

编者按: 本文根据 Michael F. Powell 教授在四川省医院协会药事管理委员会第十三次会员大会的报告内容, 及审修者与 Powell 教授当面交流后整理而得, 希望能为我国的医院药学教育及实践提供参考(注: 本文摘要、结语及文献[3-5]由审修、译者编写及补充)。

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美国内布拉斯加医学中心: 是一所三级/四级非盈利性教学医院(现代医疗保健按医疗服务类型将医院分为初级医疗、二级医疗、三级医疗和社区医疗服务单位; 其中四级医疗服务单位是三级医疗服务单位的延伸, 拥有专业但尚未普及的医疗服务, 仅在少数国家和地区保健中心设置), 作为内布拉斯加州最大的医学中心, 其肿瘤科、实体器官移植科和神经科全球知名。其开设的住院药师培训项目包括一年级住院药师培训项目(Post graduate year 1, PGY1) 和二年级住院药师培训项目(Post graduate year 2, PGY2); 其中, PGY2 从 1974 年起开设, 培训项目包括危重患者药学、肿瘤药学、急诊药学等。

美国医院药学教育与实践

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摘要 目的: 为我国医院药学教育与实践者提供参考。方法: 以美国内布拉斯加医学中心为例, 从药物与治疗学委员会、医院药房管理、临床药学教育和医院药学人员工作职责四个方面介绍美国医院药学教育与实践。结果: 药物与治疗学委员会职责为制订与执行与药品使用、管理相关的政策, 监测药品的使用等, 其下设有处方集、用药管理两个分会和一支由医学、护理与药学人员组成的专家小组; 医院药房管理主要涉及药品配制、医嘱审核、药品调剂和自动化技术四个方面; 临床药学教育分为专业药学学位教育和毕业后继续教育两种; 医院药学服务团队由药师和药学技术人员组成, 药师主要负责查房及患者监护、药物重整、用药咨询与药品管理, 药学技术人员主要负责药品采购、配制、运输、养护等传统药学服务工作。结论: 美国临床药学实践处于全球领先水平, 其医院药学教育与实践的经验值得借鉴与学习。

关键词 美国医院药学; 药学教育; 药学实践; 药师

Hospital Pharmacy Education and Practice in the USA

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ABSTRACT OBJECTIVE: To provide a reference for hospital pharmacy education and practice in China. METHODS: Taking The Nebraska Medical Center as an example, the hospital pharmacy education and practice in the USA were introduced from the following four aspects: Pharmacy and Therapeutics Committee, hospital pharmacy management, clinical pharmacy education, and the responsibilities of the hospital pharmacy staff. RESULTS: The Pharmacy and Therapeutics Committees oversees two subcommittees: the Formulary Subcommittee and the Medication Management Subcommittee and a group of expert panels including physicians, nurses and pharmacists. Hospital pharmacy management consist of four aspects: preparation of drugs, medication order review, drug dispensing and automated technology. Pharmacy education in the USA is stratified into the professional pharmacy de-

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gree and post-graduate education. The hospital pharmacy service team in the USA consists of pharmacists and pharmacy

technicians. Pharmacists' Work includes patient care rounds and monitoring, medication reconciliation, drug consulting and drug policy management, as well as pharmacy technicians' work includes drug procurement, preparation, transportation, conservation and restocking medications on patient care units, and other distributive pharmacy services. CONCLUSIONS: The clinical practice of pharmacy in the USA provides valuable lessons for the advancement of pharmacy practice throughout the world, the experience and evolution are worthy for us to learn and study.

KEYWORDS Hospital pharmacy in the USA; Pharmacy education; Pharmacy practice; Pharmacist

美国临床药学实践始于20世纪60年代,经过50多年的发展已处于全球领先水平,其医院药学教育及发展的宝贵经验值得借鉴。具体体现在使用先进科学技术提升药品采购、储存、配制与调剂等传统药学服务工作的服务质量;在医院药学服务中,药师参与患者从入院至出院及出院后随访的用药全过程,为患者提供药学服务;对药学技术人员提供规范的培训与资格认证,使其能胜任及参与更多的药学服务工作。我国医院药学目前正由传统药学服务模式向以患者为中心的临床医学服务模式转化,学科发展的机遇与挑战并存。本文以内布拉斯加医学中心为例,从药物与治疗学委员会、医院药房管理、临床药学教育和医院药学人员工作职责4个方面介绍美国的医院药学教育与实践,希望对医院药学实践者能有所启示。

