

Anthony W. Chow, MD, FACP, FRCPC

The subspecialty of adult infectious diseases in British Columbia: A personal perspective

The evolution of the infectious diseases subspecialty in BC illustrates the dynamic nature of infectious diseases and the challenges and opportunities they present to the discipline.

ABSTRACT: The current COVID-19 pandemic has intensified the public's and medical community's interest in the discipline of infectious diseases. The evolution of this relatively new subspecialty in BC over the past 40 years is highlighted. Major milestones include the establishment of an infectious diseases clinical pharmacy program, an infectious diseases fellowship program, an inpatient HIV/AIDS unit, a transplant infectious diseases service, a fellowship in reproductive infectious diseases program, and an Immunity and Infection Research Centre, as well as outpatient parenteral antimicrobial therapy and home intravenous antimicrobial treatment programs, outpatient clinics for tropical medicine and travel-acquired diseases, and cross-appointments with the BC Centre for Disease Control.

Dr Chow is a professor emeritus in the Division of Infectious Diseases, Department of Medicine, University of British Columbia and Vancouver General Hospital, Vancouver Coastal Health. He is a pioneer of infectious diseases in BC and Western Canada.

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In 1980, I wrote an editorial for the *BC Medical Journal* entitled "The subspecialty of infectious disease (ID) and the multifaceted role of the ID physician."¹ The current theme issue offers a unique opportunity to reflect upon the evolution of the discipline of infectious diseases in our province within the past 40 years and to speculate about its future.

Historical perspective

With the eradication of many classic communicable diseases in the 1950s, the clinical discipline of infectious diseases vanished in Canada. Medical microbiologists who replaced general pathologists in directing the clinical microbiology laboratory became the main source of advice to clinicians on antimicrobial therapy and for undergraduate and postgraduate education. However, it became obvious that bedside consultations by specially trained clinicians in the management of complex diseases were needed. In the 1960s, several luminaries who had trained in the United States returned to Canada to assume academic positions within departments of medicine and/or pathology (notably, Drs Allan Ronald at the University of Manitoba, George Goldsand at the University of Alberta, and Hugh Robson at McGill University). The Canadian Infectious Disease Society was established in 1976, and the subspecialty of infectious diseases was formally approved by the Royal College of Physicians

and Surgeons of Canada in 1980, with certification in 1983. Thus, a new clinical subspecialty of infectious diseases was born. It should be noted that the development of infectious diseases as a subspecialty of internal medicine or pediatrics in Canada lagged behind the United States by a decade.²

In the 1980s, due to health care reform and managed care in the United States, there was some concern about an oversupply of infectious diseases trainees to meet clinical needs. In contrast, the need for infectious diseases expertise in Canada has continued to escalate. Compared with the United States, where one infectious diseases physician served 110 000 people in 1987, Canada delivered only one infectious diseases physician per 220 000.³ It is clear that not all infections require the services of an infectious diseases specialist. Approximately 80% of infections in the community can be managed adequately by family physicians or general internists and other specialists.³ However, life-threatening and complicated infections should receive care from physicians with formal infectious diseases training [Table 1]. Furthermore, there is conclusive evidence that infectious diseases consultations are associated with improved outcome in terms of patient survival, shortened hospitalization, and cost savings.^{4,5} The diversity and specialized nature of many infectious diseases have led some infectious diseases trainees to extend their fellowships by

TABLE 1. Some complicated or life-threatening infections that may benefit from an infectious diseases consultation.

<p>Cardiovascular and pulmonary infections</p> <ul style="list-style-type: none"> • Native or prosthetic valve endocarditis, myocarditis, pericarditis • Endovascular infections, mycotic aneurysms, cardiac implantable device infections • Fulminant or refractory pneumonia
<p>Neurologic infections</p> <ul style="list-style-type: none"> • Meningitis, brain or spinal abscess • Subdural or epidural empyema • Encephalitis, transverse myelitis, Guillain-Barre syndrome
<p>Life-threatening head and neck infections</p> <ul style="list-style-type: none"> • Bacterial or fungal endophthalmitis • Orofacial and odontogenic infections with potential for airway obstruction • Ludwig angina and Lemierre syndrome
<p>Musculoskeletal infections</p> <ul style="list-style-type: none"> • Acute and chronic osteomyelitis or septic arthritis • Prosthetic joint infections
<p>Life-threatening sepsis</p> <ul style="list-style-type: none"> • Bloodstream infections • Infections requiring intensive care (e.g., necrotizing fasciitis) • Disseminated mycobacteriosis and fungal infections
<p>Infections in the immunocompromised host</p> <ul style="list-style-type: none"> • Solid organ or stem cell transplant recipients • Cancer patients undergoing chemotherapy • Opportunistic infections associated with HIV/AIDS or IV drug use • Acquired or congenital immune deficiencies
<p>Chronic or recalcitrant infections</p> <ul style="list-style-type: none"> • Antiretroviral resistance, hepatitis antiviral treatment failure, multidrug-resistant TB • Diabetic gangrene, chronic wound infections
<p>Miscellaneous, infections in pregnancy</p> <ul style="list-style-type: none"> • Imported exotic infections and tropical medicine • Infections in pregnancy and other reproductive infections

