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Comparison of Roles of Hospital Infection Control Pharmacists in Japan and the United States

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The inappropriate use of antimicrobials results in the creation of resistant organisms and increases the overall costs of health care. In 2004, the Ministry of Health, Labour and Welfare in Japan issued a report on the current state of hospital infection control in Japan. The report mentioned that though 99.8% of 1,364 hospitals in Japan had an active infection control team, only 30.9% of them had guidelines for the appropriate use of antimicrobials.

We investigated the roles of infection control pharmacists (ICPs) at Nagoya University Hospital (NUH) in Japan and compared them with those of ICPs at Cedars Sinai Medical Center (CSMC) in the US with the aim of pinpointing activities of ICPs in Japan that need improvement. NUH is a 1,035-bed national acute tertiary care teaching hospital and CSMC a 900-bed private nonprofit acute tertiary care teaching hospital. The main duties of ICPs at CSMC are the development and implementation of guidelines for the use of antimicrobials, which are approved by the hospital's Executive Committee. The duties of ICPs at NUH are mostly the same as those at CSMC, and they also work on the prevention of nosocomial infection. However, there is still no approval system for the guidelines they draw up. In many hospitals in the US, such guidelines have resulted in cost benefits, and decreases in antimicrobial resistance and length of hospital stays. US systems will serve as a useful model for Japanese ICPs.

Key words —— infection, pharmacist, team, hospital

Introduction

The inappropriate use of antimicrobials results in the emergence of resistant organisms and increases the overall costs of health care. In Japan, seven inpatients recently died while undergoing treatment at a hospital in Tokyo, apparently after being infected with *Serratia* bacteria in 2002[1]. The Tokyo Metropolitan Government's Bureau of Public Health has suggested that the bacteria entered intravenous drips or other medical equipment after inspection of the hospital. Previous *Serratia* infections have resulted in the deaths of eight people at a hospital in Sakai, Osaka Prefecture between May and July 2000, and claimed the lives of five others at a hospital in Sumida-ku, Tokyo in August 1999[2,3]. The recent spread of antimicrobial drug resistance such as methicillin-resistant *Staphylococcus aureus* (MRSA) and vancomycin-resistant Enterococci (VRE) is also a concern of medical staff in many hospitals throughout the world.

In 2004, the Ministry of Health, Labour and Welfare in Japan has reported the current state of hospital infection control in Japan[4]. The report showed that 99.8% of 1,364 hospitals have an active infection control team (ICT). The main roles of these teams are the development and implementation of an infection control manual, research and action in the case of an outbreak, education for health care workers and control of disinfection and sterilization of medical equipment. Infection control manuals are published at 98.6% of these hospitals ; the contents include standard precautions for health care workers, action to be taken in case of disease outbreaks, hand-washing, hygienic treatment of medical devices and the details of infection control for medical treatment ; however, only 39.7% of the hospitals have hospital-wide infection control rounds and only 36.8% have conferences devoted only to facility management issues. Thus, preventive activities such as surveillance for infection outbreak and infection control are not sufficiently implemented. Furthermore, guidelines for the appropriate use of antimicrobials are prepared at only 30.9% of hospitals studied.

A system of ICT in infectious disease therapy is under development in Japan. At this time, a sophisticated model util-

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izing infection control pharmacists (ICPs) is not readily found in Japan. We investigated the roles of ICPs at Nagoya University Hospital (NUH) in Japan in comparison with those at US institutions, and clarified the activities of ICPs in Japan for the potential improvement of patient care.

Methods

This study was an observational study of the role of ICPs. One of the authors (M.Y.) stayed at and investigated the activities of ICPs at Cedars-Sinai Medical Center (CSMC) in Los Angeles, CA, USA for three months (10/2004-12/2004). Their activities were compared with those of ICPs in Nagoya University Hospital.

The role of pharmacists as infectious control specialists at NUH and CSMC are uniformly referred to as ICPs in this study. The name of the committee at each hospital differed, being ICT at NUH and Antibiotic Usage Review (AUR) committee at CSMC.

Results

1. Comparison of the structure of pharmacies at CSMC and NUH

Fig. 1 shows the structure of the pharmacies at CSMC and NUH.