1 药物与治疗学委员会

内布拉斯加医学中心药物与治疗学委员会(下文统称“委员会”)隶属于医院质量委员会和用药管理委员会,下设处方集分会和用药管理分会。委员会由医师、药师、护士及科研人员组成,由医师担任主席、药师担任副主席。委员会职责为制订与执行与药品使用、管理相关的政策,制订与更新药品处方集,审核处方集外药品的使用申请,监测与随访药品的不良反应和用药错误。药物与治疗学委员会除设置上述两个分会外,还拥有一支由医学、护理与药学人员组成的专家小组,其主要职责为评估与审议委员会的各项提案与决议。

1.1 处方集分会

处方集分会分别由医师和药师担任主席和副主席,并由药师兼任秘书。该分会主要职责为评审与推荐进入处方集的药品,制订用药指南、用药计划书和用药政策;评估处方集用药数据、用药指南和用药计划书的依从性,评估与药品政策相关的患者治疗结局;许可标准治疗方案,监测处方外药品和超说明书药品的使用,监测药品不良反应与用药错误。

1.2 用药管理分会

用药管理分会由药师与护士共同担任主席。该分会职责为制订并实施病区药品管理规范(包括病区用药储存、药品配制、药品运输、用药管理),制订并审核与用药管理相关的综合信息(药品管理指南、用药教育信息),监测和评估用药错误,根据药品不良反应和用药安全数据向药物与治疗学委员会提供安全用药的政策建议,根据药品安全问题评估处方集并提出更新建议。

2 医院药房管理

2.1 药品配制

在美国由医院药学人员完成静脉用药品配制工作的医院占91.2%,其中符合美国797净化标准的静脉配制区的医院占65.2%。静脉用药品配制工作主要由药学技术人员承担,但药师必须监督配制过程并审核配制成品。内布拉斯加医学中心充分运用现代化技术减少了人为配制错误,提高了配制效率。运用的现代化技术包括应用摄像监控技术拍摄静脉用药

品配制过程的关键步骤,使药师在净化区外通过摄像图片便可监测配制过程;通过条码扫描技术保证配制中药品品种的正确性。

2.2 医嘱审核

医嘱审核是保障患者用药安全的重要环节。药师通过数字图像采集、手写医嘱、传真和电子医嘱4种方式接收医嘱。内布拉斯加医学中心所有医嘱均需经药师审核后护士方可执行。在美国提供每周7 d、每天24 h实时审核医嘱服务的医院占34.5%。工作时间内药师在医院完成实时医嘱审核,工作时间外通过数码影像技术或计算机输入技术实施远程医嘱审核。一些小型医院向大型医院药学部或公司购买药学服务(即由大型医院药学部或公司向其提供远程药师医嘱审核服务)。虽然医嘱审核意义重大,但目前美国在工作时间内完成实时医嘱审核的医院仅占43.4%,尚未实现全美医院24 h实时医嘱审核。

2.3 药品调剂

美国医院药品调剂分为中心人工调剂、非中心人工调剂、中心自动化调剂和非中心自动化调剂4种,目前主要调剂方式为非中心自动化调剂。非中心自动化调剂即用自动发药柜在病区储存一定数量的口服和注射用药品。药学人员负责补充和管理自动发药柜中药品的数量和质量;护士需使用生物识别或条码识别技术,遵医嘱从发药柜中取药发给患者,以保证护士合法取用药品、患者按医嘱使用药品。自动发药柜中药品储存可根据不同的病区(如精神护理、重症监护、心血管护理)或药品分类(如麻醉药品、精神药品)制订药品储存方案。采用非中心自动化调剂方式调剂的首剂药品和维持剂量药品分别占64.5%和62.5%。

