

THE AUSTRALIAN MASTER OF APPLIED EPIDEMIOLOGY PROGRAM: LOOKING BACK, MOVING FORWARD

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Abstract

The Master of Applied Epidemiology Program is Australia's Field Epidemiology Training Program. It was established in 1991 and is run out of the National Centre for Population Health (NCEPH) at the Australian National University. The Program has a strong track record in using field-based training to produce competent applied epidemiologists who have contributed to public health in Australia and globally. A new funding model for the program was implemented in 2012, backed by funds from field placement partners and NCEPH. In this paper we review the program's origins and achievements, discuss the ongoing needs of the program and outline a vision for the future. *Commun Dis Intell* 2016;40(3):E326–E333.

Keywords: epidemiology; university; program; funding

Introduction

Recent infectious disease emergencies, including the outbreaks of Ebola virus disease (EVD) in West Africa, Middle East respiratory syndrome coronavirus (MERS-CoV) in Saudi Arabia and later South Korea, and hepatitis A virus infections linked to imported berries in Australia, are reminders of the importance of competent field epidemiologists for emergency response, both in Australia and globally. We therefore thought it timely to review Australia's Field Epidemiology Training Program (FETP), the Master of Applied Epidemiology (MAE) Program, its origins, the changes initiated in response to recent funding cuts and where it is headed in the future.

The history of the Master of Applied Epidemiology Program

Field or applied epidemiology is the use of epidemiological methods and principles to study and understand real-world public health problems and produce evidence-based and actionable recommendations, frequently within a limited timeframe.^{1,2} It is sometimes referred to as 'shoe leather epidemiology' in recognition that much of the investigation and response involves getting out of the office or laboratory and into the field where the problem is occurring and evolving.³

The MAE Program was established in 1991 in response to a recognised gap in field epidemiology training in Australia. The driving force behind its establishment was Professor Bob Douglas, the then director of the National Centre for Epidemiology and Population Health (NCEPH) at the Australian National University. At the time, the program was funded by the Commonwealth Department of Health and was supported by the Communicable Diseases Network Australia (CDNA).³ The United States Centers for Disease Control and Prevention (CDC) provided assistance to develop the curriculum, based on the highly successful American Epidemic Intelligence Service program.

Under the original model, MAE scholars received a generous stipend while completing 3 months of coursework at NCEPH (spread across the 2 year timeframe), and 21 months spent in a field placement, typically a state, territory or Commonwealth health department. The curriculum included training on how to: 1) establish and evaluate public health surveillance systems, 2) analyse surveillance and other data, 3) investigate outbreaks, and 4) conduct epidemiological studies to inform the development and implementation of policies and programs. Scholars applied this knowledge and skills in their field placements to real-world public health problems. At the conclusion of the course, scholars submitted a bound volume summarising their 2 years of fieldwork, which was examined by 2 experienced field epidemiologists during an oral examination. Scholars recruited into the MAE Program came from medical, nursing, veterinary and science backgrounds. Further description of the MAE training model and its relevance for strengthening capacity in public health has been described elsewhere.⁴

The first cohort of 8 MAE scholars established notifiable disease surveillance systems in several jurisdictions and investigated various outbreaks of disease. The value of the national collaboration by MAE scholars was quickly demonstrated when they worked with CDNA partners to investigate a large multi-state outbreak of norovirus gastroenteritis associated with the consumption of orange juice served on domestic airlines.⁵ An estimated 25,000 people were ill as a result of this outbreak. Subsequent years saw MAE scholars investigate outbreaks of emerging infectious diseases, such as melioidosis in Darwin,⁶ respiratory illness in horses

and 2 horse handlers in Queensland, subsequently identified as Hendra virus;⁷ haemolytic uraemic syndrome due to consumption of mettwurst salami in South Australia;⁸ and the largest outbreak of Legionnaires' disease in Australia at the Melbourne Aquarium;⁹ along with many others. Other notable projects included both the establishment and later, the evaluation of the National Notifiable Diseases Surveillance System (NNDSS),¹⁰ as well as projects in non-communicable diseases such as perinatal outcomes in Indigenous infants,¹¹ investigating the link between maternal trauma and cerebral palsy¹² and a mortality survey in the Democratic Republic of Congo.¹³

Training Indigenous scholars was a priority for the program when the inaugural Indigenous MAE cohort commenced in 1998, to address the notable disparity of Indigenous public health workers who did not have a professional qualification in public health.¹⁴ (In this paper 'Indigenous' is used to refer to anyone who identifies as Aboriginal and/or Torres Strait Islander.) The Indigenous stream of the MAE Program continued until 2002 with cohorts of between 4 and 8 scholars each year, to be replaced by 2 positions for Indigenous scholars within each cohort from 2003 onwards.