CSMC is a 900-bed private, nonprofit, acute tertiary care teaching hospital with approximately 200 resident physicians and a medical staff of nearly 2000 attending physicians. The institution serves as a teaching site for pharmacy students and residents, with more than 100 pharmacists and about 50 technicians working in the pharmacy. The pharmacy is composed of one director, three managers, three supervisors, staff pharmacists, clinical pharmacists and clinical coordinators. The pharmacy department provides decentralized integrated clinical and distributive services through satellite pharmacies. Their specialties include critical care, oncology, intensive care (surgical, cardiac, respiratory, medical, and neonatal), HIV, transplant, and emergency departments.

There are five program coordinators, including 1.3 full time equivalent (FTE) for Antibiotic Usage Review (AUR) and 1.6 FTE for Medical Usage Evaluation (other than antimicrobials). The ICPs belong to the AUR. The AUR Committee includes members from different disciplines including Infectious Diseases, Surgery, Internal Medicine, Orthopedic Surgery, Obstetrics & Gynecology, Epidemiology, Microbiology and Pharmacy. The AUR works in areas regarding infectious disease. Clinical pharmacists work 24 hours a day, 7 days a week on three shifts in satellite pharmacies on each floor. The ICPs carry a pager to be available at all times.

NUH is a 1,035-bed national, acute tertiary care teaching hospital with approximately 15 resident physicians and a medical staff of nearly 500 attending physicians. This institution serves as a teaching site for pharmacy students and residents, with 45 pharmacists and 2 office clerks in the pharmacy.

The pharmacy is composed of one director, 4 managers, 10 chiefs, and staff pharmacists. The pharmacy provides

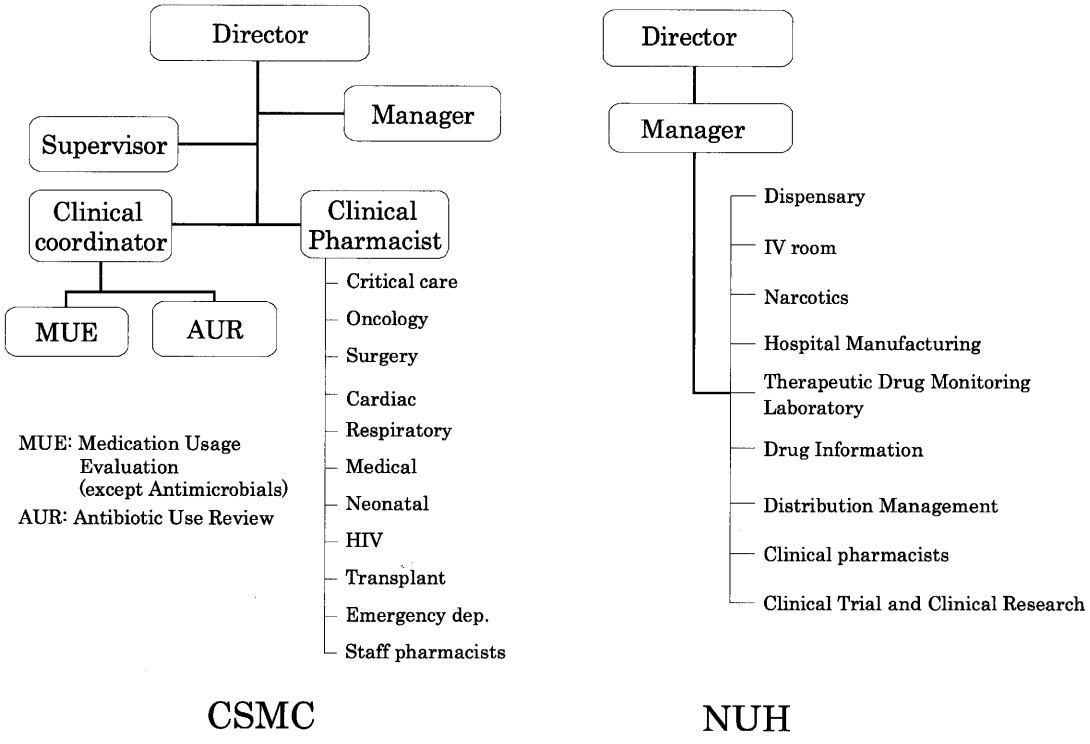

Fig. 1. Structure of the Pharmacies at CSMC and NUH.

