Literature Review

Position of Laboratory Scientist, Analyst, and Technologist in Standard Occupation Classification

Bon-Kyeong Koo

Department of Laboratory Medicine, Samsung Medical Center, Seoul, Korea

Terms for medical laboratory personnel were researched using code names in the standard occupational classification and the job titles for a total of 46 countries including the International Federation of Biomedical Laboratory Science (IFBLS) and European Association for Professions in Biomedical Science (EPBS) through Google search. In the case of the technologist or technician type, the identities used by medical laboratory personnel include biomedical laboratory health technician, clinical diagnostic laboratory technician, clinical laboratory technologist, medical laboratory technologist, medical laboratory technician, medical technologist, biomedical analysis technician, clinical analysis technician, and medical analytics technician. For the analyst type, professional titles include bio analyst, biomedical analyst, and medical analyst, whereas for the scientist type, professional designations include biomedical scientist and medical laboratory scientist. Additionally, other professional titles may include bioengineer and medical technical laboratory assistant. In most countries, medical laboratory technologists and technicians belong to the Major Group 3 Technicians and Associate Professionals in the International Standard Classification of Occupations 2008 (ISCO-08). Biomedical scientists or medical laboratory scientists in the United Kingdom (UK), Ireland, Australia, and New Zealand are categorized as Major Group 2 Professionals according to their standard occupational classification. Medical laboratory personnel must be distinguished in the International Standard Classification of Occupations because they have different education levels, experience levels, and responsibilities. Medical laboratory personnel with a bachelor's degree qualification should be moved to the Major Group 2 Professionals. Medical laboratory personnel with an associate degree or diploma qualification should be designated as Major Group 3 Technicians and Associate Professionals. A medical technologist and a medical technician or a medical laboratory technologist and a laboratory medical technician are not properly recognized by individuals with similar terms. This review proposes a new professional designation of "Medical Laboratory Analyst and Biomedical Analyst" as unified terms for medical laboratory personnel with a bachelor's degree qualification (excluding the title of medical laboratory scientist and biomedical scientist).

Key words: Associate professionals, Biomedical analyst and Medical laboratory analyst, Biomedical scientist and Medical laboratory scientist, Medical laboratory technologist and technician, Professionals

Introduction

The International Standard Classification of Occupations, abbreviated as ISCO, is an international classification under the responsibility of the International Labor Organization (ILO) for organizing jobs into a clearly defined set of groups according to the tasks and duties associated with the position.

Accepted: July 20, 2021, corrected November 3, 2021

Corresponding author: Bon-Kyeong Koo, Department of Laboratory Medicine, Samsung Medical Center, 81 Irwon-Ro Gangnam-Gu, Seoul 06351, Korea
Email: bonkyung.koo@samsung.com

The ISCO is intended both for use in compiling statistics and for client-oriented uses such as the recruitment of workers through employment offices, the management of migration of workers between countries and the development of vocational training programs and guidance.[1]Founded in 1954, the International Association of Medical Laboratory Technologists (IAMLT) was revised to the International Federation of Biomedical Laboratory Science (IFBLS) at the general assembly in 2002.[2] The IFBLS introduces the occupations of member countries as medical laboratory scientists and technologists or as biomedical laboratory scientists and technologists or as biomedical scientists and laboratory technicians.[2] Even the name of the laboratory professional occupation is not standardized, like "clinical laboratory scientist, clinical laboratory technologist, medical laboratory scientist, medical laboratory technologist, medical technologist, bio analyst, biomedical analyst, medical laboratory scientist, biomedical scientist", and so on.[4,5] The present study compares the job titles of medical laboratory personnel registered to ISCO-08 and the formal qualifications of each country, and accordingly, proposes terms for medical laboratory personnel for which identities have been established.[1]

Materials and Methods

Terms for medical laboratory personnel were researched using code names in the standard occupational classification and the official titles for a total of 46 countries including the IFBLS and EPBS using Google search.[2,3] A complete listing of the subject search organizations and associations is provided in Table 1.

Table 1. Subject Search Categories. Complete listing of the subject search organizations and associations

