gruson et.al. 2013.)

European Association for Professions in Biomedical Science (EPBS) has stated in the policy on Continuing Professional Development for Biomedical Scientists that CPD is vital to maintain and develop current competencies and to get new competencies needed in the future. For this reason, EPBS's position is that CPD should be mandatory for biomedical scientists. CPD activities must focus in professional practice. CPD activities should include e.g. professional activities, educational activities, lecturing and publishing. The effectiveness of CPD activities should be evaluated. EPBS's policy paper also states that master's and PhD degrees could be classified into a specific type of CPD. (European Association for Professions in Biomedical Science 2010.)

The Association of Biomedical Laboratory Scientists in Finland has given recommendations for CPD. According to the recommendations, the purpose of continuing education is to provide sufficient vocational further training. The Association emphasizes that the traceability of planning, evaluation and follow-up of continuing education should be shown by various indicators. For example, the employee and the employer should prepare a written plan based on individual career and development needs. Continuing education should support the development of evidence-based activities in clinical laboratories. When the aim of continuing education is to increase efficiency and improve quality, then the results of CPD activities must be measurable. The indicators presented in the recommendation include job satisfaction, customer satisfaction, measurement of laboratory errors and measurement of costs. (Suomen Bioanalyttikoliitto ry 2003:17-18.)

Different professional titles are used in different countries e.g. medical technician, medical technologist, medical laboratory technician, medical laboratory technologist, clinical laboratory technician, clinical laboratory technologist, biomedical scientist, biomedical laboratory scientist, medical laboratory scientist, clinical laboratory scientist (Martin et.al 2015, ASCLS 2018, EPBS 2018). The world's widest organisation, The International Federation of Biomedical Scientists (IFBLS), representing the above-mentioned professionals uses the professional title of biomedical laboratory scientist. For this reason, the title of biomedical laboratory scientist is used in this thesis.

#### **2.4 International experiences and challenges about CPD**

Studies have shown that the purpose of CPD and the learning activities might change during a lifetime (Pool et.al.2012). It is not new phenomenon, but new findings have shown that they are similar amongst a wide range of health professions despite geography and culture (Wareing et.al.2017). Health professions understand the meaning of CPD and it is relevancy to maintain role and standards in progressing and developing themselves professionally. At the same time, the appreciation of the purpose of CPD is comprehend. Working within current health care system is providing difficult to healthcare professionals and it is impacting on the assimilation of continuing education and learning (Govranos& Newton 2013, Stevens et.al.2016, Wareing et.al.2017). Quality and quantitative of CPD have a positive impact on the quality of medical practice (Goulet et.al.2013).

Knowledge, skills and competence are key components of CPD. Having several models of CPD activity running alongside one another for better learning outcomes has proved to be effective (Bluestone et.al.2013, Cervero& Gaines 2015, Inge et.al.2015, Wareing et.al.2017). CPD should be designed for the purpose when it should include a mixture of course accredited CPD and other forms of CPD. CPD is effective at the acquisition and retention of knowledge, attitude, skills, behaviors and clinical outcomes. Case- based learning, e- learning, problem-based learning (PBL), simulations, ward- based learning, annual training/ re-training days and integrated CPE are the most used and efficient CPD activities (Bluestone et.al.2013, Cervero& Gaines 2015, Govranos& Newton 2013, Inge et.al.2015). Multiple studies show that using computer as to delivery of CPD was effective and self- directed instruction was equally or more effective as didactic or interactive instruction. (Bluestone et.al.2013, Inge et.al.2015). In addition, using mobile

devices as CPD tool for repetitive reminders resulted improvement. It is also interesting. that didactic instructions as lecture- based learning is not found to be an effective technique compared with other methods (Bluestone et.al.2013). Also using repeatable, interactive interventions has resulted in better knowledge outcomes (Bluestone et.al.2013 Cervero& Gaines 2015).

### **3 PURPOSE OF RESEARCH**

The aim of the study was to find out what kind of experiences CPD has received in laboratories and how it has been implemented through a literature review. The purpose of the study was to find and compile the literature review as up-to-date research data on the importance of continuing education in medical laboratories.