clinical services, although the pharmacists' specialties are almost the same as those at CSMC except for the emergency department, their duties as specialists are not full time, and they also work in the pharmacy as staff pharmacists. There are 3 drug information coordinators for all areas of medication. Two pharmacists are members of the ICT. Both have two roles, as the ICP and a drug information pharmacist, or as the ICP and a member of the IV room staff. The ICT is multidisciplinary, including infectious disease doctors, infectious disease nurses, a microbiologist, pharmacists, and administrators. The ICT works on infectious disease treatment and the prevention of nosocomial infections.

2. Development and implementation of Formulary, Guidelines and Protocols

At CSMC, the ICPs develop and implement the formulary and protocols for the use of antimicrobials. As new antimicrobials are added to the formulary, the ICPs prepare monographs and present the information at AUR meetings. The monograph is a summary of information about the drug and includes characteristics such as Pharmacokinetics /Pharmacodynamics, results of clinical trials, and a summary of recommendations. After the drug is approved at the meeting, they forward the presentation and seek approval from the hospital's Pharmacy & Therapeutics Committee. Finally, they put information about the new antimicrobial into the formulary after going through the approval process of the Performance Improvement Oversight Committee and the Medical Executive Committee. **Fig. 2** shows the approval process for new drugs at CSMC.

ICPs also prepare protocols for the use of numerous antimicrobials. **Table 1** shows part of the protocol for fluoroquinolones. The protocols are developed to follow the national guidelines of Infectious Disease Society of America (IDSA) and to reflect data derived from the facility's specific isolated organisms. These protocols must be approved by the hospital's Pharmacy & Therapeutics Committee in the same manner as the addition of new drugs to the formulary. With patients, if a physician would like to order a protocol medicine through the pharmacists, the clinical pharmacists should order the prescription, blood tests and monitoring, but their actions are strictly limited by the protocol. Several antimicrobials such as oral vancomycin, amikacin, and levofloxacin could be ordered per protocol. For example, one of the protocols regulated by the "Recommendation", the conversion from intravenous to oral therapy with levofloxacin states as follows, "Patients should be switched to oral therapy if they meet four criteria : improvement in cough and dyspnea, afebrile (<100 F) on two occasions 8 hours apart, white blood cell count decreasing, functioning gastrointestinal tract with adequate oral intake". The clinical pharmacists confirm compliance with the criteria on the patient's chart and prepare a "Dear Doctor Report", then change to an oral formulation if the patient's condition meets all of the requirements stated in the protocol. **Table 2** shows a sample "Dear Doctor Report".

The ICPs select restricted antimicrobials based on efficacy data, safety and cost. Some are highly restricted while others are less so. They focus on medicines for VRE, MRSA and high-cost antifungal agents as highly restricted antimicrobials, because of the emergence of antimicrobial resistance, shortage of new antimicrobials and high cost of antimicrobials. Highly restricted antimicrobials include daptomycin, quinupristin/dalfopristin, linezolid, voriconazole, itraconazole, caspofungin, amphotericin B lipid complex, liposomal amphotericin B and oral vancomycin. A physician can order