Given the nature of communicable diseases, it was important for the MAE Program to be engaged globally. In 1997, the MAE Program was a founding member and provided the inaugural Chair of the Training Programs in Epidemiology and Public Health Interventions Network (TEPHINET)—a network of 55 field-based epidemiology training programs from around the world that aims to strengthen public health capacity in applied epidemiology and public health practice.¹⁵ Program staff also designed, planned and helped implement FETPs in India (1999), China (2001), Malaysia (2003) and Vietnam (2009), and contributed to the development of the monitoring framework of the revised International Health Regulations (2005).¹⁶ In addition, MAE scholars have responded to international public health emergencies, starting with the severe acute respiratory syndrome outbreak in 2003 when 9 students, graduates and staff were deployed across South-East Asia and to Geneva. Scholars and staff have also supported responses to H5N1 avian influenza in 2004 to 2005, and the H1N1 influenza pandemic in 2009. For the latter, scholars and staff contributed over 1,100 person days in investigation and control efforts at the local, national and international levels.¹⁷

Funding challenges, bold initiatives

The MAE Program was originally funded by the Australian Government Department of Health, and subsequently through the Public Health

Education and Research Program (PHERP).¹⁸ The PHERP program ceased in 2009 and consequently funding through this source ceased¹⁹ with the last group of scholars graduating in 2011.

However, 2 initiatives proposed in 2011 ensured that the MAE Program could continue to operate as a key source of training competent field epidemiologists in Australia. One was commitments from field placement partners around Australia to fund and host MAE scholars, and the other was the willingness of NCEPH to implement a novel funding model and underwrite initial staffing and other program costs.

The current program

The MAE Program remains a 2-year training program that emphasises '*learning at work, from work, for work*' and '*learning-by-collaborative problem-solving*'.⁴ A comparison of the previous and current forms of the MAE Program is presented in Table 1. Importantly, the structure and competency areas covered by the program remain almost identical. The major change relates to the funding. Field placements now provide the full cost of hosting a scholar either by paying the scholar's full stipend, with the expectation that the scholar will dedicate all of their time to MAE requirements, or a salary if the scholar is already an employee or recruited to be an employee, e.g. by a jurisdictional health department. In the latter case the employee will be given negotiated time off to complete the MAE requirements while still employed in the salaried position. From the NCEPH side, program costs are sourced through the [Research Training Scheme accessible to Universities](https://www.education.gov.au/research-training-scheme) (<https://www.education.gov.au/research-training-scheme>). To facilitate this process, the University reclassified the degree from a coursework to a research degree. Consequently the MAE is now more in line with a traditional Masters in Philosophy program, where MAE scholars prepare a thesis and are enrolled in 5 coursework subjects each of which includes formal assessments. These coursework subjects are also open to graduate students enrolled in other degrees.

The current model has proven very successful. After a modest start in 2012 with 4 full-time and 4 part-time scholars, subsequent MAE cohorts have increased in size with the 2015 cohort having 13 scholars—one of the largest in the program's history, including 2 Australian scholars based in overseas placements. The Program has a memorandum of understanding with the Australian Government Department of Health, which recognises it as the national field epidemiology training program. In addition, the program remains an active member of TEPHINET.