The research question is:

1. How are CPD programs implemented in medical laboratories?

## **4 DESIGN OF THE STUDY**

This thesis was made by adapting the literature review method. The purpose of the literature review is to provide an overall picture of an earlier study, a specific topic or topic and possibly identify conflicts or problems in the selected target environment. (Polit & Beck 2008). The literature review aims at systematics, so it must be reproducible and based on a comprehensive knowledge of the topic. The literature review consists of five basic steps: the definition of the purpose of the review and the research problem, the search for literature and the selection of material, the evaluation of the research, the analysis and synthesis of the material, and the reporting of the results. The results should be presented from an objective point of view. (Stolt & Axelin & Suhonen 2016: 7, 23).

### **4.1 Acquisition of data**

Database searches were made in February 2018. Search terms were selected "continuing education", "continuing professional development", biomedical scientist and medical laboratory. Searching was done with the cut-off marks, when the searches were not limited to the basic form of the word. Five databases were used for searching process and manual search was also made from international journals. The table 2 describes the procedure for selecting of the study.

The entry criteria for the research were 1) the article discussed the need, design, implementation or evaluation of continuing professional development; 2) the article was international; 3) the article had appeared in the last five years; 4) the article was in English; 5) the article was scientific, or peer reviewed if it was possible 6) the article was full text available. The exclusion criteria were 1) the article did not meet the need for, planning, reviewing, or evaluating continuous professional development from the perspective of the medical laboratory 2) the year of publication of the article was different from 2012-2018; 4) the article was not in English; 5) the article was not scientific 6) the full version of the article was not available. The research material was selected based on headings, summaries and full text. Table 1 lists the entry and exclusion criteria for articles which were selected for literature review.

Entry criterias	Exclusion criterias
<ul style="list-style-type: none"> <li>• Deals continuing professional development from a laboratory perspective</li> <li>• Published in English</li> <li>• Scientific research, peer reviewed</li> <li>• Published between 2012 and 2018</li> <li>• Full text available</li> </ul>	<ul style="list-style-type: none"> <li>• Deals continuing professional development out of a laboratory perspective</li> <li>• Publishing language other than English</li> <li>• Not scientific research, not peer reviewed</li> <li>• Published before year 2012</li> <li>• Not full text available</li> </ul>

Table 1. Entry and exclusion criteria of the study.

The articles that found in the literature review process were first reviewed through the headings. Headlines excluded articles that did not clearly meet the selection criteria. After passing the titles, duplications removed, and the total number of articles was 45. Of these 45 articles, the abstracts and summaries were read. Based on the abstracts and summaries, 10 articles were concluded. Based on the full texts of all 10 articles, six articles were selected for the actual literature review synthesis. After that, a manual search was made from international journals related to the laboratory and two articles were concluded to research. The final number of articles was eight and those are included in appendix 1.

Table 2. Selecting process of the study

Keywords	Database	Criteria	Result	Criteria	Result	Criteria	Result	Criteria	Selected studies
continuing professional development/ continuing education AND medical laborato* OR biomedical scient*	Scopus n=760	Article or Review 2012-2018 English language	130	Reading headlines	12	Reading abstracts and summaries	3	Full text read	1
continuing professional development/ continuing education AND medical laborato* OR biomedical scient*	Medline (Ovid) n=952	Article or Review 2012-2018 English language	331	Reading headlines	10	Reading abstracts and summaries	3	Full text read	2
continuing professional development/ continuing education AND medical laborato* OR biomedical scient*	PubMed n=397	Article or Review 2012-2018 English language	44	Reading headlines	13	Reading abstracts and summaries	4	Full text read	1
continuing professional development AND laborato* ” continuing education” AND medical laborato*	CINAHL n=294	Peer reviewed 2012–2018 English language	108	Reading headlines	10	Reading abstracts and summaries	1	Full text read	1
täydennyskoulu* täydennyskoulu* AND laborato* OR bioanaly* AND laborato* OR bioanaly*	Medic n= 82	2012-2018	82	Reading headlines	0		0		0
Manual search	International Journal of Biomedical Science / American Journal of Clinical Pathology/ Clinical Chemistry and Laboratory Medicine	2012-2018		Reading headlines					1
Total	2485		695		45		10		6

