A study of the relationship between infectious diseases and health economics: some evidences from Nepal

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ABSTRACT

Objective: To measure the effectiveness of short term trainings in improving knowledge of health economics and application of economic way of thinking in policy research.
Methods: The training focused to strengthen the capacity of public health practitioners to design and implement health policy and programmes especially for infectious diseases from health system and economic perspectives. We focused to measure the effects of gaining knowledge to understand the relationship between infectious diseases and poverty and to adopt a logical way of thinking to come up with a solution. This approach used in this paper to measure the "reflection" of the training is different from conventional way of evaluating training programmes. The effectiveness of the training was measured in three dimensions: (i) general understanding of economics from health policy perspective; (ii) application of economic analysis and appraisal tools and techniques; and (iii) economic way of thinking for issues related to disease control and poverty.
Results: There was a significant improvement in self-assessed knowledge after the training. Among seven knowledge related questions, in the pre-test, an average participant made 86% correct answers while in post-test, this figure increased to 100%. The results showed that there is a significant improvement in these three dimensions after the training intervention.
Conclusions: The paper concluded that endogenizing knowledge of economics and way of thinking have important implications for designing alternative policy and resource utilization.

1. Introduction

Allocating health resources in an efficient and effective manner is important for all societies but more so for low-income countries like Nepal where resources are scare and infectious disease are still a major public health problem. Advocating policy changes for increasing resource allocation to health sector requires convincing decision-makers that the additional resources will generate higher social benefits in health than in any other sectors of the economy. Knowledge of health economics (HE) and economic way of thinking (EWT) serve as inputs for improving allocative efficiency (doing right things) and technical efficiency (doing things right) to control

or eliminate the diseases of poverty[1]. Poverty is a root cause of various infectious diseases and infectious diseases increase the prevalence and severity of poverty. Health outcomes of infectious diseases are also determined by poverty status. Therefore, it is essential to understand the complex dynamics between poverty and diseases, which creates the spiral of low income to disease to poor health and further decline in income[2]. Despite the fact that many of the diseases of the poor are preventable and treatable, a host of poverty related factors hinder its successful control and elimination. This paper is based on the assumption that endogenizing knowledge of HE and EWT can help better understanding of the complex relationships between infectious diseases and poverty[3].

An intensive training on a particular field such as management practices, health literacy, financial literacy, and HE among others improve knowledge base for applications in real life settings[4]. The importance of short term training is being emphasized, particularly because of its efficacy in changing attitude, skills and knowledge. The use of many facets of economic analysis and its tools can identify areas of waste and inefficiencies and map out options for better use of scarce resources. For Nepal, efficient and effective

allocation of health resources can improve health outcomes even without additional resource mobilization[5]. In a 2009 publication, the Ministry of Health and Population and Government of Nepal, highlighted the importance of improving economic analysis for decision-making. Economic evaluation of policy alternatives can help determine the usefulness of the health policy decisions and the potential costs and effects of the interventions and policies. However, to be able to identify and evaluate policy alternatives, the decision-making process needs to apply health economic analysis of the priorities identified by the national health system and/or the political process. Trained human resources able to undertake HE studies are scarce in Nepal, unlike many other low income countries of the world. The Ministry of Health and Population of Nepal has become more aware of the needs for HE expertise in the country because of rapidly expanding health intervention options becoming available, increasing importance of the health sector to improve wellbeing of the households and increasing understanding of value for money of the health intervention[6]. Clearly, in a rapidly changing world of health care, where the need and demand for health care services and products are increasing at a much faster rate than the availability of resources, it has become important to train the existing cadre of policy analysts and decision-makers on health economic approaches and techniques. Although, educational institutions of higher learning can emphasize HE trainings, short term trainings will be required to address the knowledge gap in the short run. The question is, if short-term trainings are provided, is it going to improve HE knowledge and technical skills of health sector analysts and policy makers? This paper is an attempt to measure the effectiveness of short term trainings in improving knowledge of HE and application of EWT in policy research.