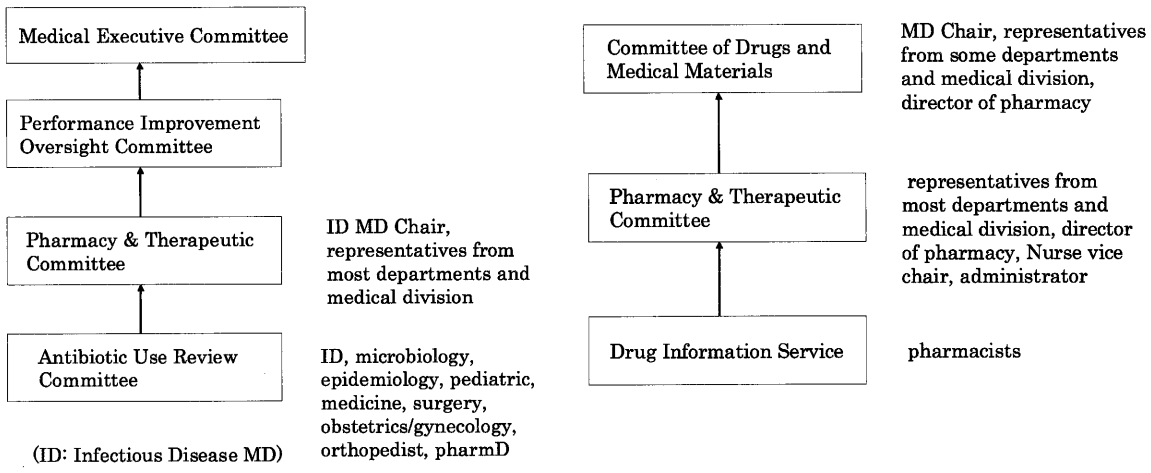

Fig. 2. The Approval Process for New Antimicrobials at CSMC and NUH.

Table 1. Abstract of Guideline for Fluoroquinolones at CSMC.

GOAL
Optimize empiric therapeutic outcomes and prevent further emergence of resistance to fluoroquinolones (FQ) by: Limiting the use of fluoroquinolones to indications with few therapeutic options AND Promoting the use of aminoglycosides, and/or beta-lactams for empiric therapy
GUIDELINE
»Second line therapy for community-acquired pneumonia »Documented infection (on recent culture result) with a gram-negative rod »Co-administration with a beta-lactam antibiotic for treatment of *Pseudomonas Aeruginosa* »Progressive renal insufficiency (e.g., an increase in SCr by > 0.5 mg/dL) while receiving an aminoglycoside »Therapy of extended duration »Documented prior intolerance (i.e. ototoxicity, nephrotoxicity) to aminoglycoside »First line therapy for bacterial gastroenteritis
PHARMACY INITIATED AUTOMATIC CONVERSION FROM IV TO THE ORAL ROUTE
The Pharmacy and Therapeutics Committee has approved an automatic switch from IV to PO when the following criteria are met; (1) functioning GI tract, (2) hemodynamic stability, (3) absence of vomiting and diarrhea, (4) clinical improvement; (exclusions: Pseudomonas bacteremia, meningitis, endocarditis, cystic fibrosis, undrained abscess, severe soft tissue infection caused by *Gas*, infections with foreign bodies) - the prescriber will be notified 24 hours in advance of automatic conversion

(Modified from the protocol)

Table 2. "Dear Doctor Report" for Conversion from IV to PO Therapy.

IV to PO/enteral conversion
Date:_____ Time:_____ The medical record does not show any contraindication* for the administration of _____(drug/dose/route) _____as a substitute for _____ (drug/dose/route) _____. The order will be changed to the oral/enteral form in 24 hours according to the Pharmacy and Therapeutics Committee policy for automatic conversion. Please feel free to contact the Pharmacist to discuss any concerns. *NPO status, nausea, vomiting, severe diarrhea, hemodynamic instability, or bowel obstruction.

(Modified from the protocol)

highly restricted antimicrobials in the formulary only after confirmation by the ICPs, the same as for nonformulary antimicrobials, which are only available on a case by case review. Less restricted antimicrobials include broad spectrum antimicrobials, such as cefepime, piperacillin/tazobactam, levofloxacin, imipenem and meropenem. Less restricted antimicrobials have specific criteria ; however, they are not controlled by the AUR committee, and do not need an infectious disease physician's or ICP's approval prior to dispensing. Clinical pharmacists should evaluate orders for less restricted antimicrobials to determine if they meet institutional criteria. If the order does not meet the criteria, the pharmacist contacts the ordering physician or the ICP.

At NUH, the ICPs focus on medicines for MRSA treatment : vancomycin, teicoplanin and arbekacin, and broad spectrum antimicrobials. The ICPs check their appropriate usage by Therapeutic Drug Monitoring (TDM), culture results and renal function for each patient. These anti-MRSA

drugs are not available in their formulary. Physicians cannot order them directly through the electronic medical chart without approval from the pharmacy. The pre-order sheets, including the physician's comments with the reason for using these drugs for their patients, are required by the pharmacy director. The ICPs develop some criteria; however, they still have no mandatory approval system like that at CSMC. They also develop guidelines for antiseptics including the appropriate concentration and the target. Fig. 2 shows the approval process for new drugs at NUH. The pharmacists in the Drug Information Service participate in this process.