Table 1. Comparison of the original Master of Applied Epidemiology degree and the re-invigorated Master of Philosophy in Applied Epidemiology degree at Australian National University before and after 2011

Element	Master of Applied Epidemiology	Master of Philosophy in Applied Epidemiology
Years of operation	1991–2011	2012–onward
Funding source	Majority of program costs funded by the Australian Government Department of Health, some staff costs funded by NCEPH and partial scholarship cost covered by field placement	Program costs covered by the Research Training Scheme, scholarship (or salary) cost covered by field placement, travel to course block covered by field placement
A scholar's stipend	\$32,000–36,000 tax-free annually	\$50,000 tax-free annually
Course work	Three months of course work in 4 intensive course blocks over the 2 years. Initial course block of 4 weeks duration covered introductory epidemiology concepts.	Five course work modules taught in 3 two-week intensive course blocks and via online teaching sessions: (1) outbreak investigation, (2) public health surveillance, (3) analysis of public health data, (4) applied epidemiology research methods, and (5) issues in applied epidemiology.
Duration	Program was initially for 24 months, but was reduced to 21 months in 2007, consistent with the timing of university semesters	22 months
Assessment	Bound volume with at least 4 field projects, followed by an oral exam.	Assessment for all 5 course work subjects, as well a thesis comprising at least 4 field projects followed by an oral viva.
Additional	–	Program allows for new arrangements, including part-time scholars, and scholars already employed by the field placement.

There are some advantages of the current model. Delivery of the MAE curriculum via courses open to other graduate students means that MAE scholars are more integrated into NCEPH, and more students are able to acquire the skills of applied epidemiology. Some of these non-MAE students have subsequently enrolled in the MAE Program. The greater investment by field placements in MAE scholars has allowed them to have a greater input into the selection of candidates and to strengthen organisational capacity by enrolling their own employees into the program.

All MAE scholars are required to publish at least one of their projects and to present their work at a national or international conference. The Box provides examples of papers published and conference presentations by scholars while Table 2 outlines the variety of placements and the number of scholars in each cohort since 2012. Of note, there continues to be a focus on Indigenous health, with 2 Indigenous scholars enrolled in the program since the new model was implemented. Moreover, several field placements have a dedicated focus on Indigenous health issues including the Indigenous Offender Health Research Capacity Building Group at the Kirby Institute and the Indigenous Health Division of the Australian Government Department of Health.

The future of the Master of Applied Epidemiology Program

The MAE Program is an example of a successful government research institution partnership. It has contributed to the advancement of public health in Australia in 3 main areas: workforce development, applied research informing evidence-based policy, and surge capacity during public health emergencies. We briefly discuss the program's track record in each of these areas and outline plans and options for the future.

Since its inception, the program has graduated 187 individuals of whom more than 15% are Indigenous. MAE graduates have made significant contributions to public health, both in Australia and internationally, including holding senior roles in state and territory health departments, national and international organisations such as the World Health Organization (in Headquarters and at various regional and country offices), as well as in university schools of public health and non-government organisations. To support workforce needs, we aim to train and graduate a minimum of 10 scholars annually for at least the next 5 years. In the context of contemporary national and global public health threats, communicable disease surveillance and control will remain the core business of the MAE Program in the short-term, with the majority of placements in this area. However, the principles

Box: List of selected Master of Philosophy in Applied Epidemiology projects completed by scholars since 2012 and published in peer review journals or presented at national or international conferences

- Human rabies immunoglobulin usage in Australia, 2010 to 2013²⁰
- Associations between antimicrobial susceptibility patterns of *Shigella* isolates and suspected country of acquisition – Victoria, Australia, 2008–2012²¹
- Very high incidence of invasive group A streptococcal disease across Northern Territory populations²²
- High levels of lead solder in drinking water tanks, Tasmania, 2013²³
- An outbreak of norovirus genotype II associated with New South Wales oysters²⁴
- Outbreak of influenza A(H1N1) virus in a remote Aboriginal community post-pandemic: implications for pandemic planning and health service policy²⁵
- Exploring a proposed World Health Organization method to determine thresholds for seasonal influenza surveillance²⁶
- Estimating the measles effective reproduction number in Australia from routine notification data²⁷
- Re-thinking traditional adverse event following immunisation surveillance: lessons from Australia's successful experience with intussusception surveillance following the 2007 introduction of rotavirus vaccines²⁸
- Evaluating the effectiveness of the human papillomavirus vaccine among Indigenous women in Australia²⁹
- Are we ready for rubella elimination? A review of rubella and congenital rubella syndrome (CRS) notification and hospitalisation data – Australia, 2008–2012³⁰
- Trends in testing for chlamydial infection in the ACT, 2003 to 2012³¹
- *Salmonella* Typhimurium phage type 44: A Victorian outbreak and review of MLVA patterns³²
- Is the National Notifiable Surveillance System an effective surveillance system for flu?³³