1 to 2 years in order to pursue dual subspecialty certification. Examples include the following:

- Combined infectious diseases/medical microbiology: Many teaching and non-teaching hospitals are actively seeking well-trained physicians who can direct the clinical microbiology laboratory and provide leadership in antimicrobial stewardship, hospital infection control, quality assurance, and cost containment programs.

The introduction of multiplex nucleic acid-based diagnostic tests and MALDI-TOF technologies in the microbiology laboratory has also revolutionized clinical virology and diagnostic microbiology by providing the ability to detect previously noncultivable or unrecognized pathogens, which makes this an exciting field for clinical and laboratory investigation.

- Combined infectious diseases/critical care medicine: Infections continue to maintain a conspicuous presence in ICUs worldwide, where rapid control of sepsis and shock, appropriate empirical antimicrobial therapy, and containment of antimicrobial resistance are of paramount importance. Although traditionally dominated by pulmonologists, formal training in infectious diseases by intensivists has strong appeal and potential for synergy in patient care, clinical investigation, and epidemiological research.⁶
- Infectious diseases/HIV medicine/chronic diseases: Due to the increasing societal burden of chronic diseases, including the need for continuing care and antiviral therapy for HIV/AIDS, viral hepatitis B and C, infections associated with injection drug use, and other opportunistic infections in marginalized populations, there is increasing demand for specialization in this arena.
- Transplant infectious diseases: With the expansion of solid organ and stem cell transplantation, there is increasing demand for infectious diseases physicians who are specially trained in the management of transplant recipients and other immunocompromised patient populations, including those with oncologic and rheumatologic conditions. The transplant infectious diseases physician is expected to be well versed not only in the epidemiology and risk assessment of uncommon infections, and unique clinical presentations associated with graft rejection and different phases of transplant progression or cancer chemotherapy, but also in the knowledge of specific immunosuppressive regimens and their toxicities, and the ability to deploy specialized diagnostic tools and administer appropriate empiric treatment or clinical trials.

- Finally, opportunities abound for infectious diseases physicians to pursue specialized training in areas such as public health and epidemiology, sexually transmitted infections, multidrug-resistant tuberculosis, travel-acquired diseases or tropical medicine, surgical infections, and reproductive or gynecologic infectious diseases.

Evolution of the Division of Infectious Diseases in BC

The University of British Columbia and Vancouver General Hospital (VGH) Division of Infectious Diseases was established in 1979 when I was recruited from the Harbor-UCLA Medical Center to join two outstanding young faculty members: Drs William Bowie and Irving Salit. Since all three of us had a similar training background in the clinician-teacher-investigator mode, our collective goal for the division was to develop a model that integrated excellent patient care with quality teaching and scholarly research. Our priority was to maximize the visibility of the clinical and teaching services through the provision of high-quality consultations that also served as an educational tool in the principles and practice of infectious diseases. High standards were expected from each written consultation note, which not only provided clear management recommendations but also included a discussion of rationale based on available evidence, possible pathogenetic mechanisms, and a brief list of key references. To broaden the scope of exposure, inpatient consultations were provided throughout the hospital rather than on a dedicated hospital ward in isolation. Telephone consultations were accepted from throughout the province. The funding model was another strategic decision point that was well ahead of its time. The division negotiated with the Medical Services Commission to provide inpatient consultations for geographic full-time funding in lieu of fee-for-service billing. This allowed faculty to rotate off busy clinical services in order to attend to research and other academic pursuits.

The subspecialty of infectious diseases in BC underwent substantial growth over the past 40 years, under the successive headships of Drs Anthony W. Chow (1978–1993), Neil E. Reiner (1994–2010), and Peter Phillips (2011–2020).