In general, successful completion of training programmes is considered usefulness. Some of the institutions providing or receiving trainings have conducted evaluation of the training sessions for internal purpose. They rarely publish the findings either because the results are considered too subjective or for not being rigorous enough to clearly identify and measure the effectiveness of the training programmes[7]. The objective of this paper is to assess the effectiveness of a short-term training in improving HE knowledge and adoption of EWT in policy analysis using pre- and post-training questionnaires. Although the acquisition of knowledge does not necessarily reflect the acquisition of "competencies", the evaluation of training can indicate if the experienced policy makers consider the knowledge acquisition as useful in future policy analyses.

2. Materials and methods

2.1. Participants and training programme

The training was organized by the Institute for Nepal Environment and Health System Development with the financial support from World Health Organization-training in tropical diseases, and in collaboration with Ministry of Health and Population and University of South Carolina, USA. The main objective of the training was to strengthen the capacity of public health practitioners to design and implement health policy and programmes especially for infectious diseases from health system and economic perspectives. The training

was intended to contribute towards identifying disease interventions for breaking vicious cycle of disease and poverty.

The residential training was organized during the period of April 21–28, 2014 in Nagarkot, Nepal. The program was disseminated with an invitation for application to participate. Among the applications received, candidates were short listed for the training. While selecting the participants the training programme wanted to select individuals from diverse background to encourage cross fertilization of ideas and experiences. Majority of participants were from the academia and the Ministry of Health and Population. Some participants were selected from non-governmental organizations closely working with the Ministry of Health and Population related issues. A total of 30 participants attended the training. Table 1 shows the distribution of the participants by their institutional affiliation.

Table 1
Institutional affiliation of participants in the HE training, Nepal 2014.

Institutional affiliation	Number of participants
Academic institution	11
Non-governmental organization	7
Ministry of Health and Population	5
MPhil/PhD candidates	4
Researchers	3
Total	30

A training document or packet on HE research was the main material used during the training programme. It was consisted of multifaceted set of knowledge issues as listed in Table 2. All sessions were designed to be interactive and participants were encouraged to ask questions during lectures. The final product of the training was the development of a research proposal applying EWT and economic principles by each of the participants. The theoretical aspects of HE was delivered through formal lectures followed by discussions. During the sessions, participants were provided with the HE tools to address problems using economic analysis tools. Informal discussions with policy makers created the enabling environment to better understand the use of economic concepts and tools from the perspective of decision-makers and policy planners.

Table 2
Descriptive statistics ($n = 28$).

Descriptive statistics		Pre-test	Post-test
Self-assessment ($n = 4$)	Total score possible	5.00	5.00
	Maximum score	4.25	5.00
	Minimum score	2.00	3.00
	Mean score	3.30	3.93
	Median score	3.25	3.88
	Standard deviation	0.58	0.51
Knowledge questions ($n = 7$)	Total score possible (%)	100.00	100.00
	Maximum correct answers	85.71	100.00
	Minimum correct answers	0.00	42.86
	Mean correct answers	48.98	68.88
	Median correct answers	57.14	71.43
	Standard deviation	0.20	0.16
Way of thinking ($n = 4$)	Total score possible	5.00	5.00
	Maximum score	5.00	5.00
	Minimum score	2.25	3.50
	Mean score	3.84	4.52
	Median score	3.88	4.75
	Standard deviation	0.73	0.50

Key components of the health economics training course include: 1) introduction to the economics of tropical diseases; 2) health policy analysis particularly focusing on infectious diseases and social protection; 3) cost of illness-application of cost-of-illness methodology for analyzing tropical diseases; 4) catastrophic and impoverishment impact of out-of-pocket payments; 5) economic evaluation: costs, effectiveness, and benefits; 6) economics of prevention: methodology and applications; 7) health care need and demand; 8) efficiency and productivity analysis for health sector.

2.2. Conceptual framework

Knowledge of economics can be defined as a capacity to act by applying economic perspective. Since "knowledge", by itself, is not observable but its effects are observable. It can be measured by observable performance or behavior. It is similar to the idea of measuring knowledge acquisition and competency development. EWT refers to the ability to apply economic concepts and ideas to come up with answers on specific health system related problems from a well-structured economic perspective. Measuring the knowledge acquisition from this training was accomplished by tracking the participants' ability to answer economic questions. However, measuring knowledge through tests using learning objective based questions was not adequate. Selecting the wrong answers in multiple choice questions were often used to conclude that the test taker did not know the answers. However, this inference may be misleading. The questionnaire was designed to measure knowledge by using various methods such as self-assessment of knowledge, ordering of best answers, multiple choices among others.