## 4.2 Analysis of the material

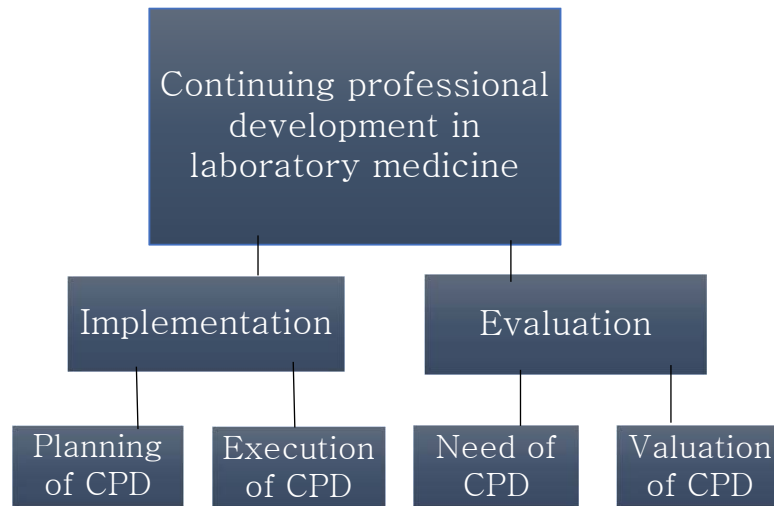
Qualitative content analysis is extremely well-suited to analyzing data on the multifaceted phenomena characteristic of nursing (Elo & Kyngäs 2008, 113). Information analysis needs to be started with the best possible qualitative information, which requires thorough knowledge of the topic, feedback, and continuous quality management (Polit & Beck 2014). Qualitative content analysis is a method for describing the meaning of qualitative material in a systematic way. Content analysis refers to a method in which the material obtained is compressed and the phenomenon is described in such a way that the meanings, purposes, intentions, consequences and connections between phenomena or things are revealed. It involves breaking down data into smaller units, coding and naming the units according to the content they represent, and grouping coded material based on joint concepts. (Schreier 2012, 35, Tuomi & Sarajärvi 2009.)

The steps for content analysis are the selection of an analysis unit, access to material, reduction of material, classification and interpretation. Content analysis can be based on inductive or deductive reasoning. In inductive reasoning, we move from concrete material to conceptual description and deductive in turn are the theoretical concepts. Inductive reasoning moves from concrete material to conceptual description and the deductive basis is theoretical concepts. (Janhonen & Mikkonen 2001, 23-40.) This study utilizes data-based content analysis, which is inductive analysis. The choice of the analysis unit is affected by the quality of the data and the research task. The data is reduced, the obtained expressions are recorded in the terms of the material. Research task questions are presented to the data, grouped together, and expressions are combined into the same class. Classes are named. Classes of the same content are combined in the upper classes and the analysis frames are formed. (Janhonen & Mikkonen 2001, 23-40.)

Analysis of the research articles was started by examining the studies one by one. The studies were carefully examined, and then summarized in a summary table relevant to the research questions. The following information was collected from the articles: research factors, publication year, country of origin, purpose of research, and key results from continuing professional development. The table made it easy to parse the main features of the studies. The content analysis of the literature review was made using an inductive approach. The material was analyzed by introducing key concepts and phrases



suitable for answering the research question (Inset 1). The theories and concepts were listed and grouped into subordinate concepts, upper concepts and ultimately the main concept, which was consistent with the research question of literature review. The research question was elaborated after analysis to answer the analysis of the material. Pattern 1 describes the analysis process.