The current UBC head is Dr Theodore Steiner. Division members are distributed within hospitals across all five health regions of the province [Table 2]. VGH, St. Paul's Hospital, and Surrey Memorial Hospital are the major tertiary referral centres for the most complicated infectious diseases in the province. All these centres maintain active inpatient consultative services, outpatient clinics for patients with special needs such as tropical or parasitic infections, HIV/AIDS care, hepatitis B and C, chronic recalcitrant infections such as prosthetic infections, and skin and soft tissue infections, as well as outpatient parenteral antimicrobial therapy. The BC Infectious Diseases Society within the BC Medical Association (now Doctors of BC) was established in 2006 and currently has a membership of 79 practising infectious diseases physicians in the province. A full listing of the UBC-affiliated infectious diseases faculty and associate members is provided on the division's website (<https://id.med.ubc.ca/faculty-members>). The following summarizes the major milestones of the division over the past 40 years.

Linkages with medical microbiology and clinical pharmacy

Critical liaisons were created with both the Division of Medical Microbiology within the Department of Pathology and Laboratory Medicine and the Division of Clinical Pharmacy within the Faculty of Pharmaceutical Sciences, both at VGH and UBC Hospital. These productive collaborations were pivotal for allowing the Division of Infectious Diseases to gain influence in the provision of key laboratory services for the management of difficult infectious diseases, and to share leadership in hospital infection control and antimicrobial stewardship. Together with the Division of Clinical Pharmacy, the Division of Infectious Diseases also pioneered the establishment of an infectious diseases clinical pharmacy program at VGH in which clinical pharmacy residents joined the infectious diseases faculty on daily consultation rounds and assisted in antimicrobial stewardship, drug–drug interactions, pharmacokinetic monitoring, and quality assurance activities.

TABLE 2. Geographic distribution of adult infectious diseases services in BC.

Hospital	Attending infectious diseases and specialists	Consultation services and specialty clinics
Vancouver Coastal Health		
VGH, UBC Hospital, BC Cancer Agency, GF Strong Rehabilitation Centre	Ted Steiner, William Bowie, Richard Lester, Robert Reynolds, Neil Reiner, Jan Hajek, Alissa Wright, Allison Mah, Sara Belga, Jennifer Grant, Katherine Plewes	General infectious diseases (ID) Tropical diseases Transplant ID OPAT† and home IV
UBC-BC Centre for Disease Control (epidemiology, STI‡, TB, antimicrobial resistance)	Robert Brunham, Mark Tyndall, David Patrick, William Connors, Miriam Torchinsky, Troy Grennan	Sexually transmitted infections Tuberculosis COVID-19 testing Parasitology reference laboratory
St. Paul's Hospital	Peter Phillips, Val Montessori, Natasha Press, Mary Kestler, Melanie Murray, Alissa Wright, Queenie Dinh, Victor Leung, David Harris, Mark Hull, William Connors, Julio Montaner, David Moore	General ID Transplant ID HIV/AIDS, hepatitis B and C Addiction medicine
BC Women's Hospital and Health Centre and Oak Tree Clinic	Neora Pick, Melanie Murray, Mary Kestler, Katherine Plewes, Deborah Money,* Julie van Schalkwyk,* Chelsea Elwood*	Women with HIV/AIDS Obstetric and gynecologic infections Human papilloma virus
Richmond Hospital	Jerry Vortel, Clement Kwok	General ID OPAT
Lions Gate Hospital	Joshua Douglas, Gannon Yu, Miriam Torchinsky	General ID OPAT
Fraser Health		
Surrey Memorial Hospital (includes coverage for Peace Arch, Langley Memorial, and Delta Hospitals)	Yazdan Mirzanejad, Michael Chapman, Greg Deans, Patrick Wong, Kevin Afra	General ID Tropical diseases HIV/AIDS, hepatitis B and C OPAT and home IV
Royal Columbian Hospital	Yasemin Arikan, Sangita Malhotra, Davie Wong, Emilie Stevens, Steven Reynolds (ICU)	General ID OPAT
Abbotsford Regional Hospital and Cancer Centre	Yiannis Himaras, Sarah Hennie	General ID OPAT
Burnaby Hospital	Laurenna Peters	General ID OPAT
Mission Hospital	Anurag Markanday	General ID
Island Health		
Royal Jubilee Hospital and Victoria General Hospital	Wayne Ghesquiere, Eric Partlow, Karsten Hammond, Siobhan Holland, Divya Virmani, Ryan LeBlanc	General ID Sexually transmitted infections OPAT and home IV
Nanaimo Regional General Hospital	David Forrest (ICU), Alastair Teale	General ID Sexually transmitted infections HIV/AIDS, hepatitis OPAT and home IV

* Obstetrics and gynecology

† OPAT = outpatient parenteral antimicrobial therapy

‡ STI = sexually transmitted infection

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TABLE 2 (continued from 157). Geographic distribution of adult infectious diseases services in BC.