International organizations
International Standard Classification of Occupations (ISCO)
International Standard Classification of Education (ISCED)
International professional associations
International Federation of Biomedical Laboratory Science (IFBLS)
European Association for Professions in Biomedical Science (EPBS)
Professional associations based in Africa
Cameroon Association for Medical Laboratory Sciences (CAMELS)
Ghana Association of Medical Laboratory Scientists (GAMLS)
Association of Kenya Medical Laboratory Scientific Officers (AKMLSO)
Association of Medical Laboratory Scientists of Nigeria (AMLSN)
Society of Medical Laboratory Technologists of South Africa (SMLTSA)
Biomedical Society of Zambia (BSZ)
Professional associations based in America
American Society for Clinical Laboratory Science (ASCLS)
American Medical Technologists (AMT)
Canadian Society for Medical Laboratory Science (CSMLS)
Professional associations based in Asia
Hong Kong Institute of Medical Laboratory Sciences (HKIMLS)
All India Medical Laboratory Technologists Association (AIMLTA)
Japanese Association of Medical Technologists (JAMT)
Korean Association of Medical Technologists (KAMT)
Malaysian Institute of Medical Laboratory Sciences (MIMLS)
Myanmar Medical Technologist Association (MMTA)
Medical Laboratory Technologists Association of Pakistan (MLTAP)
Philippine Association of Medical Technologists (PAMET)
Singapore Association for Medical Laboratory Sciences (SAMLS)
Association of Medical Technologist of Thailand (AMTT)
Taiwan Association of Medical Technologists (TAMT)
Taiwan Society of Laboratory Medicine (TSLM)
Professional associations based in Europe
Austrian Association of Biomedical Analysts (AABA/OBBA)
Belgian Association of Laboratory Technologists (BALT/BVLT)
Croatian Chamber of Health Professionals (CCHP)
Danish Association of Bio analysts (DAB)
Estonian Association of Bio analysts (EAB)
France Association of Medical Laboratory Technicians (FAMLT/AFTLM)
Finnish Association of Bio analysts (FAB)
Association for Medical Technologists and Analysts – Germany (AMTA/DVTA)
Greek Association of Medical Laboratory Technologists (GAMLT/PETIE)
Association of Biomedical Scientists – Iceland (ABS/FL)
Academy of Clinical Science and Laboratory Medicine – Ireland (ACSLM)
Medical Laboratory Scientists Association – Ireland (MLSA)
Italian Scientific Society of Biomedical Laboratory Technicians (ISCBLT/SITLab)
Netherlands Association of Medical Laboratory Employees (NAMLE/NVML)
Norwegian Engineers and Technologists Organization (NETO_DB/NITO_BFI)
Portuguese Association of Clinical Analysis Technicians (PACAT/APTAC)
Spanish Association of Laboratory Technicians (SALT/AETEL)
Institute of Biomedical Laboratory Science – Sweden (IBL)
Swiss Association of Biomedical Analysts (SABA)
Institute of Biomedical Science – UK (IBMS)
Professional associations based in Oceania
Australian Institute of Medical and Clinical Scientists (AIMS)

Results

Categorical classification of medical laboratory personnel by HISCO

The first ISCO version, known as ISCO-58, was adopted in 1957 by the 9th International Conference of Labor Statisticians; subsequent versions were ISCO-68 (17th International Conference of Labor Statisticians, 1966), ISCO-88 (14th International Conference of Labor Statisticians, 1987) and the recent ISCO-08, adopted in December 2007. Medical laboratory personnel were classified as 0-53 Medical Technicians when ISCO-58 was enacted, as 0-54.30 Medical Science Technicians in the ISCO-68 revision, as 3211 Life Science Technicians in the ISCO-88 revision, and as 3212 Medical and Pathology Laboratory Technicians in the ISCO-08 revision.[6] (Table 2)

In most countries, medical laboratory personnel are categorized as "major group: technicians and associate professionals > sub major group:

health associate professionals > minor group: medical and pharmaceutical technicians > unit group: medical and pathology laboratory technicians (examples: medical laboratory technicians, pathology technicians)," but in the UK, Australia, and New Zealand, they are characteristically registered as "major group: professionals > sub major group: science and engineering professionals > minor group: life science professionals > unit group: biologists related profession (examples: biochemists, biologists, biomedical scientist, medical laboratory scientists)."

Table 2. Categories of medical laboratory personnel in HISCO

Version	Category
ISCO-58 (1958)	0-5 Professional Medical Workers Not Elsewhere Classified and Medical Technicians 0-53 Medical Technicians
ISCO-68 (1968)	0-5 Life Scientists and Related Technicians 0-54 Life Sciences Technicians 0-54.30 Medical Science Technicians
ISCO-88 (1988)	3 Technicians and Associate Professionals 32 Life Science and Health Associate Professionals 321 Life Science Technicians and Related Associate Professionals 3211 Life Science Technicians
ISCO-08 (2008)	2 Professionals 21 Science and Engineering Professionals 213 Life Science Professionals 2131 Biologists, Biologists, Botanists, Zoologists and Related Professionals 3 Technicians and Associate Professionals 31 Science and Engineering Associate Professionals 314 Life Science Technicians and Related Associate Professionals 3141 Life Science Technicians (excluding Medical) 32 Health Associate Professionals 321 Medical and Pharmaceutical Technicians 3212 Medical and Pathology Laboratory Technicians

Abbreviation: HISCO, Historical International Standard Classification of Occupations.

