



Review

Apheresis Medicine education in the United States of America: State of the discipline



Monica B. Pagano^{a,*}, Gay Wehrli^b, Darlene Cloutier^c, Eileen Galvin Karr^c,
Ileana Lopez-Plaza^d, Joseph Schwartz^e, Chester Andrzejewski^f, Jeffrey L. Winters^g,
Edward C.C. Wong^{h,i}, Yanyun Wu^j, Nicole D. Zantek^k

^a Department of Laboratory Medicine, University of Washington, Seattle, WA 98195, United States

^b Department of Pathology and Laboratory Medicine, University of Virginia, Charlottesville, VA, United States

^c Transfusion and Apheresis Medicine Services, Department of Pathology, Baystate Medical Center, Baystate Health, Springfield, MA, United States

^d Department of Pathology and Laboratory Medicine, Henry Ford Health System, Detroit, MI, United States

^e Department of Pathology and Cell Biology, Columbia University, New York, NY, United States

^f Department of Pathology, University of Massachusetts Medical School-Baystate, Springfield, MA, United States

^g Department of Pathology and Laboratory Medicine, Mayo Clinic, Rochester, MN, United States

^h Departments of Pediatrics and Pathology, George Washington School of Medicine and Health Sciences, Washington, DC, United States

ⁱ Department of Coagulation, Quest Diagnostics Nichols Institute, Chantilly, VA, United States

^j Bloodworks Northwest, Seattle, WA, United States

^k Department of Laboratory Medicine and Pathology, University of Minnesota, Minneapolis, MN, United States

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ABSTRACT

Apheresis Medicine is a medical discipline that involves a variety of procedures (based on the targeted component to be removed or collected), indications (therapeutic vs. donation), and personnel (operators, management, and medical oversight). Apheresis services are accredited and/or regulated by a number of agencies and organizations. Given the complexity and the heterogeneity of apheresis services, it has been particularly challenging to formulate educational goals and define curriculums that easily cover all aspects of Apheresis Medicine. This review summarizes the current state of the discipline in the United States of America, and some of the challenges, strategies, and resources that Apheresis Medicine educators have used to ensure that Apheresis Medicine educational programs meet the health care needs of the relevant population within regulatory and accrediting entity frameworks.

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* Corresponding author.

E-mail address: monibea@uw.edu (M.B. Pagano).

1. Background

1.1. Introduction

The practice of Apheresis Medicine is extremely diverse in the United States of America (US). Clinicians overseeing the procedures come from a variety of backgrounds including Pathology and its subspecialty called Blood Banking and Transfusion Medicine, Internal Medicine and its subspecialties such as Nephrology, Hematology/Oncology, Neurology, Rheumatology, Dermatology, and other specialties such as Pediatrics [1]. Staff providing care for apheresis includes physicians [including doctors of medicine (M. D.) and osteopathic medicine (D. O.)], advanced practitioners (including physician assistant and nurse practitioner), nurses, laboratory staff, and staff with baccalaureate degrees from accredited universities or colleges with advanced training in apheresis. Apheresis procedures may be performed for therapeutic purposes or donation of autologous and allogeneic blood components and cellular therapy products. Procedures performed by a therapeutic Apheresis Medicine service may include therapeutic plasma exchange (TPE), erythrocytapheresis (RBC), leukocytapheresis, thrombocytapheresis, mononuclear cell (MNCs) collections including hematopoietic progenitor cells, monocytes, lymphocytes, and dendritic cells (autologous or allogeneic), low density lipoprotein (LDL) apheresis, and extracorporeal photopheresis (ECP). Apheresis Medicine services can be provided by in-patient hospital or outpatient clinic staff or contracted mobile apheresis staff, through oversight by different medical specialties, in different settings including in-patient services (hospital units), and outpatient services such as outpatient clinic, dialysis outpatient clinic, or outpatient blood collection centers. Apheresis for allogeneic blood donation may include plasmapheresis, plateletpheresis, erythrocytapheresis, and leukocytapheresis. These donation procedures are typically performed by community based or hospital based blood collection facilities.