Hospital	Attending infectious diseases specialists	Consultation services and specialty clinics
Interior Health		
Kelowna General Hospital	Dwight Ferris, Boingotlo Masake, Issa Ephantimos	General ID HIV/AIDS, hepatitis OPAT
Royal Inland Hospital, Kamloops	Elizabeth Parfitt, Kaveri Gupta, Caitlyn Marek	General ID HIV/AIDS, hepatitis OPAT
Northern Health		
Prince George general hospital (University Hospital of Northern British Columbia)	Abu Hamour	General ID HIV/AIDS, hepatitis Tuberculosis OPAT

Cross-appointments with the BC Centre for Disease Control

These cross-appointments greatly strengthened training and research opportunities in public health epidemiology, outbreak investigation, antimicrobial resistance, sexually transmitted infection control, and multidrug-resistant tuberculosis. Members at the BCCDC who had infectious diseases training were extraordinarily successful in the provincial response to the SARS-CoV-1 outbreak; the SARS-CoV-1 accelerated vaccine initiative; the H1N1 pandemic; the expansion of immunization programming and drug addiction, overdose, and harm reduction programs; sexually transmitted infection and TB control; surveillance of antimicrobial resistance within BC; and most recently, surveillance and testing for SARS-CoV-2 infection.

Fellowship training program

The UBC infectious diseases fellowship program, first established in 1982 as one of three programs in the country that was fully accredited by the Royal College of Physicians and Surgeons of Canada, is designed to attract candidates who have completed internal medicine training and are motivated toward a career as clinician-scientists, clinician-educators, or consultant specialists in the community. The program provides integrated inpatient and outpatient rotations within various affiliated institutions, as well as training in epidemiological and microbiological research. The program also provides clinical rotations for residents from disciplines

other than internal medicine, such as obstetrics and gynecology, general surgery, neurosurgery, and dermatology. It has become the premier training program in the country. An unexpected benefit of the current COVID-19 pandemic is the creation of a phenomenally successful and well-attended weekly infectious diseases conference that is accessible by Zoom to all infectious diseases physicians throughout the province.

Outpatient parenteral antimicrobial therapy and home intravenous antimicrobial treatment programs

One of the earliest outpatient parenteral antimicrobial therapy clinics in the country was started at VGH in 1982 by Dr H. Grant Stiver, who demonstrated that this mode of antimicrobial delivery was both safe and cost-effective.⁷ Candidates include patients with bone and joint infections; selective cases of infective endocarditis; some acute infections such as skin and soft tissue infections; and urinary, respiratory, and gastrointestinal infections without prior hospitalization. With few exceptions, outpatient parenteral antimicrobial therapy clinics are available at all UBC-affiliated teaching hospitals and are supervised by infectious diseases specialists.

HIV/AIDS and the Urban Health Acute Care Unit

In 1992, at the height of the HIV/AIDS epidemic, Drs Michael O'Shaughnessy, Martin Schechter, and Julio Montaner established the

BC Centre for Excellence in HIV/AIDS at St. Paul's Hospital and led an interdisciplinary team that targeted the treatment and prevention of HIV/AIDS and opportunistic infections. Dr Montaner and his group were lead researchers on the highly active antiretroviral treatment and "treatment as prevention" strategies that have since been adopted worldwide. The inpatient HIV/AIDS unit at St. Paul's Hospital was established in 1997. It was unique in Canada and attracted undergraduate and postgraduate trainees from across the country for preceptorships in epidemiological investigations and care of marginalized populations. The success of highly active antiretroviral treatment and treatment as prevention strategies transformed the rapidly fatal condition of HIV/AIDS into a manageable chronic disease. However, the number of patients with complications from infections due to injection drug use that require hospitalization and other marginalized patient populations have continued to escalate. The Urban Health Acute Care Unit was established at St. Paul's Hospital in 2014 to meet these needs; it supersedes the former HIV/AIDS unit. The facility provides inpatient care for all patients, both HIV-positive and negative, with complex infections and serves as a provincial tertiary care resource for addiction medicine and other acute and chronic conditions in marginalized populations. In addition, the Hope to Health Research & Innovation Centre was established in 2019 to provide integrated and accessible ambulatory health care to clients in the Vancouver Eastside inner city who have complex needs.

Transplant infectious diseases

The transplant infectious diseases service at VGH was established in 2016 and provides both inpatient and outpatient consults for solid organ transplant and leukemia, and for bone marrow transplant recipients. The service also attends to outpatient consults for solid organ recipients from St. Paul's Hospital. Currently, approximately 500 solid organ transplants, including heart, lung, kidney, liver, and pancreas, are performed annually. The service is also linked administratively with BC Transplant for clinical trials and quality improvement projects.