Table 2: A summary of field placements for the Master of Epidemiology Program, Australian National University, 2012 to 2016

Field placement type	Placement name (number of scholars completed and in progress 2012 to 2016)
Commonwealth Government departments	Office of Health Protection, Department of Health (3 completed, 2 in progress)
	Indigenous Health Division, Department of Health (1 completed, 3 in progress)
	Therapeutic Goods Administration, Department of Health (1 in progress)
State or territory health departments and regional public health units	Victorian Department of Health and Human Services (DHHS) (1 completed, 1 in progress, plus 2 completed and 1 in progress in shared placement with the Victorian Infectious Diseases Reference Laboratory, 1 in progress with Murdoch Children's Research Institute and 1 in progress with the Microbiological Diagnostic Unit)
	Centre for Disease Control, Department of Health Northern Territory (1 completed, 2 in progress)
	Western Australian Communicable Disease Control Directorate, Government of Western Australia Department of Health (1 completed and 1 in progress, shared with PathWest Laboratory; 1 in progress shared with Telethon Kids Institute)
	Communicable Disease Control Branch, SA Health (1 completed)
	Department of Health and Human Services, Tasmanian Government (1 completed, 1 in progress)
	Health Protection Branch, New South Wales Ministry of Health (1 completed, 1 in progress)
	Health Improvement Branch, ACT Health (1 in progress)

Table 2 cont'd: A summary of field placements for the Master of Epidemiology Program, Australian National University, 2012 to 2016

Field placement type	Placement name (number of scholars completed and in progress 2012 to 2016)
State or territory health departments and regional public health units, <i>cont'd</i>	Health Protection Service, ACT Health (1 completed, 1 in progress)
	Hunter New England Population Health, New South Wales Ministry of Health (1 completed, 1 in progress)
	Kimberly Population Health Unit, Western Australian Country Health Service (1 completed)
	Queensland Health (1 completed in shared placement with Queensland Children's Medical Research Institute, 1 in progress)
Public health laboratories	Victorian Infectious Diseases Reference Laboratory (2 completed and 1 in progress, in shared placement Victorian DHHS)
	Microbiological Diagnostic Unit (1 in progress in shared placement with Victorian DHHS)
	PathWest Laboratory (1 completed and 1 in progress, both in shared placements with Western Australian Communicable Disease Control Directorate)
National surveillance centres/research institutes/ non-government organisations/other	Médécins Sans Frontières (1 in progress, based in India)
	National Centre for Immunisation Research and Surveillance (3 completed and 2 in progress)
	The Kirby Institute (1 completed, partially funded by Leonard Broome Scholarship)
	Australian Institute of Aboriginal and Torres Strait Islander Studies (1 in progress)
	Murdoch Children's Research Institute (1 in progress based in Lao People's Democratic Republic, 1 in progress in shared placement with Victorian DHHS)
	Queensland Children's Medical Research Institute (1 completed in shared placement with Queensland Health)
	Telethon Kids Institute (1 in progress, in shared placement with Western Australian Communicable Disease Control Directorate)
	National Aboriginal Controlled Community Health Organisation (1 completed)
	Healthdirect Australia (1 in progress)
	National Critical Care Trauma Response Centre (1 in progress)

and practice of field epidemiology are applicable to other areas of public health and we will continue to expand placements beyond communicable diseases. Indigenous health will remain central to the MAE Program and we aim to have at least 1 Indigenous scholar graduate per year, as well as at least 2 other field placements with a primary focus on Indigenous health. We plan to strengthen links with both government and non-government organisations in this area, as well as exploring further options to increase the pool of Indigenous applicants. This may include developing bridging courses and alternative entry pathways for Indigenous candidates from non-traditional academic backgrounds.