Job titles of medical laboratory personnel in 45 countries

History of job titles in UK medical laboratory personnel

Medical laboratory personnel in the UK were pathological and bacteriological laboratory assistants in 1912, medical laboratory technicians in 1943, medical laboratory scientific officers in 1974 before being designated as biomedical scientists in 1994 .[7] The European Federation of Clinical Chemistry and Laboratory Medicine (EFCC) defines "specialists in laboratory medicine" as medical doctors, pharmacists, and scientists and includes biomedical scientists in the UK at the scientist level. Biomedical scientists are academically trained laboratory professionals (master's degree) without specialist training unlike physicians.[8]

History of job titles of US medical laboratory personnel

In 1926, the ASCP (1922 American Society for Clinical Pathologists; 2001 American Society for Clinical Pathology) established the Committee on Registration of Technicians (1928 Board of Registry; 2009 Board of Certification) to address the need for formally registering and regulating the field of medical technology. Registration was open to practicing medical and laboratory technicians. According to the ASCP, registration for laboratory technicians and medical technologists began in 1931. With college graduates being granted the qualification of medical technologist in 1935, the title laboratory technician was automatically discontinued. In 1969, a qualification examination was established for medical laboratory technicians.[9] In 2009, the ASCP Board of Registry and the National Credentialing Agency for Laboratory Personnel (NCA) merged into a single credentialing agency, the ASCP Board of Certification. The two-major national certifying agencies (ASCP and NCA) agreed to provide a single credential under the ASCP Board of Certification, combining titles of medical technologists and clinical laboratory scientists. The official title from ASCP was renamed medical laboratory scientist.[9] The NCA certification clinical laboratory technician was replaced with the title medical laboratory technician.[9] There are currently three major certification agencies in the United States of America for medical laboratory personnel. They are the American Society for Clinical Pathology (ASCP), the American Medical Technologists (AMT), and the American Association of Bio analysts (AAB).[10]

Unit group and Job titles

The qualification for medical laboratory personnel was designated at the skill level 3-4 in the ISCO-08. In the case of the technologist

or technician type, the identities used by medical laboratory personnel include biomedical laboratory sanitary technician, clinical diagnostic laboratory technician, clinical laboratory technologist, medical laboratory technologist, medical laboratory technician, medical technologist, biomedical analysis technician, clinical analysis technician, and medical analytics technician. For the analyst type, the professional titles include bio analyst, biomedical analyst, and medical analyst, whereas for the scientist type, the titles include biomedical scientist and medical laboratory scientist. Additional designations include the bioengineer and medical technical laboratory assistant.[11-54] (Table 3)

Table 3. Job titles of medical laboratory personnel on ISCO-08

SOC version	Examples of job title according to unit group*	Reference
SCIENTIST REGISTRATION		
UK 2020	P: 2113 Biomedical Scientist AP: 3111 Laboratory Technician (ex: Medical Laboratory Assistant)	[11]
Ireland 2010	P: 2112 Medical Laboratory Scientist AP: N/A	[12]
Iceland (unk)	P: 2212 Biomedical Scientist AP: N/A	[13]
Australia 2013	P: 2346 Medical Laboratory Scientist AP: 311213 Medical Laboratory Technician	[14]
New Zealand# 2013	P: 2346 Medical Laboratory Scientist AP: 311213 Medical Laboratory Technician	[14]
Saudi Arabia# 2019	P: 213115-06 Medical Laboratory Scientist AP: 321201 Medical Laboratory Technician	[15]
Singapore 2020	P: 2134-02 Medical Laboratory Scientist (ex: Epidemiologist) AP: 3212 Medical Laboratory Technologist	[15]
AFRICA		
Cameroon (unk)	P: N/A AP: 3212 Medical Laboratory Scientist; Medical Laboratory Technician	[17]
Ghana 2010	P: N/A AP: 3212 Medical Laboratory Scientist; Medical Laboratory Technician	[18]
Kenya (unk)	P: N/A AP: 3212 Medical Laboratory Technologist; Medical Laboratory Technician	[19]
Nigeria (unk)	P: N/A AP: 3212 Medical Laboratory Scientist; Medical Laboratory Technician	[19]
RSA 2012	P: N/A AP: 3212 Medical Laboratory Scientist; Medical Technologist; Medical Technician	[20]
Zambia (unk)	P: N/A AP: 3212 Biomedical Scientist; Biomedical Technologist; Biomedical Technician	[21]
AMERICA		
US 2018	P: N/A AP: 29-2010 Clinical Laboratory Technologist; Clinical Laboratory Technician 29-2011 Medical and Clinical Laboratory Technologist (ex: Medical Laboratory Scientist, Medical Technologist) 29-2012 Medical and Clinical Laboratory Technician (ex: Medical Laboratory Technician; Medical Laboratory Assistant+)	[22]
Canada 2016	P: N/A AP: 3211 Medical Laboratory Technologist AP: 3212 Medical Laboratory Assistant+	[23]
Mexico# 2011	P: N/A AP: 2813 Medical Laboratory Technician	[24]
Brazil# 2010	P: N/A AP: 3242-05 Clinical Pathology Technician (ex: Clinical Analysis Technician) AP: 3242-10 Clinical Pathology Technical Assistant+	[25]
ASIA		
China# 2015	P: N/A AP: 20507-04 Clinical Laboratory Technologist; Clinical Laboratory Technician	[26]
Hong Kong (unk)	P: N/A AP: 3212 Medical Laboratory Technologist	[27]
Pakistan# 2015	P: N/A AP: 3212 Medical Technologist; Medical Laboratory Technician	[28]
India 2015	P: N/A AP: 3212 Medical Laboratory Technologist; Medical Laboratory Technician	[29]
Sri Lanka 2011	P: N/A AP: 3212 Medical Laboratory Technologist	[30]
Myanmar (unk)	P: N/A AP: 3212 Medical Technologist; Medical Laboratory Technician	[31]
Malaysia 2020	P: N/A AP: 3212 Medical Laboratory Technologist	[32]
Thailand# (unk)	P: N/A AP: 3212 Medical Technologist	[33]
Philippines 2012	P: N/A AP: 2227 Medical Technologist	[34]
Japan 2009	P: N/A AP: 143 Clinical Laboratory Technician (ex: Medical Technologist)	[35]
Korea 2017	P; N/A AP: 2451 Clinical Laboratory Technologist (ex: Medical Technologist)	[36]
Taiwan 2010	P: N/A AP: 3212 Medical Laboratory Technologist (ex: Medical Technologist)	[37]
EUROPE		
Belgium# (unk)	P: N/A AP: 3212 Medical Laboratory Technologist	[38]
Greece (unk)	P: N/A AP: 3212 Medical Laboratory Technologist	[39]
France# 2017	P: N/A AP: 433a Medical Laboratory Technician	[40]
Spain 2011	P: N/A AP: 3314 Clinical Diagnosis Laboratory Technician	[41]
Croatia 2010	P: N/A AP: 3212 Health Laboratory Technician	[42]