Reproductive infectious diseases and the Oak Tree Clinic

In partnership with the UBC Division of Infectious Diseases, Dr Deborah Money established the first fellowship in reproductive infectious diseases program in Canada within BC Women's Hospital and Health Centre, with a focus on subspecialty training for obstetricians and gynecologists. She also established the Infectious Diseases Clinic within BC Women's to provide unique expertise in the management of women with HIV/AIDS, hepatitis B or C, human papillomaviruses, infections during pregnancy, and other complex gynecologic infections. The Oak Tree Clinic, also housed within BC Women's, is a multidisciplinary facility that provides specialized care to women, children, and their families who are living with HIV/AIDS. It is a provincial resource and provides educational support for health care workers, organizations, institutions, and the public. There is a strong research program focused on clinical trials in HIV/hepatitis co-infections, human papillomaviruses, and reproductive, endocrine, and metabolic health of women with HIV/AIDS.

Global health, tropical diseases, and GeoSentinel surveillance

The Division of Infectious Diseases conducts weekly outpatient clinics at VGH and Surrey Memorial Hospital for tropical medicine and travel-acquired diseases. These clinics are supported by the BC Centre for Disease Control's parasitology laboratory and zoonotic and emerging pathogens program. The division also offers an annual tropical and geographic medicine course at UBC, the first of its kind in Western Canada. The UBC Division of Infectious Diseases has had a strong international presence, including a Canadian International Development Agency (CIDA)-funded training and treatment program for chronic hepatitis B in mainland China (1988–1992), a CIDA-Peru-Canada biomedical training program in Lima, Peru (1989–1994), and multiple CIDA-sponsored projects to establish a network of sexually transmitted infection clinics for low-income sex trade workers in southern Vietnam (1998–2010). More recent international connections include investigations

into the use of cell phones and text messaging to improve antiretroviral therapy in Nairobi, Kenya,⁸ malaria research in Bangladesh,⁹ and training and research on tropical diseases in Gulu, northern Uganda. Division members also co-direct the UBC Neglected Global Diseases Initiative (<http://ngdi.ubc.ca>), which addresses 18 neglected tropical diseases designated by the World Health Organization, including HIV/AIDS, tuberculosis, and malaria, and the GeoSentinel surveillance network (www.istm.org/geosentinel), a worldwide communication and surveillance network for tracking geographic and temporal trends in morbidity among travelers, immigrants, and refugees.

Immunity and Infection Research Centre

Several scientists were recruited to VGH to investigate the pathogenesis and molecular mechanisms in tuberculosis, leishmaniasis, toxoplasmosis, *Clostridioides difficile*, *Staphylococcus* spp., *Streptococcus* spp., *Escherichia coli* and inflammatory bowel disease, fecal transplantation, and more recently the prevention and treatment of SARS-CoV-2 infections. The success of these research programs culminated in the creation of the Immunity and Infection Research Centre within the Vancouver Coastal Health Research Institute in 2011. This virtual centre brought together approximately 20 principal investigators and 50 to 60 graduate students, postdoctoral fellows, and research associates in a highly productive and collaborative research environment.

Key infectious diseases pioneers in BC

Several individuals played key roles in the development of the infectious diseases specialty in British Columbia. Dr Robert M.T. Chan was the first infectious diseases specialist in Vancouver in 1975 and practised at St. Paul's Hospital until retirement in 2011. He was also among the first in BC to be accredited in infectious diseases by the Royal College of Physicians and Surgeons of Canada. Dr Frank Jagdis was the first and only infectious diseases consultant on Vancouver Island in 1976 when he attended the Royal Jubilee and Victoria General Hospitals in Victoria until retirement in 2010. Although trained as a pediatrician, he treated both adults and children in his practice. Dr Christopher Wong was the

first infectious diseases specialist to join Fraser Health in 1977 and practised in Royal Columbian Hospital until retirement in 2016.

Summary

It has been most gratifying to see how the subspecialty of infectious diseases has flourished in BC within the past 40 years. It is particularly rewarding to witness how well our trainees have fared and are continuing to contribute to this relatively new but important discipline across our province. In the current COVID-19 pandemic, the subspecialty of infectious diseases is finally getting the attention it is due, both in the public and the health care community. With continued support from the Province and UBC, I have no doubt our subspecialty will continue to mature and provide invaluable service to our patients and community for generations to come. ■

Competing interests

None declared.

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