A qualitative study of avian influenza A H5N1 at the human-animal interface: Examining constructions of risk and associated behaviours of people who work with poultry in three live bird markets in Indonesia

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Declaration of authorship

I certify that the thesis I have presented for examination for the MPhil/PhD degree of the London School of Economics and Political Science is solely my own work other than where I have clearly indicated that it is the work of others (in which case the extent of any work carried out jointly by me and any other person is clearly identified in it).

I declare that my thesis consists of 93,625 words.

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Abstract
This thesis draws on the notion of disease narratives to examine the manner in which people who work with poultry (PWP) in live bird markets (LBMs) construct risks associated with avian influenza A H5N1, as well as how these constructions of risk inform behaviours at the human-animal interface. Focusing on PWP in three live bird markets in Indonesia, this qualitative study employs a constructivist perspective to look at what informs PWP's constructions of risk about avian influenza in relation to themselves, their animals, their livelihoods, and the political authorities within their communities, and offers insight into the extent to which these constructions of risk underpin their behaviours. Although not strictly designed as a comparative study, this research draws out similarities and differences across the three fieldsites.

Findings suggest that PWP assess risk by drawing on experiential knowledge and observations. Respondents across the three sites suggest a theory of species-specific infection in relation to H5N1, which broadly posits that there are certain diseases that infect different types of poultry and certain diseases that infect humans. For most PWP, diseases in birds are not considered contagious, even between different species, and the possibility of zoonosis implausible. The majority of respondents conclude that humans are not susceptible to poultry diseases because their observations and experiences do not support such a conclusion. PWP do, however, indicate that other forms of risk, such as the risk that a disease outbreak or an intervention can threaten their livelihood are plausible and salient. Behaviours of PWP at the human-animal interface reflect their constructions of risk, in that they prioritize economic considerations over any concern for mitigating the risk of disease in poultry or in people.

This thesis concludes by outlining policy implications and researchable hypotheses, and in highlighting the benefits as well as the challenges of integrating qualitative, social science research into the interdisciplinary, collaborative study of emerging infectious diseases.

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Acronyms

AI	Avian influenza
ARC	American Red Cross
ARTI	Aceh Research Training Institute
CDC	Centers for Disease Control and Prevention
DOC	Day-old chicks
FAO	Food and Agriculture Organization
EID	Emerging infectious disease
GAM	*Gerakan Aceh Merdeka*
GISN	Global Influenza Surveillance Network
GPG	Global public goods
HPAI	High pathogenic avian influenza
KAPB	Knowledge, attitudes, practices, and behaviours
KAP	Knowledge, attitudes, practices
LBM	Live bird market
LPAI	Low pathogenic avian influenza
ND	Newcastle disease
NIC	National Influenza Centres
NSABB	National Science Advisory Board for Biosecurity
OIE	World Organization for Animal Health
PDSR	Participatory disease surveillance and response
PMI	*Palang Merah Indonesia*
PPE	Personal protective equipment
PWP	Person/people who work with poultry
STEPS	Social, Technological and Environmental Pathways to Sustainability Centre, University of Sussex
WHO	World Health Organization

Approximate exchange rate between British Pound (GBP) and Indonesian Rupiah (IDR) in 2012: 1 GBP = 15,000 IDR

Chapter 1: Introduction

Introduction

When this study was first conceptualized in 2008, fears about a potential influenza pandemic were elevated. In 2007, the World Health Organization (WHO) labelled the H5N1 virus among "the most feared security threat[s]" (World Health Organisation 2007, 45). On 2 May 2009 *The Economist* presented an image of the Grim Reaper wearing a mask and thumbing through a world atlas, as if deciding where the next outbreak of H1N1 should take place (Image 1).

Image 1: The Economist 2 May 2009

Though at that time, concerns about an influenza pandemic were global, they were also focused on Indonesia for a number of reasons. First, Indonesia had the largest number of reported human cases of avian influenza A H5N1[1] and the highest crude fatality rate. Second, Indonesia in relation to other affected countries had received a disproportionate share of multilateral and bilateral funding for H5N1 programming. Third, in 2006, a member of the Indonesian government responded to avian influenza in a controversial manner that dramatically captured the attention of politicians, scientists, and academics. Former Indonesian Health Minister Siti Fadilah Supari observed that global supply for an antiviral used to treat H5N1 had surpassed the supply and, motivated by a combination of nationalism, and a concern for greater equity in international health governance and access to medicines, announced that Indonesia would stop sending H5N1 virus samples through the

[1] The number of reported cases in Egypt has recently surpassed those in Indonesia.

Global Influenza Surveillance Network (GISN) and onwards to WHO reference laboratories. Following controversy and debate about the fairness of existing International Health Regulations, this virus-sharing dispute concluded in 2011 with a restructured international virus-sharing agreement.[2]

While Supari's brinkmanship drew more attention to the potential risks for the emergence of an H5N1 virus with the potential for human-to-human transmission originating from Indonesia, over time, and as fears about swine flu abated and no sustained human-to-human transmission of H5N1 occurred, public interest in the dangers of influenza waned. Indeed, during the course of fieldwork for this study, I was frequently asked: "Is bird flu *still* a concern?" It appeared that by the time this study was completed, public attention, donor funding, and academic interest might have shifted elsewhere, away from avian influenza.

In 2011, however, public and academic interest once again spiked in response to the release of the Hollywood movie *Contagion*, which revolved around a fictional pandemic – a viral respiratory infection - which had come to humans from bats, via pigs. This hypothetical scenario was made more realistic by the many well-known public health experts employed as consultants for the production (R. Ellis 2011). Around this time, actual developments within the scientific community reinvigorated interest in influenza viruses.