Germany 2010	P: N/A AP: 8121-02-103 Medical Technical Laboratory Assistant	[43]
Portugal 2010	P: N/A AP: 321201 Clinical Analysis Technician	[44]
Poland# 2014	P: N/A AP: 3212 Medical Analytics Technician	[45]
Netherlands# 2014	P: N/A AP: 3212 Medical Analyst	[46]
Italy 2011	P: N/A AP: 321302 Biomedical Laboratory Sanitary Technician	[47]
Switzerland# 2010	P: N/A AP: 862-08 Biomedical Analyst (Biomedical Analysis Technician)	[48]
Austria 2011	P: N/A AP: 3212 Biomedical Analyst	[49]
Sweden 2012	P: N/A AP: 3212 Biomedical Analyst	[50]
Denmark 2010	P: N/A AP: 321210 Biomedical Analyst	[51]
Estonia 2021	P: N/A AP: 32120101 Bio analyst	[52]
Finland 2010	P: N/A AP: 3212 Bio analyst	[53]
Norway 2011	P: N/A AP: 3212 Bioengineer	[54]
Hungary# (unk)	P: N/A AP: 3324 Medical Laboratory Assistant (ex: Medical Laboratory Analyst)	[63,64]

* Entry-level education: Bachelor's degree (3, 2+2, 4 years); Associate degree or Diploma (2-3 years).
\+ Certificate (4-6 months, various)
\# IFBLS Non-member country

Abbreviations: ISCO, International Standard Classification of Occupations; SOC, Standard Occupational Classification; P, Professionals; AP, Associate Professionals; RSA, Republic of South Africa; US, United States of America; UK, United Kingdom; unk, unknown; N/A, Not Applicable.

Adapted from Koo et al. Korean J Clin Lab Sci. 2010;53(1):105-121.

Discussion

Ambiguity regarding medical technologist's professional titles

ISCO-08 distinguishes the types of identity for science occupations as scientist, technician, and assistant, and for engineering occupations, engineer, engineering technician, and drafter. What's unusual is how the standard occupational classification in the United States (US) and Canada distinguishes between technician and engineering technician on the one hand and technologist and engineering technologist on the other regarding occupations in science, medicine, and engineering, whereas the ISCO-08 and most countries simply use the term technician. Technologist and engineering technologist refers to an individual who has completed 3 years of college or 3-4 years at a university. This is not reflected in the standard occupational classification. The term medical technologist has the disadvantage of lacking identity due to the various professional titles unlike medical doctor, pharmacist, nurse, and physical therapist. In the case of medical technologist and medical laboratory technician in the US, individuals use casual, non-professional terms such as "med tech, lab tech, or tech" in referring to laboratory experts.[55] Medical laboratory technicians work under the supervision of a medical technologist, who performs more complex testing. The difference between the medical technologist and the medical laboratory technician is the complexity of tests performed, the level of judgment needed, and the amount of responsibility each has. It is the difference in the amount of education and job skill that allows one to perform at the medical technologist or medical laboratory technician level. Technicians require the completion of a two-year associate degree, while a technologist requires the completion of a bachelor's degree. There is more of a difference between a medical technologist and a technician career than many people realize. The similar-sounding labels of "medical technician, medical technologist," as well as the overlap between the acronyms, was yet another reason for the migration to the more descriptive title of "medical laboratory scientis."[56]

Medical technologist is a term that occupationally requires renaming. Medical technologists are recognized as medical laboratory technicians working in clinical laboratories, but in most countries, they are introduced as including medical radiation technologists, nucleated medicine technologists, and medical sonographers. In Korea, medical service technologists (formerly medical technicians) are be classified into medical technologists, radiological technologists, physical therapists, occupational therapists, dental technicians, and dental hygienists .[57]