2.4 自动化技术

自动化技术广泛应用于医院工作的各个环节中,如电子病历系统、自动化调剂系统(机器人、自动摆药机和旋转摆药机)、药品条码管理、智能输液泵等,可节省人力资源和减少人为差错。在药品供应和使用全过程应用自动化技术,不仅方便了各环节工作,还可追踪和监控药品的流向、使用情况和数量,保证了药品使用的安全性。

3 临床药学教育

美国临床药学教育分为专业药学位教育和毕业后继续教育两种。专业药学位即药理学博士学位(Doctor of pharmacy, Pharm. D.),由美国教育部药学教育鉴定委员会(Accreditation Council for Pharmacy Education, ACPE)认证的药学院颁发,是药学实践的入门学位。毕业后继续教育即参加由美国卫生系统药师协会(American Society of Health-system Pharmacists, ASHP)认证、医院举办的一年级或二年级住院药师培训^[1]。

2000年以前,药学实践入门学位包括5年制的本科学士学位和7~8年制的药理学博士学位。2000年后,ACPE取消了5年制药理学本科教育,统一将7~8年制的药理学博士学位作为唯一

的专业药学学位,以利于培养出临床经验丰富的药师,保证药物的合理使用。美国药学博士学位教育分为两个阶段:前3~4年学习药学预科课程(Pre-pharmacy curriculum),包括数学、化学、生物学、生理学等基础课程,完成规定预科课程学习后参加药学院的准入考试(Pharmacy college admission test, PCAT),并向药学院提出书面申请。以获得的药学预科课程分数和PCAT分数来判断其能否进入药学院,合格者继续学习为期4年的药学课程(Pharm. D.)。其中前3年为理论课学习,包括药理学、药物治疗学、药学实践、临床药学等专业课程的学习;第4年为临床轮转实习,是药学实践的核心训练过程^[2]。

学生获取药学博士学位后,可参加以临床实践为主的住院药师培训或以研究为主的研究员培训。据美国卫生系统药师协会的统计数据显示:美国卫生系统药师协会认证的住院药师培训项目始于1964年,截至2013年,开展的住院药师培训项目已超过1600项,其中一年级住院药师培训项目(PGY1)971项、二年级住院药师培训项目(PGY2)633项;共有2694名学员参与了PGY1培训,692名学员参与了PGY2培训。PGY1培训是以全科临床药学实践为核心的普通培训,PGY2培训则是以高级监护为主的专科培训,详见图1[在1964—2013年期间,住院药师培训项目的名称和内容都在不断变化:1964—1981年培训项目统一称为医院药学(Hospital);1982—1991年培训项目包括医院药学、临床通科(Clinical)和临床专科(Specialized);1992—2006年培训项目包括药学实践(Pharmacy practice)和临床专科(Specialized);自2007年起,又统一称为PGY1和PGY2(此句由译者添加)]。

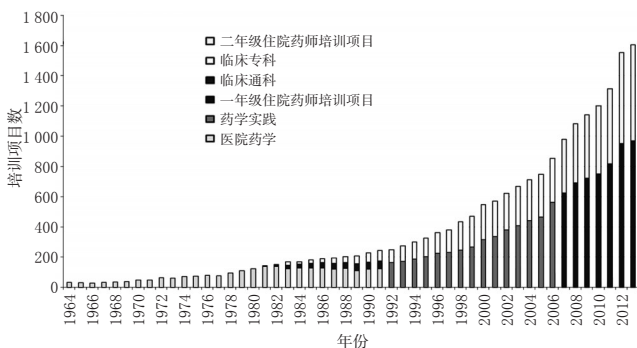


图1 美国医院药师协会认证的住院药师培训项目增长情况(1964—2013年)

Fig 1 ASHP accredited pharmacy residency program growth (1964-2013)

在2008年,美国卫生系统药师协会发布了针对PGY1的培训目标和评价方法,随后又发布了针对PGY2的专科培训目标和评价方法,以指导各培训基地开展标准化的药师培训工作,培训的最低水平是完成临床药师的药学实践工作。随着住院药师培训的规范发展,参与该培训的药师数量也逐年增加。