The approach used was different from conventional way of evaluating training programmes. The focus was to measure the effects of gaining knowledge to understand the relationship between infectious diseases and poverty and to adopt a logical way of thinking to come up with a solution. This study attempted to measure the "reflection" of the training as shown in Figure 1. The reflection was measured in two ways: a) whether the participants are able to apply the HE approach and tools in addressing the practical problems often encountered in health services research and policy; b) explaining the health service and policy related issues using economics approach. The measuring instruments were developed in such a way so that it can measure the desired change and facilitate the evaluation of the training.
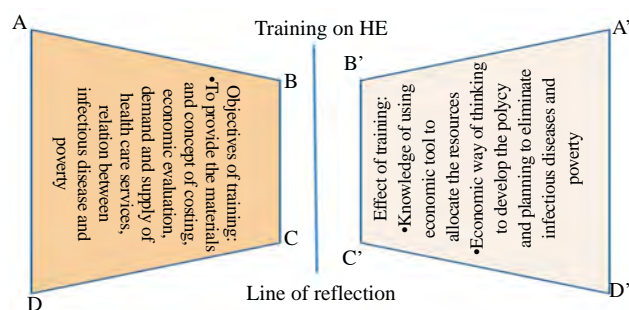

Figure 1. Conceptual framework for training evaluation.

2.3. Study design

Pretest-intervention-posttest designs are appropriate for investigating the effects of educational interventions[8] and are commonly used in various training evaluation research[9]. Strict experimental design suggests the use of two group pretest-intervention-posttest designs with a control group that receives no training intervention and a group that receives training intervention[10]. However, in this case, the absence of control group was not considered as a significant threat to internal validity of the experiment because the likelihood that extraneous factors affecting change is unlikely in this one week long residential training. In this setting, there should not be any outside variables that may significantly change a participant's cognitive knowledge or perspective with regard to HE research methods and tools over the pretest to posttest timeframe. Therefore, the use of experimental design without control group was justified.

2.4. Instrument

Two instruments were designed for the purpose of evaluation. The first was designed to measure the knowledge in terms of contextual application and reflection of concept and research tools. The second was designed to measure the EWT and ability to explain health services and policy issues. Few questions were included in the instrument for two reasons. First, the questions were designed to assess applied knowledge. A relevant scenario was explained at the beginning of the question and participants were allowed to think and apply the tools learned from the training session. Second, the purpose was to encourage to use EWT while providing answers.

The knowledge questions were further grouped into two types: a) general reflection of the training objectives, and b) contextual application of economic methods and tools. The knowledge questions measured the insights in the following areas: scope and functions of HE, decision-making principles in economics, health as a normal or luxury good, decision-making with fixed budget, regulation of demand and supply, and cost-effectiveness analysis of infectious disease. The first type of knowledge was covered by two questions, while the second type of knowledge was covered by five questions. All of them were multiple choice/true false type questions. General questions were primarily related to the scope of HE methods and roles of health economists. These questions were principally designed to measure how economic principles, methods and tools can explain and contribute to public health and policy issues. Second type of knowledge questions were related to the application of methods and tools presented in the training sessions. The questions were applied contextually, and allowed participants to use the economic tools and methods in specific practical circumstances. For these types of questions, the context was clearly explained and then the participants were asked to apply the knowledge in that defined context. For example, a question was asked about the types of cost that will be included in the cost-effectiveness analysis of measles vaccine from the societal perspective. Similarly, another question

was about decision-making of a district manager on how to allocate a fixed budget using cost-effectiveness of potential interventions.

The shift in the EWT from the conventional health service perspective to economist's perspective was measured with the help of four questions. The questions were designed carefully to measure on 1 to 5 scales, where lower score represented conventional health service perspective and higher score represented shift towards EWT. The levels of the questions were carefully designed to reflect the transition. Five levels were prepared for each question. Questions were designed with a detail explanation of context, and five options corresponding to above-mentioned perspectives were developed. For example, "health intervention should be introduced based on…". The levels defined for these questions were based on epidemiological data, quality of services, need of services and demand of services. These five levels were prepared in such a way to reflect the shift in perspectives explained above. The five levels were randomly placed when the question was presented to the participant in order to prevent the associated bias.