Ambiguity regarding medical technology's occupational title

Medical technology can be defined as the application of science to develop solutions to health problems or issues such as the prevention or delay of onset of diseases or the promotion and monitoring of good health .[58] In the World Health Organization (WHO), a health technology is the application of organized knowledge and skills in the form of devices, medicines, vaccines, procedures and systems developed to solve a health problem and improve quality of lives.[59] In a comprehensive way, medical technology includes medical and surgical procedures, drugs, equipment and facilities, and the organizational and supportive systems within which care is provided.[60] Even the academic name for the field of study for medical technologists, according to International Standard Classification of Education-Fields of Education and Training 2013 (ISCDE-F 2013) of the United Nations Educational, Scientific and Cultural Organization (UNESCO), is medical laboratory technology, not medical technology.[61] Moreover, the course of study and scope of business for medical laboratory technology have expanded following changes in the medical environment so that medical laboratory science and biomedical laboratory science have been used instead.

Preliminary Study of Name Change by the KAMT

In the Korean Association of Medical Technologists (In Korea, medical technologists are called “Clinical Pathology Technologists”) in 2021, the organization was charged with conducting research concerning the potential for a new professional title using 22,638 full members as subjects.[5] The survey was distributed to all members. The results indicated that “Diagnostic Laboratory Analyst” was the most preferred alternative selected by the largest proportion of respondents (34.73%), followed by “clinical laboratory analyst” (24.57%), “biomedical pathology technologist” (10.89%), “biomedical analyst” (10.49%), “biomedical laboratory analyst” (10.03%), and “clinical laboratory scientist” (9.26%).

The view regarding the need for a new professional title is thought to have been impacted by the fact that diagnostic tests (or diagnostic laboratory test) were popularly recognized during the past two years due to the coronavirus (COVID-19) pandemic. It is also important to note that medical, veterinarian, pharmaceutical, and chemical facilities and specialized laboratories employ such analysts to work in all types of laboratory environments. Depending on the industry, laboratory analysts can test and evaluate materials ranging from biological samples such as DNA and blood to environmental samples such as water and industrial waste.[62]

Cases to Move the Occupational Classification

Depending on the discipline, some occupations were already classified in Minor Group 226, Other Health Professionals (ISCO-88 examples: 3223 Dieticians and Nutritionists, 3224 Optometrists and Ophthalmic Opticians, 3226 Physiotherapists, 3229 Occupational Therapists, 3229 Audiologists and Speech Therapists). The skill level and essential qualifications for medical laboratory personnel have increased because of advances in scientific technology. In some countries, medical laboratory personnel now fall under science professionals to reflect the advancement of the discipline. Biomedical scientists or medical laboratory scientists in the UK, Ireland, Australia, and New Zealand are categorized as life scientists along with biologists, biochemists, and microbiologists according to their standard occupational classification. According to the standard occupational classification in the US, life scientists consist of Board Group 19-1020 Biological Scientists (examples: biologists, biochemists, microbiologists) and Board Group 19-1040 Medical Scientists (examples: epidemiologists, toxicologists). If medical laboratory scientists in the US are to be registered in the standard occupational classification, a detailed occupation must be created for Board Group 19-1040 Medical Scientists, or Board Group 10-1050 Medical Laboratory Scientists. Especially, “scientist” types of title are officially being recognized

Table 4. Proposal new titles for medical laboratory personnel

Unified job titles	ISCO-08 Skills (1-4)	ISCED 1997 Groups (1-6)	ISCED 2011 Groups (1-8)
Medical Laboratory Scientist, Biomedical Scientist	4	5a	6
Medical Laboratory Analyst, Biomedical Analyst	4*	5a*	6*
Medical Laboratory Technologist and Technician	3	5b	5
Medical Laboratory Assistant	3	4 (PNDA)	4 (PNDA)

*Bachelor's degree or equivalent

Abbreviations:
ISCO, International Standard Classification of Occupations;
ISCED, International Standard Classification of Education;
PNDA, postsecondary non-degree award.

and regulated by the Government Departments (examples: Ministry of Education, Ministry of Health).

Recommendation for Renaming and Realigning Laboratory Professionals

Medical laboratory personnel must be distinguished in the International Standard Classifica-tion of Occupations because they have differe-nt education levels, experience levels, and responsibilities. Medical laboratory personnel with a bachelor's degree qualification should be moved to Major Group 2 Professionals, and medical laboratory personnel with an associate degree or diploma qualification should be composed as Major Group 3 Technicians and Associate Professionals.

This paper proposes a new professional designation of "Medical Laboratory Analyst and Biomedical Analyst" as a unified term for medical laboratory personnel with a bachelor's degree qualification, excluding the title of medical laboratory scientist and biomedical scientist. (Table 4)

Table 5. Proposal new categorical classification for medical laboratory personnel