3. Infectious Disease Rounds and Consultations

At CSMC, infectious disease rounds are conducted by a group including infectious disease physicians, infectious disease fellows, internal medicine residents, ICPs, and pharmacy students. The medical fellows and residents give presentations about the patients on infectious disease rounds followed by the infectious disease service. The infectious disease physicians also visit the patient's bedside, check the culture results, and review recent X-ray and laboratory data with the fellows. The infectious disease physicians can then advise the physicians-in-training to optimize patient management. The ICPs also offer suggestions based on evidence from the latest literature and the trend of detected organisms in their own facility. The infectious disease rounds play an important part in the education of infectious disease fellows, pharmacist students and medicine residents.

At NUH, infection control rounds are conducted by the ICT, and consist of an infectious disease physician, residents if available, ICPs, and infection control nurses. The infectious disease physician selects some patients who are consulted by the attending physician, or who have received anti-MRSA or broad spectrum antimicrobials. The ICT visits each nurse station where infectious disease patients are available, checks their culture results, and reviews recent X-ray and laboratory data on electronic medical charts. The ICT also discusses issues regarding infection control, e.g. an isolation system, hand washing, and Personal Protective Equipment (PPE), with the staff nurses at the patient's bedside. The role of ICPs in the infection control rounds is almost the same as at CSMC. The ICPs offer suggestions about the usage of anti-MRSA agents following the TDM and the usage of other antimicrobials following the patient's renal function. They also give recommendations about antiseptics. The infection control rounds play an important part in multidisciplinary discussions.

4. Monitoring—antibiogram, quarterly report

An antibiogram for CSMC has been developed by the Department of Pathology and Laboratory Medicine, Division of Microbiology, and includes an antimicrobial susceptibility profile and cost information. It is updated annually. A unit-specific antibiogram is evaluated by the ICPs. The ICPs pay attention to the resistance trends of organisms such as *Pseudomonas aeruginosa* or *Klebsiella pneumoniae* which produce Extended Spectrum Beta Lactamase (ESBL) in the entire hospital and in selected treatment areas, such as the medical intensive care unit and the surgical intensive care unit.

The ICPs review the medical records of patients who have received broad spectrum antimicrobials and evaluate the appropriateness of these orders every three months. They also keep track of broad spectrum antibiotic usage. The ICPs evaluate antibiotic usage using the following parameters: acquired in hospital or not, immunocompromised or not, admission from a nursing home or not, failure of other antimicrobials, recent hospitalization within 30 days and meeting the criteria for usage. They collect these data and evaluate them with previous data or those from the same month of the previous year. The AUR expenditure report includes the total cost compared to the same period in the previous year to justify the increase or decrease in expenditure. AUR expenditure is reported monthly to the pharmacy director and the AUR meeting, with a quarterly report of the data regarding broad spectrum antibiotic usage.

At NUH, an antibiogram has been developed by the microbiology division and includes an antimicrobial susceptibility profile. It is updated annually. The ICPs review the medical records of patients who received anti-MRSA drugs and monitor the serum concentrations of vancomycin, teicoplanin, and arbekacin. The ICPs mainly focus on the trend of MRSA and other resistant bacteria. The amount of antimicrobial use is reported annually to the pharmacy director and the infection control meeting of National University Hospitals. This information is also available in the ICT newspaper which is distributed to the whole hospital.

5. Education of residents and students

At CSMC, preceptor pharmacists organize the training of pharmacy students and residents, and have adopted a mutual evaluation system between pharmacists and students to maintain a high quality of education. **Table 3** shows an abstract of the requirement of students on ICPs rotation, which is a six-week program under the ICPs. Pharmacy students learn from the ICPs and infectious disease physicians about the appropriate usage of antimicrobials though monitoring, research, discussion, and presentations about the patients. The students have mini tests every day for 4 weeks, and a final test, including the efficacy, adverse events, mechanism, and cost of main antimicrobials and house guidelines. They also research and develop presentations and make slides. After the presentation, they have a discussion period during which the preceptor and other pharmacists and students question them about the evidence or the method of conducting research. They learn not only about the diseases or the therapy but also about presentation skills through this process. The presentations are therefore evaluated based on the content as well as the presentation skills. **Table 4** is the evaluation form for the student pharmacist presentation.