1.2. Apheresis procedure utilization in the US

Blood for transfusion may be collected by whole blood donation or apheresis. Based on the 2013 blood utilization survey by AABB, the number of blood component units collected by apheresis was estimated to be 1.86 million (M) (allogeneic and autologous) red blood cell units, 2.23 M platelet units collected by plateletpheresis procedures, and 0.53 M plasma units were collected by plasmapheresis or multicomponent apheresis [2]. In addition, an estimated 7 M plasma units intended for further manufacturer were collected in 2013, a portion of these units would have been collected by an unknown number of plasmapheresis procedures [2]. These numbers were part of an overall downward trend in blood collections from the previous data collected in 2011 [3]. Many centers in the US perform apheresis collections for autologous and allogeneic hematopoietic progenitor cell-apheresis (HPC-A) and other novel cellular therapies. There are no readily available statistics on the number of donors collected or procedures performed for HPC-A or other cellular therapies; however, among the National Marrow Donor Program (NMDP) facilitated transplants, which include both US and international transplants, the most common source of unrelated hematopoietic progenitor cells is peripheral blood [4].

Currently in the US, there is no national registry or reporting mechanism from which to obtain the total number of therapeutic procedures performed within the country. A recent single center case series from 2003 to 2012 including adults and pediatric patients, from a large center in the US reported conducting 11,718 therapeutic procedures including 6331 TPE, 5164 ECP, and 223 other procedures (erythrocytapheresis, leukocytaphere-

sis, and thrombocytapheresis) [5]. The most common reasons for TPE were thrombotic thrombocytopenic purpura (TTP), myasthenia gravis, solid organ transplant rejection, focal segmental glomerular sclerosis, chronic inflammatory demyelinating polyneuropathy, and acute inflammatory demyelinating polyradiculoneuropathy (Guillain-Barré syndrome). The indications for TPE were similar to those found in a prior US center series published in 2007 [6]. Another study reviewing the large US pediatric health information system (PHIS) inpatient database including 42 pediatric hospitals (70% of all freestanding children's hospitals in the US and covering 85% of all major US metropolitan areas) from 2003 to 2010, found that TPE use ranged from 8 to 14 per 10,000 admissions, with the most common indication for TPE were complications of a transplanted heart, complications of a transplanted kidney, myasthenia gravis, TTP and hemolytic uremic syndrome [7]. The American Society for Apheresis (ASFA) has recently published updated guidelines for therapeutic procedures; however, the extent of the use of these guidelines is unknown [8].

2. Nursing and technical (apheresis operator) education and training for Apheresis Medicine

In the US, apheresis procedure operators may include nurses [registered nurse (RN), licensed practicing nurse (LPN), or licensed vocational nurse (LVN)], clinical laboratory staff [medical laboratory scientist (MLS), previously known as the medical technologist (MT) or the clinical lab scientist (CLS), medical laboratory technician (MLT), medical technologist (MT), and specialist in blood banking (SBB)], and phlebotomists. However, many states only allow nurses or physicians to perform therapeutic apheresis procedures.

Nursing education can be obtained through different pathways including the associate degree in nursing (ADN), which is a 2–4 year program college degree; the diploma in nursing, a 3 year hospital based education program; and for nursing students interested in pursuing an academic career, it is possible to obtain a Bachelor of Science in nursing (BSN), which is a 4 year program that prepares the student for academic positions and graduate training. Graduate training includes master [advanced practice registered nurse (APRN), clinical nurse leader (CNL)] and doctoral levels [Doctor of Nursing Practice (DNP)]. After training completion, nurses obtain their license to practice through the National Council Licensure Examination (NCLEX). Nursing schools are accredited by the Accreditation Commission for Education in Nursing (ACEN) or the Commission on Collegiate Nursing Education (CCNE).

Similar to nursing education, technical education can be obtained through different pathways. For example, phlebotomist requires post-secondary education phlebotomy training program, MLT requires an associate degree in a 2 year program in medical technology, MLS requires bachelor's degree typically from a 4 year program in medical technology; SBB requires completion of an accredited SBB Program and examination for SBB Certification; BB(ASCP) technologist in blood banking requires non-medical technologist baccalaureate degree and Certification Examination from the American Society of Clinical Pathology.

There are no nationally mandated requirements for the formal therapeutic apheresis training of nurses and technologists in the US. Several regulatory and accrediting entities, however, provide regulatory guidance on training and assessment of operator competency along with basic information on the documentation of practitioner training and competence.

In general, education and training of apheresis operators in the US are typically provided by more experienced colleagues at the institution where the Apheresis Medicine service is located, by national professional organizations, and/or educators affiliated

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