Current group in ISCO-08
2 Professionals
22 Health Professionals
221 Medical Doctors
222 Nursing and Midwifery Professionals
223 Traditional and Complementary Medicine Professionals
224 Paramedical Practitioners
225 Veterinarians
226 Other Health Professionals
2261 Dentists
2262 Pharmacists
2263 Environmental and Occupational Health and Hygiene Professionals
2264 Physiotherapists
2265 Dieticians and Nutritionists
2266 Audiologists and Speech Therapists
2267 Optometrists and Ophthalmic Opticians
2269 Health Professionals Not Elsewhere Classified
3 Technicians and Associate Professionals
32 Health Associate Professionals
321 Medical and Pharmaceutical Technicians
3211 Medical Imaging and Therapeutic Equipment Technicians
3212 Medical and Pathology Laboratory Technicians
3213 Pharmaceutical Technicians and Assistants
3214 Medical and Dental Prosthetic Technicians
322 Nursing and Midwifery Associate Professionals
323 Traditional and Complementary Medicine Associate Professionals
324 Veterinary Technicians and Assistants
325 Other Health Associate Professionals
Proposed group
2 Professionals
22 Health Professionals
221 Medical Doctors
222 Nursing and Midwifery Professionals
223 Traditional and Complementary Medicine Professionals
224 Paramedical Practitioners
225 Veterinarians
226 Dentists
227 Pharmacists
228 Allied Health Professionals
2281 Physiotherapists
2282 Dieticians and Nutritionists
2283 Audiologists and Speech Therapists
2284 Optometrists and Ophthalmic Opticians
2285 Occupational Therapists
2286 Radiographers and Sonographers
2287 Medical Laboratory Analysts and Biomedical Analysts
2288 Orthotists and Prosthetists
2289 Other Allied Health Professionals
2291 Environmental and Occupational Health and Hygiene Professionals
2292 Allied Health Professionals Not Elsewhere Classified
3 Technicians and Associate Professionals
32 Health Associate Professionals
321 Medical and Pharmaceutical Technicians
3211 Radiography Technicians and Sonography Technicians
3212 Medical Laboratory Technicians and Pathology Technicians
3213 Pharmaceutical Technicians and Assistants
3214 Medical and Dental Prosthetic Technicians
322 Nursing and Midwifery Associate Professionals
323 Traditional and Complementary Medicine Associate Professionals
324 Veterinary Technicians and Assistants
325 Other Health Associate Professionals

The recommendation from the present study is to separate the medical technologist and medical technician qualification in Unit Group 3211, 3212, and 3214, and subsequently include medical technologists as a new group of health professionals. (Table 5) First, the new group will be established to include dentists and pharmacists in Minor Groups 226 and 227. Second, the existing Minor Group 226 Other Health Professionals will be changed to 228 Allied Health Professionals. Allied health professionals will include physical therapists, occupational therapists, audiologists and speech therapists, dieticians and nutritionists, optometrists and ophthalmic opticians,

radiographer and sonographer, medical laboratory analysts and biomedical analysts, and orthotists and prosthetists. Third, environmental and occupational health and hygiene professionals will be included in the newly established Minor Group 229. Renamed Minor Groups 3212 Medical Laboratory Technicians and Pathology Technicians perhaps should be categorized in the same category as occupations such as assistant nurses, assistant midwives medical and dental technicians, physiotherapy technicians and assistants, pharmaceutical technicians and assistants, and veterinary technicians and assistants in revisions after ISCO-08. Medical laboratory technicians and pathology technicians can also be described as clinical pathology technicians, medical biology technicians, and histopathology technicians, etc.

Conclusion

Name changes are not just a change of designation but signify the occupational growth of a specialized job and the growth of its social value. In conclusion, the proposal for name changes for medical technologist grade can shed new light on the roles and responsibilities of the medical laboratory expert in education, research, and laboratory management.

References

1. International Labor Organization. International Standard Classification of Occupations. https://ilostat.ilo.org/resources/concepts-and-definitions/classification-occupation/ (Accessed May 2021).

2. International Federation of Biomedical Laboratory Science. About IFBLS. https://http://www.ifbls.org/index.php/about-ifbls/history (Accessed May 2021).

3. European Association for Professions in Biomedical Science. Membership. https://epbs.net/membership/ (Accessed May 2021).

4. Komatsu K. Qualification system for BLS - domestically and internationally. Rinsho Byori (Jpn J Clin Patol). 2016;64(8):932-935.

5. Koo BK, Kim WS, Park SG, Park JO, Yoon SM. A study on the validity of changing the job title of medical technologist. Korean J Clin Lab Sci. 2010;53(1):105-121.

6. International labor Organization. International standard classification of occupations. https://www.ilo.org/public/english/bureau/stat/isco/intro2.htm (Accessed May 2021).

7. Pitt SJ, Cunningham J. An introduction to biomedical science in professional and clinical practice. 1st ed. Chippenham: Willey=Blackwell. 2009.

8. Oosterhuis WP, Zerah S. Laboratory medicine in the European Union. Clin Chem Lab Med. 2015;53(1):5–14.

9. American Society for Clinical Pathology. History of BOC. www.ascp.prg/docs/about_boc/boc-history-timeline (Last accessed on May 2021).

10. Estridge BH, Reynolds AP. Basic medical laboratory techniques. 6th ed. Cengage Learning; 2011.

11. Statistics UK. Standard occupational classification 2020. https://www.ons.gov.uk/methodology/classificationsandstandards/standardoccupationalclassificationsoc/soc2020/soc2020volume1structureanddescriptionsofunitgroups (Accessed May 2021).