此外,美国药师还可参加由药物治疗专家认证委员会(Board Certified Pharmacotherapy Specialists, BCPS)认证的专业技术考试并获取相应药理学专业(如重症监护药学、儿科药学)资质认证书,药物治疗专家认证委员会由ASHP和美国药师协会(American Pharmacists Association, APhA)资助。通过实施住院药师培训和委员会认证的专业技术考试,一方面可为药学实践领域提供准入标准、规范人员资历管理;另一方面也树立了药学实践的专业性,提升了其他医务人员对药学的

实践专业的认同度。

在2014年秋季,美国卫生系统药师协会通过了新的住院药师培训项目认定及管理标准,并计划增加培训基地数量、扩大培训基地的招生规模。截至2015年,有超过3600名学员参加住院药师培训,其中2811名学员参加了PGY1,794名学员参加了PGY2,相比2014年增加了300余人^[3]。

4 医院药学人员的工作职责

美国医院药学服务团队由药师和药学技术人员组成,内布拉斯加医学中心的药师主要从事药学临床实践工作,主要职责是药学实践和药学服务。美国医院药师的日常工作主要为参与每日查房、询问患者入院前用药史、审核患者出院带药情况、基于药动学与药效学调整用药方案、监测患者住院期间药品使用、监测药品不良反应、提供药品信息、参与心肺复苏与营养支持治疗、参与处方集和用药指南制订等药事管理工作。

4.1 药师的工作职责

4.1.1 查房及患者监护 据美国卫生系统药师协会2013年的统计数据显示,临床药师对住院患者实施监护的医院占47%,监护率达75%。药师通常在查房前进入病房了解患者的疾病史、社会史、过敏史、重要的生命体征与新的实验室检查结果,并结合患者病情及实验室检查结果提出用药方案调整建议。

4.1.2 药物重整 药物重整即药师通过问诊或查询用药记录,核实患者当前使用的所有药品,向医师提供患者准确的用药信息,避免发生重复用药、剂量错误、药品相互作用等错误,该项工作体现了多学科协助促进患者监护的特点,并主要是对换转医疗单位(如入院、出院或转科)的患者提供此项服务。目前,在少数医院中已逐渐由药学技术人员代替药师收集患者的用药史,节约了人力成本。

4.1.3 用药咨询 药师的另一项重要工作是向医师、护士及患者提供药学咨询服务。所涉及的咨询服务内容与比例如下:剂量调整占98.1%、药品信息占96.7%、药动学占90.6%、抗菌药物管理占83.8%、抗凝药品管理占64.8%、营养支持占52.4%、患者教育占50.1%、疼痛管理占41.7%、患者依从性与用药史相关问题占31.2%。此项工作有利于药师在医疗团队树立自身的专业形象。

4.1.4 药品管理 药师应积极主动参与到医院药品的使用管理中,如制订、审核、更新和管理处方集,管理抗菌药物、抗凝药品和免疫抑制剂等。其中,处方集管理工作包括评价同类药品间的有效性、安全性,评估处方集外药品使用的合理性及监测医师对处方集政策的执行力度等。医院药师参与了抗菌药物管理工作的医院在全美医院中占43.5%,在抗菌药物管理领导小组中,药师占48.5%。抗凝药品管理主要涉及对华法林、肝素、低分子肝素的剂量调整与不良反应监测,以及对携带抗凝药品出院的患者进行用药教育。

4.2 药学技术人员的工作职责

药学技术人员在医院药学实践中承担重要工作,包括药品采购、配制、运输及病区药品的养护与数量保障等传统药学服务工作。在部分医疗机构中,药学技术人员也开始参与面向患者的药学服务工作,如开展用药重整、协助药师采集患者信息、参与用药项目管理等。通过进一步规范其培训及资格认定制度,药学技术人员将在未来的药学服务中扮演更为重要的角色。