During their time on the program, MAE scholars have investigated over 300 outbreaks, established and evaluated national and local surveillance systems and have published more than 200 papers in peer reviewed journals. This body of work has contributed to evidence-based actions, policies, programs and practice in Australia and internationally. As the funding for the MAE Program now comes from a diverse range of field placement organisations it is imperative to determine how the program can continue to effectively meet the needs of field placement partners and the broader public health community to promote, protect and restore health. To this end we are currently evalu-

ating the MAE Program with an emphasis on the contributions of students and staff to public health in Australia and globally.

This evaluation includes analysing MAE outputs to document systematically how and where MAE projects have contributed to public health, including factors that have facilitated or hampered this process. We are also examining whether the traditional field epidemiology curriculum, originally designed to strengthen the surveillance and control of communicable diseases, best equips scholars to contribute effectively to their field placements. From a technical standpoint, field epidemiology is becoming increasingly challenged by rapid advances in many areas. These include developments in diagnosis, analysis, prevention and management such as whole genome sequencing; increased availability of large administrative data sets; data-linkage and the use of novel sources of data for disease surveillance. For this reason, MAE scholars must now be competent to work in a high-tech environment whilst still acquiring the investigative competencies needed for 'shoe leather' epidemiology. Furthermore, to conduct and transform research into effective public health actions and policies, scholars must also grasp and apply principles of systems-thinking when exploring causality and when seeking to influence policy-makers. Through this evaluation we hope to inform decisions on revising or fine-tuning the curriculum and strengthen learning, teaching and training techniques to ensure that the MAE Program focuses on those areas where our scholars, in collaboration with Program partners, will have the greatest impact within and beyond Australia's borders. We will also review administrative aspects of the current Program, such as how field placements and supervisors can be better supported to host MAE scholars, and the relative advantages or disadvantages of the 2 models of funding (employee and scholar).

MAE scholars constitute an important surge workforce during national and international public health emergencies. This was demonstrated most recently during the 2014 to 2015 EVD outbreak, when almost all scholars were involved in surveillance activities for EVD at either the jurisdictional or national levels, and 3 scholars and 1 staff member were deployed to West Africa to assist with the public health response. It is our intention that MAE scholars continue to provide this service at both a national and global level, a resource that now extends beyond scholars currently enrolled in the program via the [Australian Response MAE \(ARM\) network](http://www.arm.org.au/) (<http://www.arm.org.au/>). Established by 3 MAE alumni after Typhoon Haiyan in the Philippines in 2013, the ARM network is built on the alumni of the MAE Program³⁴ and functions

as a focal point for identification, selection and referral of Australian public health practitioners for deployment to public health emergencies through the World Health Organization's Global Outbreak Alert and Response Network (GOARN), RedR, or other agencies.³⁵ The ARM network is open to all public health epidemiologists and other public health specialists, not solely MAE alumni. Since its establishment, ARM has conducted training workshops on EVD and on measles, and facilitated the deployment of Australian practitioners (including a significant number of MAE alumni) to assist with responses to EVD in West Africa.

No single country in isolation can respond effectively to the escalating public health threats and challenges resulting from globalisation. The work and orientation of the MAE Program must be contextualised within a global health framework. The MAE Program will continue to work with other FETPs in the region and globally, including supporting the development of an adapted model of the MAE in the Pacific. This work aligns with regional health priorities of the Australian government and other national partners. Targeting work towards government priorities as well as forming collaborative research partnerships with international organisations will also help our continuing efforts to identify alternative funding sources that will ensure the ongoing expansion and long-term sustainability of the MAE Program.

Conclusions

In 2016, the MAE Program celebrates 25 years as Australia's FETP. Australia requires competent field epidemiologists to detect and respond effectively to ongoing and emerging threats and challenges to public health in the realms of communicable, non-communicable and other diseases. Indeed the International Health Regulations (2005) require that member states have the core capacities to detect and respond to public health events of international concern, and an FETP is an essential component of building and maintaining this capacity. With the ongoing support of field placement partners and NCEPH, the MAE Program has emerged from recent funding cuts in a strong position. Indications are that it will adapt continuously to the changing national and global context and provide another 25 years of training and service to Australia and the global community.

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