The pharmacy students' course consists of 4 sections: at-

Table 3. Specific Requirements for Students on Infectious Disease Rotation Grading System (abstract).

	% OF GRADE
1. Antibiotic evaluations for targeted antibiotics	20%
・Student will be assigned to a different area/ floor each week	
・Student will be evaluated by ability to execute interventions	
2. Infectious Disease Rounds	15%
・Student will follow all patients who have ID Teaching Consultation	
・Student will be evaluated on ability to determine the appropriateness of antimicrobial regimens, and identify intervention opportunities	
3. Medication Usage Evaluation	20%
4. Antimicrobial Monograph and/or Literature Review	20%
5. Journal Club Presentation	5%
6. Final Exam (antibiotic certification exam)	15%
7. Attendance and Motivation	5%

tending infectious disease rounds, a journal club that includes journal research and presentation, antimicrobial surveillance, and a project. For example, each student is given a project to make a monograph of a new medicine from industry information and articles. After graduation from their pharmacy school, they can complete a one- or two-year residency depending on their career goals. The program for the first year is accredited by the American Society of Health Systems Pharmacists (ASHP) (The Residency Learning System (RLS) Model Second Edition © 2001 ASHP : http : // www.ashp.org/rtp/rls/index.cfm)

Residents participate in clinical rotations in inpatient practice, drug distribution, pharmacy management and primary care, and work as staff pharmacists approximately 4 days a month, with salary. The residency program for the second year includes more specific fields such as administration, infection disease, and oncology.

At NUH, fourth-year pharmacy students spend 4 weeks at the hospital, with details of their course of study determined by their pharmacy school. They are given lectures by representatives of each unit, as shown in Fig. 1, and also have clinical experiences in each unit.

After graduation from their pharmacy school, they can elect residency training, with details of the program depending on their educational needs. There are several kinds of residents in the pharmacy at NUH. Residents from the Master's Course of Clinical Pharmacy in the pharmacy school spend 18 to 20 months at NUH. Residents from the Japan Pharmacists Education Center have a training course of 10 months at NUH in addition to a training course of 2 months at various community pharmacies. Some of the graduates apply to the residency program at NUH, and can be residents if they pass the entrance examination. The term of study is approximately 3 months, but can be up to 6 months in length. All of the residents follow the same program during the first 6 weeks. This includes experience in each unit of the NUH pharmacy for 2 weeks and lectures for 4 weeks. After this introductory phase, they rotate and study in the dispensary, the IV room, hospital manufacturing, and the clinical pharmacist service until they complete the program. Both fourth-year pharmacy students and pharmacy residents must pay tuition to their institutions, and they do not receive a salary from the pharmacies in Japan.

Discussion

Pharmacists acting as infectious disease specialists have different titles in Japan and the US. They are unified by the title "Infection Control Pharmacists" by the JSHP in Japan, and are called "Antibiotic Usage Review" pharmacists at CSMC. They are referred to by several other names throughout the US, including Infectious Disease Pharmacists, Antibiotic Pharmacists, Antimicrobial Utilization Pharmacists, and so on. In the US, they play a role in the treatment of infectious diseases, but are not very involved in infection control.

Practices to improve antimicrobial use in Japan and the US are shown in **Table 5**, using data from 47 US hospitals participating in a Phase 3 project, Intensive Care Antimicrobial Resistance Epidemiology (ICARE)[5] and data from a survey of 42 Japanese National University Hospitals on the appropriate use of antimicrobials[6]. ICARE hospitals are a subset of hospitals participating in the intensive care unit (ICU) component of the National Nosocomial Infections Surveillance (NNIS) System of the Centers for Disease Control and Prevention (CDC)[7]. NUH is included in 42 Japanese National University Hospitals. The survey of 47 US hospitals focused on programs available for improving antimicrobial use : the hospitals have a median of 378 beds (range, 147-2,022). In a majority of the hospitals (33 of 47), infectious disease consultations are performed to improve antimicrobial prescription : ICPs at 31 hospitals play a role

Table 4. Student Pharmacist Presentation Evaluation Form.