Pattern 1. Process of the analysis (Kati Immonen 2018)

## 5 RESULTS

The literature review process produced eight articles matching the search criteria: two from United States of America (Ali et.al. 2012, Amerson et.al 2012), one from Great Britain (Martin ym.2015), one from Croatia (Topic et.al. 2013), one from Japan (Horiuchi et.al. 2016), one from Finland (Liikanen et.al 2013), one from Botswana (Kasvosve et.al 2014) and one from Nigeria (Ekwembu et.al.2015). The studies were from year 2012- 2016. Regarding the application of continuing professional developing, two main themes highlighted from the analysis; Implementation of CPD and evaluation of CPD. Implementation of CPD contained two subclasses, planning and execution of CPD. Another main theme, evaluation of CPD contained two subclasses, need and valuation of CPD. The results from the subclasses were combined with the upper classes, which formed the whole of continuing professional development in laboratory medicine. The following describes the material produced by the literature review process.

### 5.1 Implementation of CPD

Implementation of CPD contained subcategories planning of CPD and execution of CPD. Category planning of CPD covered the reasoning of CPD. In some countries where re-registration or re-licensing is mandatory, the responsible organization for registration/license has given exact definitions of the concept of CPD (Martin et.al. 2015). CPD must be continuous throughout the professional career (Martin et.al.2015). Studies recommend that CPD should be based on time- cycles of reasonable duration (3-5 years) during which professionals can earn credits or points from different categories (Topic et.al.2013). It has been defined that professionals should have at least one CPD activity in every two months. On the other hand, it has also been defined that CPD activities should be carried out during one's professional career. (Martin et.al.2015). The CPD can be performed by collecting points or credits from different parts of the CPD categories. In most cases CPD activities are defined in hours (Martin et.al.2015, Topic et.al.2013).

The planning of the CPD was seen as an important factor for effective implementation. CPD planning should be considered that CPD program structure should always cover a wide range of activities intended to CPD, thus offering benefits like strengthening the

position of the laboratory medicine at the clinical interface (Topic et.al.2013). CPD activities were often purchased from service provider and in the future, they should focus future trends in the laboratory medicine and advanced technology (Martin et.al.2015). CPD models and activities should be designed to increase the skills sets, proficiency and professionalism of the medical laboratory scientist. At the same time, they allowed to experience and understand all aspects of the laboratory from the basics tasks through management skills (Ali et.al. 2015). In the future, harmonization of CPD planning and activities may be necessary to maintain continuous quality improvement and maintain high standards of clinical laboratory practice (Topic et.al.2013).

According to study from United Kingdom, duration of CPD activity should be between six and 10 hours including written working materials, written exams and course evaluation. It can be relevant and demonstrated objective evidence. (Martin et.al.2015.) However, these definitions vary between these organizations. For example, Health and Care Professions Council in United Kingdom has defined that CPD is “a range of learning activities through which health and care professionals maintain and develop throughout their career to ensure that they retain their capacity to practice safely, effectively and legally within their evolving scope of practice”. In opposite to this kind of broad definition the corresponding organizations in Croatia and Czech Republic have defined that CPD is the same as keeping up with the latest scientific findings and advances in the medical-biochemical science (Martin et.al. 2015).

According to the studies, CPD programs were executed in many different ways. Most popular CPD activity categories were training workshops, continuing education journal-based learning, e-learning, hands-on workshops and distance learning (Amerson et. al.2012, Ali et.al.2012, Horiuchi et.al.2016, Liikanen et.al.2013, Martin et.al.2015, Topic et.al.2013). For example, CPD activities can be written working materials, written exams or course evaluation when it can be relevant and demonstrate objective evidence (Liikanen et.al.2013, Martin et.al.2015). Different kind of models for CPD has also been established such as Professional Development Model (PDM) developed by the Division of Pathology and Laboratory Medicine at the university hospital laboratory in Texas (USA). It has four competency levels and each of them requires professionals to learn and become more proficient in their own special working area. The levels are: discovery, application, maturation and experts. After complete levels professionals are evaluated and compensation is given by increase salary (Ali et.al.2012, Amerson

et.al.2012). Another CPD model was Development Work Thesis (DTW) which is an important part of the specialized studies for biomedical scientists. DTW is a method where students and the laboratory recognize an area for improvement from the real world, carry out the improvement project and report it. DTW projects can be reported as articles in professional journals. DTW can be usefulness to the workplace (Liikanen et.al.2013).