5 结语

目前,我国医院药学实践发展空间较大,不同医疗属性、

等级的医疗机构药学服务状况差异大^[4],而美国医院药学经过50多年的发展,已相对成熟,其发展经验值得我们借鉴。在医院药事管理研究方面,我国偏重于药物利用、制剂管理和采购管理等方面的药品管理研究^[5]。而美国的药物与治疗学委员会则同时注重以患者为中心的用药服务管理和药品本身的管理,分别由其下设置的处方集分会和用药管理分会负责。该委员会由医师和药师担任正副主席并重视药学技术人员的参与,可以更多地从医院管理层面上满足患者的需求,此管理模式值得借鉴。随着医疗体制的改革,我国临床药师需求量逐渐增大,现已有部分高校开设临床药学本科教育,但在数量和质量上仍存在较大问题。我国的临床药学本科教育、研究生教育以及规范化培训正处于高速发展阶段,且已经取得了一定成绩,但临床药学教育和实践的体制与规模仍有待改善。学科的发展和建设是一个漫长而艰难的过程,我国医院药学实践虽起步晚但发展迅速,借鉴国外药学实践的发展经验有利于我国医院药学实践的稳步发展。我国从事药学工作的人员众多,医院药学实践者在未来也将会为患者提供更多的药学服务。

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附 Michael F. Powell 教授报告原文

The Introduction of Author and The Nebraska Medical Center

Professor Michael F. Powell serves as Executive Director, Pharmaceutical & Nutrition Care at the Nebraska Medical Center and the Nebraska Poison Control Center, as well as Associate Professor and Associate Dean for Hospital Affairs at the University of Nebraska Medical Center College of Pharmacy. His primary teaching interests are in post-graduate experiential training programs. The Nebraska Medical Center and the University of Nebraska Medical Center jointly offer PGY1 and PGY2 residency programs. Mr. Powell provides instruction in the areas of ethics, health systems policy and institutional pharmacy practice. Mr. Powell offers elective rotations in pharmacy practice management.

The Nebraska Medical Center is a tertiary/quaternary academic hospital (modern healthcare can be divided into primary care, secondary care, tertiary care and community-based care). Quaternary medical care is the extension of tertiary medical care by highly trained subspecialists and which generally is delivered in a small number of national and regional health referral centers. The Nebraska Medical Center is the largest health care facility in Nebraska where Oncology, Solid Organ Transplantation and Neurology are world-renowned. Hospital pharmacist training programs, including the post graduate year 1 (PGY1) and post graduate year 2 (PGY2) programs in Oncology Pharmacy, Critical Care and Emergency Pharmacy specialty programs, among others, were established in 1974.

The article records the report of Professor Michael F. Powell in the conference of Pharmacy Administration Commission, Hospital Association of Sichuan Province. The article takes the Nebraska Medical Center as an example, introducing the hospital pharmacy education and practice in the USA from the following four aspects: Pharmacy and Therapeutics Committee, hospital pharmacy management, clinical pharmacy education and the responsibilities of the hospital pharmacy staff, hoping that it can bring inspirations to hospital pharmacy practitioners.

Hospital Pharmacy Education and Practice in the USA

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The clinical practice of pharmacy in the USA began in the 1960's. Through the past 50 years the evolution of the clinical practice of pharmacy provides valuable lessons for the advancement of pharmacy practice throughout the world. The experi-

ence specifically includes developments in advanced science and technology advancing drug procurement, storage, preparation, transfer and other traditional pharmacy services to enhance the quality of pharmacy service. In the hospital, phar-

macists participate in pharmaceutical care covering the whole process of care; from admission to discharge and follow-up treatment after discharge. Pharmacy technicians are also trained to enable pharmacists to provide patient focused pharmacy services. Hospital pharmacies in China are transforming from a traditional pharmacy services pattern to a patient-centered clinical pharmacy service pattern, with academic development opportunities as well as challenges.

1 Pharmacy and Therapeutics Committee, the Nebraska Medical Center

1.1 Pharmacy and Therapeutics Committee

The Pharmacy and Therapeutics Committee at the Nebraska Medical Center reports to the Hospital Quality Committee and the Medical Executive Committee. A Pharmacy and Therapeutics Steering Committee oversees two subcommittees: the Formulary Subcommittee and the Medication Management Subcommittee. The Committee consists of physicians, pharmacists, nurses and researchers and is chaired by physicians with pharmacists serving as co-chairs. Responsibilities of the Committee are as follows: to create and implement the policies related to drug utilization and management, to create and update drug formularies, to monitor non-formulary drug use, and to monitor and follow up adverse drug reactions and medication errors. In addition to the two subcommittees, the Pharmacy and Therapeutics Committee has a group of expert panels including physicians, nurses and pharmacists, charged with evaluating subspecialty requests for drug policy and formulary action.