The instrument was developed by the iterative process by the study team. Each question was carefully defined and levels were carefully selected such that it will ensure content and construct validity of the instrument. In the beginning of the training, participants were asked to rate the learning reflection from the training on a five-point scale.

2.5. Statistical analysis

Data were entered in MicroSoft Excel and imported to R Development Core Team[11] for analysis. First, analysis of descriptive statistics was performed for each question in two states: pre- and post-training. Regression analysis was used to detect the significance of the change in the parameters. Knowledge related questions were true/false type, so, logistic regression was used. Exact logistic regression, a version of logistic regression applicable to small samples, was used. The estimation technique of Markov Chain Monte Carlo, also called Bayesian estimation technique, was used. In this regression, self-assessed knowledge was adjusted. Linear regression was used to assess the effectiveness of training in altering EWT. In the regression analysis, self-assessed initial knowledge was explicitly controlled.

3. Results

3.1. Descriptive statistics

Table 2 shows the descriptive statistics in terms of the number of items, total possible score, maximum score, minimum score, median, mean ± SD. These statistics shown for both pre-test and post-test were averaged over the total number of items. Four items were asked for the self-assessment of the concept, ideas and application. Maximum and minimum scores were shifted upward in post-test as compared to pretest. Similarly, mean and median scores were also improved.

There were 7 knowledge related items. In the pre-test, an average

participant made 86% correct answers while in post-test, this figure increased to 100%. Similarly, there were some participants who couldn't make correct answers to all of the questions in pretest, however, in post-test, this figure increased to almost 50%. Mean and median proportions of correct answers were also increased from pre-test to post-test. EWT was measured by asking four questions that were later scored between one and five. Though maximum score was found 5 in pre and post-test, minimum score was shifted from 2.25 to 3.50. Similarly, mean score was also improved from 3.84 to 4.52. The overall mean ± SD was found less in post-test as compared to pre-test. This indicated the consistency in improvement due to intervention.

3.2. Self-assessment of knowledge

Table 3 shows the improvement in scores on the scale of 1 to 5 for self-assessment of knowledge. There was a significant improvement in self-assessed knowledge after the training on the following statements: 1) able to think the public health issues from economics perspective; 2) ability to view the health system related issue from economics perspective; 3) overall knowledge of the topics covered in this training course. Average score for the question: usefulness of the concept of HE in policy, planning and delivering of health services didn't change after the training.

3.3. Knowledge and way of thinking

Tables 4 and 5 show the differences in knowledge and way of thinking related questions before and after the training. Exact logistic regression was also used to test the difference by adjusting self-assessed knowledge before and after the training. For the initial two general questions related to HE, exact logistic regression was unable to detect any statistically significant differences before and after the training. Next five questions assessed the change in technical knowledge due to training. The first question was about application of decision-making criteria in using economics principles, a significantly higher number of participants made correct answer in the post-test as compared to pre-test. The second question was assessed from economics perspective according to the preconditions specified in the question. Percentage of respondents made correct responses did not differ significantly before and after the training. The third question was about decision-making as a district health manager based on fixed budget. Participants made a significantly higher number of correct answers after the training. Percentage of participants who made correct responses was not significantly different before and after the training for the fourth question. About selection of cost-items in an economic evaluation, a significantly higher number of participants made correct answers after the training.

The rest of the questions were used to measure the way of thinking as indicated by the significant rise in average score after the training. The third question, which was about regulating the smoking behaviour, shows a significant improvement only at 10% level of

Table 3

Self-assessment of knowledge and reflection from the training.

Questions	Number of individuals	Average score (1–5)		P
		Pre-test	Post-test	
Able to think the public health issues from economics perspective	28	2.93	3.75	0.000
Usefulness of the concept of HE in policy, planning and delivering of health services, however, didn't change after the training	28	4.39	4.39	1.000
Ability to view the health system related issue from economics perspective	28	2.89	3.82	0.000
Overall knowledge of the topics covered in this training course	28	3.00	3.75	0.001

Table 4

Knowledge questions before and after the training.