## **5.2 Evaluation of CPD**

Category of evaluation contained subcategories need of CPD and valuation of CPD. According to the studies, CPD programs are often evaluated and evaluation is mostly based on hours (Ali et.al.2012, Amerson et.al.2012, Topic et.al.2013). Majority of European Federation of Laboratory Medicine countries have developed CPD programs which are regularly evaluated and accompanied by crediting system. Evaluation of CPD is conferred by appointing professional and government bodies or national societies as responsible for this process (Topic et.al.2013). There is scale of requirements regarding the amount of CPD activity (Martin et.al.2015, Topic et.al.2013). Studies has shown that for example e-learning can provide effective results for CPD. Using e-learning programs improved the performance with the less experienced individuals (Horiuchi et.al.2016).

Need of CPD contains benefits of continuing professional development (CPD) which was seen as an integral element of professional career development. It is used to improve knowledge and skills with various categories and tools (Ifeoma et.al.2015). CPD is essential in supporting sustained competence of the healthcare workforce (Kasvove et.al.2014) and contains range of learning activities through which health and care professionals maintain and develop throughout their career to ensure that they retain their capacity to practice safely, effectively and legally within their evolving scope of practice. (Martin et.al 2015). For example, medical laboratory professionals in Botswana felt that they needed more training on topics in quality management systems and more experience to identify sources of error in laboratory procedures (Kasvosve et.al. 2014).

In the studies, valuation of CPD was seen as part of successful continuing education. The level of education and qualifications for equivalent grades of laboratory staff are usually compared within European countries. Study has shown that professionals within

different basic academic background has unequal availability for CPD. More recently qualified laboratory professionals felt they needed more training on competence assessment and case studies than those with over 10 years experiences (Kasvove et.al.2014, Topic et. al.2013).

CPD programs brought communication within workplace and result from them were used to develop and challenge the work being carried out there (Liikanen et.al.2013). Salary compensation from complete different levels in CPD programs gives satisfaction to continue working (Ali et.al. 2012).

## 6 DISCUSSION

### 6.1 Discussion of the results

Based on the analysis, CPD is used around the world but practices vary from the requirements of professional development and the maintenance of professional skills (Martin et.al.2015). Studies provides that CPD must be continuous and it should be based on time- cycles of reasonable duration (Martin et.al.2015, Topic et.al.2013). From researches survived that the laboratory professionals have the understanding to learn new skills and develop themselves, but younger professionals felt that they need more skills development (Kasvove et.al.2014, Topic et. al.2013). Studies have also shown that the motives implement CPD ranging between age, private life and career stage (Inge et.al.2015, Wareing et.al.2017.) Younger health professionals see the future as open and many career development possibilities whereas older professionals were minded remaining in the same job as far as it is possible. That's why it is important to notice learning potential and use it systematically (Inge et.al.2015).

Studies have shown that it is important for professional development to do it effectively and correctly and it must be continuous and based on time- cycles of reasonable duration (Martin et al.2015.) But time of restrain is distinctly seen as the biggest barrier to undertake CPD (Coventry et.al.2015, Govranos& Newton 2013, Stevens et.al.2016, Wareing et.al.2017). CPD can not to be done during working hours due example to large workloads, so the motivation of CPD performance is automatically lowered (Coventry et.al.2015, Inge et.al.2015). Health professions have their own responsibility for planning and undertaking their own CPD, but it can be problematic considering balance between home and work life.