1.2 Formulary Subcommittee

The Formulary Subcommittee is chaired by a physician with a pharmacist co-chair. A pharmacist also serves as secretary of the Subcommittee. The main responsibilities of this Subcommittee are to assess and recommend drugs to be included in formularies, to develop guidelines, protocols and medication policies, to assess data related to formulary drug use, as well as guideline and protocol adherence, to review patient outcomes related to drug use policy, to review and approved standardized order sets, to review non formulary and unapproved drug, and to review adverse drug reactions and medication errors.

1.3 Medication Management Subcommittee

The Medication Management Subcommittee is co-chaired by a pharmacist and a nurse. The responsibilities of the Subcommittee are to develop and manage processes for management of drug products (storage of drugs in unit based medication cabinets, drug preparation, drug transportation, medication administration), to create and review comprehensive information regarding medication administration (Drug Administration Guideline Development, educational or informational content regarding medication use), to monitor and review medication errors, to recommend strategies and policies on medica-

tion safety to Pharmacy and Therapeutics Executive Committee based on adverse drug reactions and medication safety data, and to assess and recommend strategies for implementation of formulary changes based on medication safety issues.

2 Hospital Pharmacy Management

2.1 Preparation of Drugs

The Hospital Pharmacy Staff compounds intravenous admixtures of medications in 91.2% of U.S. hospitals. Among these hospitals, 65.2 percent of the intravenous pharmacy admixture areas meet U.S. Pharmacopeia 797 standards. The preparation of intravenous drugs is primarily performed by pharmacy technicians. Pharmacist must supervise the process of preparation and check the finished products. The Nebraska Medical Center makes full use of the modern technology to reduce medication errors in the preparation of intravenous admixtures by pharmacy staff and to improve the efficiency of the preparation. One of the modern technologies creates a photographic record of the steps of intravenous pharmacy admixture using remote video supervision of technicians. The pharmacists can monitor the process of intravenous pharmacy admixture by reviewing the steps performed in preparation from outside of the clean room area. Additionally, the system uses barcode scanning to record the drug and solutions added to the final product during the compounding process.

2.2 Medication Order Review

Pharmacists review medication orders so as to assure the safety of patients. Pharmacists receive prescriptions through digital image capture technology, handwritten prescriptions, facsimile transmission and electronic order entry systems. Thirty-four and half percent of hospitals in the USA provide real time order review service 24 hours per day, seven days per week. All medication orders must be verified by pharmacists before nurses administer the drugs to patients at the Nebraska Medical Center. In smaller institutions without 24 hour pharmacist coverage, pharmacists provide the real time medication order review service in the hospital during working hours. During hours when a pharmacist is not present, outside pharmacists can review medication orders remotely via digital imaging technology or computerized order entry technology. Some small hospitals purchase remote order review services provided by pharmacists from Pharmaceutical Departments in large hospitals or service companies. Even with the availability of remote order review services, only 43.4% of hospitals in the USA have achieved real time order review on a 24-hour basis.

2.3 Drug Dispensing

There are four methods for dispensing drugs: Centralized manual, Decentralized manual, Centralized Automated and Decentralized Automated methods. The Decentralized Automated method is the most common method. This method requires storage of oral and injectable unit dosed medications in Automated Dispensing Cabinets on the patient care units. The pharmacy

staff is responsible for monitoring and replenishing the supply of medications stored in the automated dispensing cabinets. The nurses pick drugs for administration to patients following receipt of a medication order from the machines by signing into the machines using biometric identification or barcode identification badges (this process is) to assure the nurse is authorized to access the medications and the patients has medication orders for the drug. Medication storage may be customized by patient care unit (psychiatric care, intensive care, cardiac care) or by medication type (narcotic, psychotropic drugs). Decentralized Automated medication distribution is employed for medication delivery for first doses and maintenance doses 64.5 and 62.5 percent of the time respectively.