Questions		Number of individuals	Logistic regression[1]		
			Estimate	Standard error	P
General questions related health and economics	1. Roles of HE in public health issues	28	1.70	0.01	0.10
	2. Considering the principles of economics, health is	28	0.44	0.01	0.73
Knowledge about subject matter	1. People make decisions at the margin means that they	28	1.88	0.01	0.05
	2. In 2000 a family had an income of NRS 20 000 and had an average of NRS 100 in health care expenditures, while in the year 2010 this family had an income of NRS 40 000 and had an average of NRS 500 in health care expenditures. Assuming there was no inflation, this shows that on average	28	0.96	0.01	0.25
	3. Suppose you are a district level manager of public health programmes. A budget ceiling of $ 900 000 is provided to implement only one intervention; which one do you select:	28	1.84	0.01	0.03
	4. Feeling that price for cancer treatment is far too high, the government wishes to implement a policy designed to improve both the accessibility and affordability for the services. Which of the following policy options would most likely achieve this goal?	28	0.62	0.01	0.35
	5. As a policy maker, if you want to conduct cost effectiveness analysis of measles vaccine; what the costs should be included:	28	1.12	0.02	0.05

Table 5

Way of thinking questions before and after the training.

Questions		Number of individuals	Linear regression[2]		
			Estimate	Standard error	P
Way of thinking related questions	1. Economic analysis in the health sector is concerned primarily with	28	0.598	0.270	0.031
	2. When viewing age in connection with the health status, which of the following is the most appropriate	28	1.224	0.337	0.001
	3. In a community, where the prevalence of smoking tobacco products is increasing, which of the following strategies will be the most suitable in reducing the incidence of tobacco smoking behaviour	28	0.391	0.230	0.096
	4. The health intervention should be introduced based on	28	0.390	0.405	0.339

significance. Fourth question, which was about rationale behind introduction of any public health program and improvement in EWT, is not significant after controlling for self-assessed knowledge.

4. Discussion

The use of many facets of economic analysis and its tools can identify areas of waste and inefficiencies and map out options for better use of scarce resources. With the economic analyses, policy makers can help to reduce the uncertainty associated with predicting the usefulness of health policy decisions and their effects. The capacity of public health practitioners needs to be improved to undertake applied HE analyses on priorities identified by the national health system. Short term training on HE was provided and the effectiveness of training was evaluated in terms of improving EWT and knowledge of HE. We found a significant improvement in applied knowledge and skills of economics tools as well as improvement in the way of thinking of infectious diseases and poverty related issue from economics perspective. Measuring the reflection of training, besides, the subject matter of the training is a new approach used here in evaluating the training organized and delivered.

These findings have important implications for policy makers to

design and develop HE culture in resource poor settings. First, Nair and Tushune[12] suggested a low level of awareness about usefulness of HE methods and tools among health professionals in developing countries. Our findings showed that a focused and well-articulated training improves applied knowledge and reflection of HE as well as adds the new perspective to look at the disease controls and poverty issues in Nepal from economic perspective. Second, Ministry of Health and Population[6] suggested that ministry has increasing a number of priorities due to triple burden of disease and other health system related challenges. At this juncture, it is necessary to perform economic analysis in order to prioritize the tropical disease and poverty issues for the resource allocation decisions. The short term training has impact on using technical tools of economics as well as perspective to see the health service and policy issues from economics perspective.

There are some findings that are not statistically significant despite the expected positive sign. For example, the participants were asked to provide judgment of health from the normative perspective, and percentage of correct response didn't change over the training period. This indicated that health professionals can relate various health policy related issues to HE, however, it is hard for them to conceive the concept of health from normative perspective. This is also supported by Drummond *et al.*[13] in their explanation of various

perspective to see health and related issues. They recommended normative perspective as appropriate in such circumstances. Similarly, participants didn't show a significant improvement in knowledge related to the general questions. This indicated that participants already had basic idea about the scope and application of HE. Questions related to suitable financing mechanism for catastrophic payment for non-communicable diseases. The evaluation didn't show a significant improvement in knowledge. It might be due to the fact that the training focused on economics analysis tools and techniques, allocated hours for the financing mechanism were not sufficient to provide enough understanding of the subject matter.