There were also differences in the time use of CPD. Studies concluded that health professionals should have at least one CPD activity every two months. However, it has been specified that CPD actions should be carried out during a professional career. (Martin et.al.2015.) At the same time health professionals believe that they do not do enough CPD, which they hope for more than five hours a month (Stevens et.al.2016). Study from United Kingdom propose minimum one hour of study time per week. From the studies found also other barriers of CPD which were cost, competing priorities, workload, access to journals and lack of perceived benefit. Department and activities

should be flexible to accommodate the miss match between expectation and reality of CPD activity (Wareing et.al.2017).

CPD is used for professional education with numerous different types of tools. The use of various programs, especially the internet- based, has proved to be an effective way of developing professional skills. (Ali et.al.2012, Horiuchi et.al.2016, Liikanen et.al.2013, Martin et.al.2015, Topic et.al.2013). The use of various CPD models increases cooperation within the workplace and provides a systematic opportunity for self- and career development (Ali et.al.2012, Liikanen et.al.2013). Studies has also shown that repeatable, interactive interventions give better knowledge outcomes (Amerson et. al.2012, Bluestone et.al.2013, Cervero& Gaines 2015). In addition, an experience-based payment system motivates the development of skills and recognizes competence (Amerson et.al.2012).

## **6.2 Reliability and ethicality of research**

The literature review follows in the best possible way the guidelines of the Research Ethics Committee on the principles of good scientific activity (TENK 2012). The researcher has avoided fraudulent expressions and reports the work steps and results of research without distorting. In all stages of the work, the researcher has sought to be thorough, accurate and honest with respect for the transparency of scientific knowledge.

The quality criteria of the study were validity, reliability and credibility (Polit & Beck 2014). Overall, the purpose of the material-based content analysis was to find deeper information on the implementation of the CPD and the CPD experience in the field of laboratory research from the research literature. The reliability of the research was sought by describing carefully all the stages of the research so that another researcher could repeat the same research. The reliability of the research was also sought by carefully selecting the articles selected for the literature review. The selected articles were read several times. The English-language articles were thoroughly translated so that the researcher fully understood what the studies were about and was able to make the right conclusions. The reliability of the research may be affected by the choice of literature review only English-language articles for the researcher's language skills. That is why it is possible that an excerpt has been left in some other language an article that could have been included in a literature review. Identifying appropriate keywords was challenging and researcher quickly discovered that there are numerous different terms to

describe terminology of CPD or CE. This could have limited the research results. The study time limit was from 2012 to 2016, when the founded studies were recent results. But could it have been found more result from medical laboratories if the timescale would have been e.g. 10 years?

Choosing articles by title, researcher may have missed an article that did not match the title review but could have been included in the review. Literature reviews involve the risk that some of the relevant sources will not be found, and the results may well be too much of a researcher's perspective on the subject (JBI 2014; Polit & Beck 2014). Reliability is also influenced by the fact that the researcher conducted a review of literature alone without previous experience of the study. Reliability was enhanced by the help of Nordlab Development Manager for carrying out research and identifying research problems.

The results of the literature review are valid as they correspond to the positions research questions. The study set out carefully studied and well-defined research questions. The aim was to ensure the credibility of the literature review by carefully and accurately describing all the steps of the study. When selecting articles, the input and exclusion criteria were defined, which in turn increased the research credibility of the results. Articles selected for literature review are scientific peer-reviewed articles, which also adds the credibility of the literature review. The literature on the review included eight original articles. The reliability of the research results may be affected by a small number of articles. Several different titles are used internationally as medical laboratory professional, when some studies may have been left out from research process.

Standards requires continuous professional development and laboratories must show that the laboratory staff participate or receive CPD and its effectiveness is measured. Taking this into consideration, eight founded articles are small amount. This small amount can be due e.g. to the medical and biochemistry background research in laboratory medicine and biochemistry.

### **6.3 Conclusions**

The studies provided information and experiences on CPD and its needs, implementation, planning and evaluation, but little information was found from the medical laboratory itself. The CPD has been recognized as necessary for professional



development and its effective use with a variety of tools adds to motivation and a positive attitude towards continuing professional development. It is important for medical laboratories to maintain their own professional skills and to be constantly interested in changing technology. After all, the CPD and the experiences of use it have been studied marginally in the medical laboratory. Further research would be needed in the medical laboratory sector, especially what kind of experiences and results have been achieved.