2.4 Automated Technology

Automation technology is widely used in various aspects in the hospital, such as electronic medical records systems, automated dispensing systems (robots, Auto-dispensary devices and rotary dispensary devices), bar coded medication administration, smart infusion pumps, etc., which can save manpower and reduce medication errors. In the whole process of supplying and utilization of drugs, automation technology is essential in facilitating efficiency, assuring safety, managing the logistics and security of drug distribution and monitoring the utilization of medications.

3 Clinical Pharmacy Education

Pharmacy Education in the USA is stratified into the professional pharmacy degree and post-graduate education. The entry level degree for professional pharmacy practice is the Doctor of Pharmacy (Pharm D.) awarded by a School of Pharmacy accredited by Accreditation Council for Pharmacy Education (ACPE) in the USA. Pharmacists receive post-graduate clinical training through post graduate year one and two education residency programs conducted by hospitals and accredited by American Society of Health-system Pharmacists (ASHP)^[1].

Prior to the year 2000, a five year baccalaureate and the Pharm D. degree were both accredited entry level degrees in pharmacy. Since 2000, the ACPE no longer accredits undergraduate education of five years. As a result, the Pharm D. degree is the only professional pharmacy degree awarded in the USA. The change was made to assure that pharmacists would have more clinical skills to monitoring patients and managing drug utilization. In the USA, it takes 7-8 years to earn a Pharm D. degree. The education of pharmacists include the pre-pharmacy curriculum, during which the students spend the first 3-4 years focusing on mathematics, chemistry, biology, physiology and other basic sciences. Upon completion of pre-pharmacy curricula, students must take the Pharmacy College Admission Test (PCAT) and complete an application to a College of Pharmacy. Admission to a college of pharmacy is competitive based on pre-pharmacy grades and scores achieved on the PCAT. Students selected to enter a college of pharmacy

will complete three years of class room study including pharmacology, therapeutics, pharmacy practice, and clinical pharmacy. The fourth year of the professional curriculum consists of clerkship training in the core areas of pharmacy practice^[2].

After obtaining a Pharm D. degree, students choose between entry level pharmacy practice positions or enter post graduate training. Pharmacists pursuing clinical practice may enter pharmacy residency training programs focusing on hospital clinical practice. Pharmacists choosing research careers may enter graduate programs focusing on research. The American Society of Health-systems Pharmacist (ASHP) began accrediting residencies in 1964. In 2013, The number of pharmacy residency training programs accredited by ASHP has grown to more than 1 600 and includes 971 Postgraduate year 1 (PGY1) training programs and 633 Postgraduate year 2 (PGY2) training programs (Figure 1). Those programs trained 2 694 pharmacists in PGY1 training programs and 692 participated in PGY2 training programs. The pharmacists in PGY1 receive training focused on the general clinical pharmacy practice. The pharmacists in PGY2 programs focus on training in the advanced patient care.

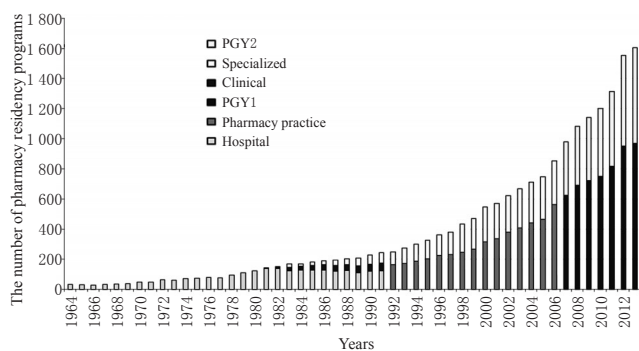


Figure 1 ASHP Accredited Pharmacy Residency Program Growth

In 2008, American Society of Health-system Pharmacists (ASHP) released the most recent training standards by which the PGY1 residencies are evaluated. Shortly thereafter, ASHP released training standards for PGY2 residencies as well. These standards guide hospitals in developing their training programs to assure that a standardized, minimum level of training is received by pharmacists completing pharmacy practice residencies. The number of pharmacists who participate in this training increases every year.

In addition to residency training, pharmacists in the USA can become board certified in pharmacotherapy. Pharmacists are eligible to take exams to be certified as Board Certified Pharmacotherapy Specialists (BCPS). This board certification is administered by the Board of Pharmaceutical Specialties, which is jointly sponsored by the ASHP and American Pharmacists Association (APhA). The exams can provide sub-specialty certifications in other areas of pharmacotherapy in disciplines such as critical care pharmacy, pediatric pharmacy, etc.