12. Statistics Ireland. Critical skills occupations list using standard occupational classification 2010. https://enterprise.gov.ie/en/What-We-Do/Workplace-and-Skills/Employment-Permits/Employment-Permit-Eligibility/Highly-Skilled-Eligible-Occupations-List/ (Accessed May 2021).

13. Association of Biomedical Scientists. About. https://lifeindafraedingur.is/english/ (Accessed May 2021).

14. Statistics Australia. Australian and New Zealand standard classification of occupations

2013.
https://www.abs.gov.au/AUSSTATS/abs@.nsf/DetailsPage/1220.02013,%20Version%201.3?OpenDocument (Accessed May 2021).

15. Statistics Saudi Arabia. Unified occupational classification 2019.
https://www.stats.gov.sa/sites/default/files/Report_GAStat%20Unified%20Saudi%20Occupational%20Classification_English_V1.pdf (Accessed May 2021).

16. Statistics Singapore. Standard occupantional classification 2020.
https://www.singstat.gov.sg/standards/standards-and-classifications/ssoc (Accessed May 2021).

17. Cameroon Taniform University. Academics.
http://www.taniform.org/medical-laboratory-sciences/. (Accessed May 2021).

18. Statistics Ghana. Human resources for health country profile.
https://www.moh.gov.gh/wp-content/uploads/2016/02/Ghana-hrh-country-profile.pdf (Accessed May 2021).

19. Shneidman M, Dacombe RJ, Carter J. Laboratory professionals in Africa: the backbone of quality. Washington DC: International Bank for Reconstruction and Development/World Bank; 2014 Nov. p1-52.

20. Health Professions Council of South Africa. Professional boards.
https://www.hpcsa.co.za/?contentId=0&menuSubId=48&actionName=Professional%20Boards (Accessed May 2021).

21. International Federation of Clinical Chemistry and Laboratory Medicine. Biomedical Society of Zambia.
https://www.ifcc.org/media/419096/IFCC_histories_Zambia.pdf. (Accessed May 2021).

22. US Bureau of Labor Statistics. Standard occupational classification 2018.
https://www.bls.gov/soc/2018/home.htm. (Accessed May 2021).

23. Statistics Canada. National occupational classification 2016.
https://www23.statcan.gc.ca/imdb/p3VD.pl?Function=getVD&TVD=314243. (Accessed May 2021).

24. Statistics Mexico. National classification system of occupations 2011.
https://www.inegi.org.mx/app/biblioteca/ficha.html?upc=702825003336. (Accessed May 2021).

25. Statistics Brazil. Classification of occupations 2010.
https://portalfat.mte.gov.br/wp-content/uploads/2016/04/CBO2002_Liv3.pdf. (Accessed May 2021).

26. PRC Ministry of Human Resources and Social Security. Career classification ceremony 2015.
https://zhuanlan.zhihu.com/p/111069889 (Accessed May 2021).

27. Hong Kong Department of Health. Boards and Councils Office.
https://www.dh.gov.hk/english/main/main_bco/main_bco.html (Accessed May 2021).

28. Statistics Parkistan. Standard classification of occupations 2015.
https://www.pbs.gov.pk/sites/default/files//PSCO_2015.pdf. (Accessed May 2021).

29. Statistics India. National classification of occupation 2015.
https://labour.gov.in/sites/default/files/National%20Classification%20of%20Occupations_Vol%20II-B-%202015.pdf. (Accessed May 2021).

30. Statistics Sri Lanka. Standard classification of occupations 2011.
http://www.povertyportal.lk/resource-library/sri-lanka-standard-classification-of-occupations-2011-55017be500b226cbc694fa3880c99331.html. (Accessed May 2021).

31. Myanmar Medical Technologist Association. Membership.
http://www.mmtamm.org/en/about-us/about-mmta. (Accessed May 2021).

32. Statistics Malaysia. Standard classification of occupations 2020.
https://www.mohr.gov.my/pdf/masco/MASCO_2020_BI_Edaran.pdf. (Accessed May 2021).

33. Association of Medical Technologist of Thailand. About us.
https://www.amtt.org/about/history (Accessed May 2021).

34. Statistics Philippines. Standard

occupational classification 2012. https://psa.gov.ph/content/philippine-standard-occupational-classification-psoc-1. (Accessed May 2021).

35. Statistics Japan. Standard occupational classification 2009. https://www.soumu.go.jp/english/dgpp_ss/seido/shokgyou/co09-4.htm. (Accessed May 2021).

36. Statistics Korea. Standard classification of occupations 2017. http://kssc.kostat.go.kr/ksscNew_web/ekssc/main/main.do#. (Accessed May 2021).

37. Statistics Taiwan. Standard occupation classification 2010. https://www.stat.gov.tw/public/Attachment/141413555071.pdf. (Accessed May 2021).

38. Belgium Federal Public Service. Regulated healthcare professions in Belgium. https://www.health.belgium.be/en/health/taking-care-yourself/patient-related-themes/cross-border-health-care/healthcare-providers-0 (Accessed May 2021).