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## Appendix 1.

<b>Authors</b>	<b>The purpose of the study</b>	<b>Material/ collection of material</b>	<b>Key results</b>
1. Comparison of approaches and measurement of continuing professional development for specialists in laboratory medicine within four European countries. Martin J etc. 2015 United Kingdom	This study investigates approaches to CPD for specialists in laboratory medicine within four European countries.	Four European countries: Croatia, the Czech Republic, Malta and UK.	There is similarities and differences in both CPD requirements and CPD profiles for specialist in laboratory medicine within European countries.
2. A professional development model for medical laboratory scientists working in the Core Laboratory. Ali FA etc. 2012 United States of America	The Division of Pathology and Laboratory Medicine at The University of Texas MD Anderson Cancer Center has implemented a professional development model (PDM).	A professional development model for medical laboratory scientists.	The professional development model (PDM) has four competency levels. It creates an opportunity to expand skills and abilities in a laboratory. Upon completion of a level the medical laboratory scientist receives a salary adjustment based on the competency level completed.
3. Continuing professional development crediting system for specialists in laboratory medicine within 28 EFLM national societies. Topic E etc. 2013 Croatia	To present results of the survey on current CPD situation in EFLM member countries, with emphasis on crediting system.	A questionnaire had been forwarded to presidents/national representatives of all EFLM members.	Majority of EFLM members have developed CPD programs which are regularly evaluated and accompanied by crediting systems. Continuing education, authorship and e-learning are mainly recognized as CPD activities. Professionals with different basic academic background have the unequal possibility for CPD.

4. A cross-sectional study of the knowledge and attitude of medical laboratory personnel regarding continuing professional development. Ifeoma EA etc.2015 Nigeria	This work was aimed at evaluating the level of awareness/knowledge and attitude of MLS regarding CPD and possibly identifying challenges encountered in attending CPD sessions.	Cross-sectional questionnaires survey of MLS and other laboratory staff attending a CPD workshop.	The main barrier encountered by respondents was a lack of funding and policy for CPD by most organizations.
5. Continuing professional development training needs of medical laboratory personnel in Botswana. Kasvosve I. etc.2014 Botswana	Identify current development needs of medical laboratory scientists and technicians to address performance requirements. Secondly, identify the format preferences for CPD delivery.	Descriptive cross-sectional assessment utilizing a self- administrated questionnaire.	CPD is essential in supporting sustained competence of the healthcare workforce. The ranking of training needs by the survey respondents did not vary by qualification or years of experience. Top 3 preferred CPD models were training workshops, hands-on workshops, internet- based learning.
6. The efficacy of an internet- based e-learning system using the Cella Vision competency software for continuing professional development. Horiuchi Y. etc. 2016 Japan	Reaches created a cloud computing-based e-learning system of CCS and same time the efficacy of CPD was evaluated.	They created one of CPD model.	Internet- based learning can provide effective results for CPD. It has demonstrated the advantage of easy distribution of a proficiency program. using the e-learning program improved the performance of the less experienced individuals. With this type of programs, it is easy to routinely conduct proficiency testing and regular monthly
7. “Development work thesis” as a tool for continuing professional education. Liikanen E. etc. 2013 Finland	To describe, from an educator’s viewpoint, the development work thesis as a tool for CPD within specialized studies in point-of-care testing	Focus group format	Development work thesis (DTW) is functional tool for CPD. Biomedical scientist have a positive attitude towards CE and they are comfortable using e-learning.
8. A professional development model for medical laboratory scientists working in the microbiology laboratory. Amerson MH. etc. 2012 United States of America	Department administrators and Human Resource generalist developed a professional development.	CPD model to support skills, behaviors, certification and CE within its staff.	Model sets high standards for the laboratory professionals to allow the labs to work at their fullest potential. It provides organization to training technologists based on complete laboratory needs instead of training technologists in individual.