Our findings were not without limitations. First of all, we asked only a limited number of questions to assess the reflection of the training, and could not cover all the topics of the training curriculum. This is due to the fact that questions designed were applied and context-specific and so, it is important to provide enough time for the participants to respond effectively. Our approach of evaluation was based on the idea that the assessment should not be burdensome to the respondents by using too many applied and cognitively demanding questions. This made it challenging to increase the number of questions. Second, sample size for this evaluation was quite small due to the low number of participants in the training. We used appropriate analytical tools to cope with this limitation, but small sample made it difficult to identify statistically significant results. Third, we could not adopt experimental pretest-intervention-posttest design with a control group, which is considered as the best design to measure the impact of an intervention or set of interventions[10]. However, as the training was well focused and intensive, it is not unrealistic to assume that there were minimal non-training related factors, if any, that could significantly change a participants' cognitive knowledge or perspective with regard to HE research methods and tools over the short pre-test to post-test interval.

This paper provided evidence that short term training on HE methods and tools is effective in improving the practical understanding and effective application of EWT for health system related issues. The paper showed that training for health professionals and researchers on HE can improve understanding of the subject matter and better reflection of the contents. Targeted HE training could be a useful interim strategy for developing countries like Nepal to develop a cadre of HE analysts who can effectively use economic tools and approaches in health sector analysis and development. The approach of measuring the outcome of training programmes can also be replicated in other settings in order to ascertain the usefulness of trainings.

Conflict of interest statement

We declare that we have no conflict of interest.

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References

[1] Thomson S, Foubister T, Mossialos E, editors. *Financing health care in the European Union: challenges and policy responses*. Copenhagen: World Health Organization on behalf of the European Observatory on Health Systems and Policies; 2009.

[2] World Health Organization, Global report for research on infectious diseases of poverty. Geneva: World Health Organization; 2012. [Online] Available from: http://www.who.int/tdr/stewardship/global_report/Summary_advocacy_web.pdf [Accessed on 10th March, 2016]

[3] Adhikari SR, Supakankunti S, Khan MM. Incidence of kala-azar in Nepal: estimating the effects of individual and household characteristics. *Trans R Soc Trop Med Hyg* 2010; **104**(11): 720-5.

[4] Elena R. Effectiveness evaluation of training programmes for disadvantaged targets. *Procedia Soc Behav Sci* 2014; **141**: 1239-43.

[5] Adhikari SR. Health care financing in Nepal. Kathmandu: Ministry of Health and Population and RTI International; 2010. [Online] Available from: http://www.ministerial-leadership.org/sites/default/files/resources_and_tools/Health_Care_Financing_in_Nepal1.pdf [Accessed on 10th March, 2016]

[6] Ministry of Health and Population. Nepal health sector program-II (2010-2015). Kathmandu: Ministry of Health and Population; 2010. [Online] Available from: http://nhsp.org.np/wp-content/uploads/2014/11/NHSP-II-Final.pdf [Accessed on 10th March, 2016]

[7] Keurhorst MN, Anderson P, Spak F, Bendtsen P, Segura L, Colom J, et al. Implementing training and support, financial reimbursement, and referral to an internet-based brief advice program to improve the early identification of hazardous and harmful alcohol consumption in primary care (ODHIN): study protocol for a cluster randomized factorial trial. *Implement Sci* 2013, **24**: 8-11.

[8] Aitken LM, Burmeister E, Clayton S, Dalais C, Glenn G. The impact of Nursing Rounds on the practice environment and nurse satisfaction in intensive care: pre-test post-test comparative study. *Int J Nurs Stud* 2011; **48**: 918-25.

[9] Jacobs JA, Duggan K, Erwin P, Smith C, Borawski E, Compton J, et al. Capacity building for evidence-based decision making in local health departments: scaling up an effective training approach. *Implement Sci* 2014; **9**(1): 124.

[10] Khandker SR, Koolwal GB, Samad H. *Handbook on impact evaluation: quantitative methods and practices*. Washington DC: World Bank Publications; 2010.

[11] R Development Core Team. *R: a language and environment for statistical computing*. Vienna: R Foundation for Statistical Computing; 2011.

[12] Nair D, Tushune K. Assessment of knowledge of health economics among medical professionals: a study in Jimma University Medical School, Ethiopia. *Educ Med J* 2013; **5**(2): 6.

[13] Drummond MF, Sculpher MJ, Claxton K, Stoddart GL, Torrance GW. *Methods for the economic evaluation of health care programmes*. 4th ed. Oxford: Oxford University Press; 2015.