Presenter:_____ Date: _____
Evaluator: ☐ Preceptor, ☐ Resident, ☐ Student, ☐ Other

Please assign a score to each objective using the following scale:
1. Did not fulfill objective
2. Partially fulfill objective
3. Met objective
4. Met and exceeded objective

Content-Patient Case (if applicable) :
___C1: Provided thorough information about patient's condition
___C2: Provided an accurate assessment of the treatment regimen
___C3: Provided an appropriate therapeutic plan tailored to the patient's needs

Content-Highlighted Medication Therapies :
___Rx1: Provided complete and pertinent information on the indications of the medicines
___Rx2: Provided an evidence-based evaluation of the safety, efficacy and place in therapy

Delivery :
___D1: Appropriate speech (volume, clarity, pace, etc.)
___D2: Appropriate posture and composure
___D3: Appropriate speech content
___D4: Appropriate response to questions

Audio-Visuals :
___AV1: Effectiveness of charts and graphs
___AV2: Properly formatted handouts (arrangement, referencing, summarization, etc.)
___AV3: Slide/overheads were easy to follow

Overall Rating : ☐

Comment :

(Modified from the student pharmacist evaluation form)

in formal pharmacy consultations about initial antimicrobial choice. Nineteen hospitals have a restriction system for at least one antimicrobial. Hospital-wide restriction has been reported, most commonly for imipenem, ciprofloxacin, ceftazidime, and ticarcillin-clavulanic acid. The survey of 42 Japanese National University Hospitals focused on appropriate antimicrobial use : the hospitals have a median of 713 (range, 559-1,196) beds. At 20 hospitals, infectious disease consultations are performed to improve antimicrobial choice ; however, data about pharmacy consultations is not included in the report. Fourteen hospitals have a hospital-wide restriction system for at least one antimicrobial. Hospital-wide restrictions have been reported mainly for anti-MRSA drugs such as vancomycin, teicoplanin, and arbekacin. Both of these surveys show almost the same results as the observational study at CSMC and NUH.

The policy improvement system is very different in the US and Japan. Many hospitals in the US have attempted to control antimicrobial use through a variety of strategies[8-12]. At CSMC, restricted antimicrobials consume most of the antimicrobial drug budget, because restricted antimicrobials are significantly more expensive than non-restricted antimicrobials. In general, over 95% of antibiotic usage is for empiric therapy. Approximately 50 to 75% receive infectious disease physician consultations and 80 to 85% of all antimicrobial usage meets the AUR criteria. Highly restricted antimicrobial usage meets the criteria for use in almost 100% of cases.

Several strategies such as formulary restriction, drug utilization review, rapid reporting of culture and susceptibility data, computer-based decision-support pharmacy intervention programs, and multidisciplinary antimicrobial teams have been described in the literature[13-22]. More than half of all hospitalized patients receive antimicrobials, and such drugs can account for up to 50% of the hospital pharmacy budget[23]. As a result of these interventions, some studies have shown cost benefits, decreased antimicrobial resistance[13], and decreased length of hospital stay without compromising patient care[14]. Gums et al. have designed a randomized, prospective study to evaluate the outcomes of antimicrobial therapy interventions by a multidisciplinary consult team. This study has shown antimicrobial recommendations for possible optimal antimicrobial choices, dosages, and the rationales associated with a significant decrease in hospital

Table 5. Description of Practices to Improve Antimicrobial Use at CSMC, NUH, 47 Hospitals in US[5], and 42 National University Hospitals in Japan[6].