39. Greek Association of Medical Laboratory Technologists. About. https://www.petie.gr/ (Accessed May 2021).

40. Statistics France. Definitions, methods and quality. Consult the PCS-ESE 2017 nomenclature. https://www.insee.fr/fr/metadonnees/pcsese2017/rubriqueRegroupee/433a?champRecherche=true (Accessed May 2021).

41. Statistics Spain. National classification of occupations 2011. https://www.boe.es/boe/dias/2010/12/17/pdfs/BOE-A-2010-19389.pdf. (Accessed May 2021).

42. Croatia Office of Gender Equality. National classification of occupations 2010. https://ravnopravnost.gov.hr/UserDocsImages/arhiva/images/pdf/dokumenti/nacionalni/nacionalna%20klasifikacija%20zanimanja_2010.pdf. (Accessed May 2021).

43. Statistics Germany. Standard classification of occupations 2010 (revised version 2020). https://statistik.arbeitsagentur.de/DE/Navigation/Grundlagen/Klassifikationen/Klassifikation-der-Berufe/KldB2010-Fassung2020/KldB2010-Fassung2020-Nav.html (Accessed May 2021).

44. Statistics Portugal. Classification of professions 2010. https://www.ine.pt/xportal/xmain?xpid=INE&xpgid=ine_publicacoes&PUBLICACOESpub_boui=107961853&PUBLICACOESmodo=2&xlang=pt (Accessed May 2021).

45. Statistics Poland. Classification of professions 2014. https://stat.gov.pl/Klasyfikacje/doc/kzs/kzs_pp.htm (Accessed May 2021).

46. Statistics Netherlands. Occupational classification 2014. https://www.cbs.nl/nl-nl/onze-diensten/methoden/classificaties/onderwijs-en-beroepen/beroepenclassificatie—isco-en-sbc-- (Accessed May 2021).

47. Statistics Italy. Classification of professions 2011. http://www.statisticlass.eu/statisticlass.classificazioni/index.php?idFamiglia=1&idIndice=10&flag=1&codice (Accessed May 2021).

48. Statistics Swiss. Socio-professional categories 2010. https://www.bfs.admin.ch/bfs/en/home/statistics/work-income/nomenclatures/spk2010.html (Accessed May 2021).

49. Statistics Austria. Standard classification of occupations 2011. http://www.statistik.at/web_de/klassifikationen/oeisco_08/entwicklung_der_oeisco08/index.html (Accessed May 2021).

50. Statistics Sweden. Standard occupational classification 2012. https://www.scb.se/dokumentation/klassifikationer-och-standarder/standard-for-svensk-yrkesklassificering-ssyk/ (Accessed May 2021).

51. Statistics Denmark. Standard occupational classification 2010. www.schultzboghandel.dk/distribution@rosendahls-schultzgrafisk.dk (Accessed May 2021).

52. Statistics Estonia. Classification of professions 2021. http://metaweb.stat.ee/classificator_publish_list.htm?siteLanguage=ee (Accessed May

2021).

53. Statistics Finland. Classification of professions 2010. https://koodistot.suomi.fi/codescheme;registryCode=jhs;schemeCode=ammatti_1_20100101 (Accessed May 2021).

54. Statistics Norway. Standard occupational classification 2011. https://www.ssb.no/klass/klassifikasjoner/7 (Accessed May 2021).

55. American Society for Clinical Laboratory Science. Defining our identity. https://www.ascls.org/communication/ascls-today/341-ascls-today-volume-34-number-1/639-defining-our-identity (Accessed May 2021).

56. Medical technology schools website. Medical laboratory science program. https://www.medicaltechnologyschools.com/medical-lab-scientist/medical-technologist-vs-clinical-lab-scientist (Accessed May 2021).

57. Korean Legislation Research Institute. Medical Service Technologists, Etc Act. https://elaw.klri.re.kr/kor_service/lawView.do?hseq=46422&lang=ENG. (Accessed May 2021).

58. Tulchinsky T, Varavikova E. The new public health. 3rd ed. Academic Press; 2014.

59. World Health Organization. Health topics. https://www.who.int/health-technology-assessment/about/healthtechnology/en/ (Accessed May 2021).

60. International Federation of Medical and Biological Engineering. Clinical engineering handbook. 2nd ed. Academic Press; 2020.

61. United Nations Educational, Scientific and Cultural Organization. International standard classification of education-field 2013. http://uis.unesco.org/sites/default/files/documents/international-standard-classification-of-education-fields-of-education-and-training-2013-detailed-field-descriptions-2015-en.pdf (Accessed May 2021).

62. Job hero website. Laboratory analyst. https://www.jobhero.com/job-description/examples/sciences/lab-analyst (Accessed May 2021).

63. Official website of the European Union. Laboratory assistant. https://ec.europa.eu/growth/tools-databases/regprof/index.cfm?action=professions&quid=1&mode=asc&maxRows=*#top (Accessed May 2021).

64. Kovacs GL, Ludany A, Koszegi T, Lisszt F, Kellermayer. Graduate and postgraduate state university education of laboratory specialists in Hungary: medical doctors, pharmacists and laboratory analysts. BioChemia Medica. 2011;22(2):22-29.