Residency training and the certification exams provide standardized credentials in the field of pharmacy practice, standardize the management of personnel qualifications, and enhance the recognition of pharmacy practice by medical staff.

Currently, revising the identification and management standards of training hospital pharmacists program is under consideration by ASHP which is intended to increase the number of training bases and enlarge the number of enrolled students in each base. The new standard is expected to be approved in the fall of 2014 to guide residency training for the next seven years^[3].

4 The Responsibilities of Hospital Pharmacy Staff

The hospital pharmacy service team in the USA consists of pharmacists and pharmacy technicians. Pharmacists at the Nebraska Medical Center are heavily engaged in the clinical practice of pharmacy. These pharmacist spractice at the bedside daily. The daily routines of hospital pharmacists in the USA include participating in rounds, taking patient medication histories upon admission, performing medication reconciliation at patient discharge, adjusting the regimen based on the pharmacokinetic and pharmacodynamics analysis, monitoring the utilization of drugs when patients are in the hospital, monitoring adverse drug reactions, providing drug information, participating in cardiopulmonary resuscitation and nutrition support, participating in the creation of formularies, medication guideline development, and administrative activities.

4.1 Pharmacists' Work

4.1.1 Patient Care Rounds and Monitoring Statistics from ASHP in 2013 show that the hospital pharmacists monitor drug therapy for 75 percent of patients in 47 percent of the hospitals nationally. Pharmacists conduct pre-round drug therapy assessments (monitoring) to review their patients' medication, social, and allergy histories, vital signs and new laboratory results, and clinical note in order to be able to propose the recommendations for adjusting medication regimens.

4.1.2 Medication Reconciliation Pharmacists perform medication reconciliation to verify all patient medication use by interviewing patients directly or through medication records. Medication reconciliation allows the pharmacists to provide accurate medication information to physicians to assure accurate continuation of medications and to avoid misprescribing, dosage errors, and drug interactions. This activity reflects multidisciplinary collaboration to promote the patient care. Pharmacists perform medication reconciliation upon admission ,upon transfer between medical units and discharge. In some hospitals, pharmacy technicians collect the medication histories for pharmacists to streamline data collection, saving labor costs.

4.1.3 Drug Consulting Pharmacists perform several medication consulting activities in support of the patient care teams. Those pharmacy consulting services may include dosage adjust-

ment (98.1%), drug information (96.7%), pharmacokinetics (90.6%), antimicrobial stewardship (83.8%), anticoagulation (64.8%), nutrition support (52.4%), patient education (50.1%), pain management (41.7%), and patient compliance and medication histories(31.2%). These consulting activities enhance professional status of pharmacists with the medical team.

4.1.4 Drug Policy Management Hospital pharmacists are actively involved in drug utilization management. Pharmacists lead the processes involved increasing, maintaining and managing formularies. Pharmacists perform stewardship activities managing antimicrobial, anticoagulant, and immune suppressant agents, among categories of drug therapy. Formulary management activities include evaluating the effectiveness and safety of drug class, evaluating the rationality of the non-formulary drugs, and monitoring the compliance with formulary policies, etc. Hospital pharmacists participating in antimicrobial stewardship in 43.5% of US hospitals while 48.5% if these antimicrobial stewardship pharmacists assume leadership roles in their programs. Anticoagulation management mainly involves in the dosage adjustment of warfarin and heparin, low molecular weight heparin, monitoring adverse drug reactions and anticoagulation education forpatients who are discharged from hospitals.

4.2 The Work of Pharmacy Technicians

Pharmacy technicians perform increasingly important roles in support of hospital pharmacy practice. Those activities include drug procurement, preparation, transportation, conservation and restocking medications on patient care units, and other distributive pharmacy services. In some medical institutions, pharmacy technicians have begun to participate in patient-focused pharmacy services. For instance, pharmacy technicians collectpatient information for medication reconciliationand participate in drug administration. Through standardizing pharmacy technician training and qualifications, pharmacy technicians will play an increasingly more important role in pharmacy services in the future.

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