	CSMC*1	NUH*2	US*3	Japan*4
hospital description				
hospital beds	900	1035	348 (147-1022)	713 (559-1196)
ICUs	76	8	4(1-8)	8(3-20)
policy				
house formulary	established	established	47(100%)	41(100%)
Antimicrobial use policy	established	established	43(91%)	22(54%)
- establishment of clinical guidelines	established	not established	33(70%)	22(54%)
- restriction on any antimicrobial	established	established	19(40%)	14(34%)
- stop order on any antimicrobial	established	not established	28(60%)	no data
intervention				
infectious disease consultation (physicians)	established	established	33(70%)	20(49%)
formal pharmacy consultation	established	not established	31(66%)	no data
Informal pharmacy conslutation	established	established	16(34%)	no data
pharmacy intervention for appropriate antimicrobial use	established	established	47(100%)	35(85%)
system to measure compliance with any antimicrobials	established	not established	30(64%)	7(17%)
pharmacist routinely round with physician in ≧1 intensive care unit	established	establiehsd	28(60%)	no data

*1: Cedars Sinai Medical Center (LA, USA)
*2: Nagoya University Hospital (Nagoya, Japan)
*3: Infect. control Hosp. Epidemiol., 21,256-259 (2000)[5]
*4: 15th annual meeting abstracts, Jpn. J. Pharm. Health Care Sci., p.167 (2005)[6].
(Modified of Infect. control Hosp. Epidemiol., 21, 256-259 (2000))

costs and median length of hospital stay[14]. One of the antimicrobial therapy interventions is to switch from IV to oral therapy. Patients in an acute-care setting are more likely to be started on IV rather than oral antimicrobials ; however, injectable antimicrobials are generally more expensive than oral antimicrobials. Several studies have shown that patients can be safely switched from IV to oral therapy decreasing the length of hospital stay without adverse effects[11, 22, 24, 25].

The literature has reported the benefits of introducing a computer-assisted system[26-32]. Mullett et al. have shown that computer-guided statistically derived antimicrobial regimens improve the rate of effectiveness of empirically chosen antimicrobials compared to antimicrobial regimens initiated by physicians[8]. This study also demonstrated that using their program may reduce patient mortality rates associated with misdirected empiric therapy. The Health Care Advisory Board has reported that only 2−5% of hospitals currently use computerized order entry[33], and only 4 of 47 hospitals which participated in Phase 3 of the ICARE project are routinely using computer-assisted prescribing to influence antimicrobial choice[5]. The situation in Japan may not be so different from that in the US. If the program could be incorporated into a computerized order entry system when the system is created at a hospital, it would be very useful in both the US and Japan. It would also increase the effectiveness of understaffed pharmacists in Japan.

The inappropriate use of antimicrobial agents can lead to therapeutic failure, severe infectious disease, an increase in overall drug costs, and the emergence of antimicrobial resistance[24, 34]. In a prospective cohort study, Kollef et al. evaluated the relationship between inadequate antimicrobial treatment and hospital mortality rates for patients requiring admission to an intensive-care unit, and indicated a reduced mortality rate associated with appropriate initial antimicrobial therapy primarily for patients with pneumonia[35]. In the period from 1998 to 2002, Spellberg et al. reported that the U.S. Food and Drug Administration (FDA) approval of new antibacterial agents decreased by 56%, compared with 1983 to 1987. Of 225 new molecular entities approved by the FDA from January 1998 through December 2002, seven (3 %) were for new antibacterial agents[36]. The lack of development of novel antimicrobials and the emergence of resistant organisms are problems not only in the US but also in Japan and in many countries throughout the world. IDSA warns that the lack of research and development of novel antimicrobials is considered a "public health threat" (www.idsociety.org/"Bad Bugs, No Drugs", IDSA 2004, IDSA, accessed 1 May 2005).

In Japan,"treatment by team" has just begun in the last decade. There is an ICT in most Japanese hospitals today. The main aim of the ICT is the hospital's sanitary environment. The pharmacist's role in the ICT is primarily to suggest the appropriate use of antimicrobials, disinfectants, and antiseptics. AUR activity at CSMC focuses on the treatment of infectious diseases of inpatients, this being significantly different from the role of the ICT in Japan. Dickerson et al.

have suggested that the effectiveness of available antimicrobials may be sustained and the threat of resistance minimized with the cooperation of health care teams[37]. Dranitsaris et al. have concluded that there are several potential barriers to the optimization of ICPs. These barriers could include the combination of physician autonomy and limitations in the clinical training of pharmacists[38].

Pharmacists in Japan stand at a crossroads in their attempts to establish and augment the specialization of pharmacists. Although the education of pharmacists and health care systems in the US are considerably different from those in Japan, American systems will serve as a useful model for Japanese pharmacists as ICPs.

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