In late 2011, two scientific papers described the molecular changes required for H5N1 to mutate so as to be able to transmit between mammals via respiratory droplets. Some argued that the results may be used by bioterrorists to modify the virus, or that the virus might be accidentally released from the laboratory into the general population (Doherty and Thomas 2012). For this reason the U.S. National Science Advisory Board for Biosecurity (NSABB) asked the academic journals *Science* and *Nature* not to publish details from either study. The lead authors agreed to a voluntary publication ban until the risks associated with this research could be reviewed. Eight months later, in mid-2012, the ban was removed and each study was published in full (Herfst et al. 2012; Imai et al. 2012). As the international community came to terms with the potentialities of such research, in 2013 a novel influenza virus believed to have pandemic potential emerged (Qi et al. 2013).

In March 2013 the Chinese Centres for Disease Control confirmed diagnosis of three human cases of avian influenza A H7N9, two of which resulted in death. As of July 2015, H7N9 has resulted in over 678 laboratory-confirmed human infections, with 278 deaths.[3] Novel influenza viruses have also recently been discovered in bats (Tong et al. 2013). These viruses, and their potential for human-to-human

[2] While this case is analysed in greater detail elsewhere (Elbe 2010a; Kamradt-Scott and McInnes 2012), it is discussed in brief here to underscore the very political nature of the evidence and policies that have been most emphasized in conceptualizations of avian influenza in Indonesia.
[3] See: www.fao.org/ag/againfo/programmes/en/empres/H7N9/Situation_update.html Accessed: July 21, 2015.

transmission, have reignited fears of an influenza virus evolving to become capable of spawning a pandemic.

Such oscillation in global concern about influenza viruses serves as a reminder of how perceptions of pandemic threats themselves wax and wane. This summary of the headlines associated with influenza viruses, and in particular H5N1, also illustrates how concerns about influenza primarily focus on the virus as a potential threat to humans. Though this particular framing of H5N1 is important, persuasive and striking, it is not the sole interpretation of the virus. As Leach and Dry argue, "there is always more than one way to tell a story, or 'frame' a particular issue". They direct attention to different "disease narratives" (Wald 2008; Leach and Scoones 2013; Sarah Dry and Leach 2010) that serve to highlight the diversity of conceptualizations about "the dynamics of a given disease, what counts as a problem, and to who" (2010, 5).

Focus of this thesis

This thesis draws on the notion of disease narratives to reflect on the different ways avian influenza – and H5N1 specifically - can be interpreted, and responded to, by global, national and local communities. Of particular interest in this thesis are disease narratives of people who work with poultry (PWP) in live bird markets (LBMs) on a routine basis. In certain conditions LBMs can host and facilitate the evolution of avian influenza viruses, posing a potential risk for disease in poultry and in people (Fournié et al. 2013; Fournié and Pfeiffer 2013). As will be highlighted in more detail in the following section of this chapter, the focus on PWP in the current study is both because they work at the human-animal interface and are thus regarded as a potential "bridge" population, facilitating the much-feared jump between animals and humans (Gray and Kayali 2009; Gray, Trampel, and Roth 2007), and because live bird markets are a primary site of focus for interventions and responses aimed at limiting the spread and impact of avian influenza viruses in poultry and in people (FAO 2011; FAO 2013b; FAO 2013a; Samaan et al. 2011; Samaan et al. 2012). Though PWP are often the subject of commentaries, studies, and policy prescriptions, few qualitative studies to date have examined PWP's perceptions and behaviours with regards to avian influenza at the human-animal interface.

Of particular interest in this study is the manner in which PWP construct the risks associated with avian influenza. The term "construct" is used advisedly throughout this thesis, alongside the more commonly employed "risk perceptions", as a way of drawing attention to the formation of assessments of risks as active, dynamic processes. In attempting to account for why some individuals or communities may not believe that avian influenza poses a significant threat to humans, some have singled out individuals' levels of knowledge as a key site for intervention (Fielding and Lam 2007; Q. Yu et al. 2012). Thus, when individuals suggest that they do not personally feel at risk from avian influenza, as many respondents do in this thesis, it is often viewed as an indication of the need for remedial communications initiatives.

In contrast, this study draws on Keck's notion of "rationalities of risk" (2008) to highlight both the validity of multiple, divergent constructions of risk as well as the expectation that such constructions will exhibit an internal coherence with the context in which they have developed. This study, therefore, focuses on exploring how PWP conceptualize the risks posed by H5N1 to themselves, while also considering the other dimensions of risk – such as risks to animals or economic risks stemming from disease outbreaks or disease interventions – that may be familiar or salient for PWP. This thesis also investigates the extent to which PWP's constructions of risk about avian influenza underpin their behaviours at the human-animal interface. These behaviours are implicated in increasing the potential for infection and disease spread (Janes et al. 2012) and as such, aligning PWP's behaviours with dominant constructions of risk is a focus of interventions (Samaan et al. 2012).

Situated in this way, as a community of people who may play a central role in efforts to contain the spread of avian influenza in poultry and in people, PWP's constructions of risk and behaviours are significant, and raise important ethical questions. The prevention and containment of communicable diseases such as avian influenza is seen as a global public good in that the benefits of effective containment are both non-excludable - they are available to everyone - and non-rival in consumption - because consumption by one person does not limit consumption by others (Nordhaus 2005). Viewed through this lens, PWP have the potential, and perhaps an obligation, to contribute towards the attainment of this global public good. Yet PWP may fail to do so, motivated by their own constructions of risk. Attention to the issue of global public goods means that PWP's behaviours cannot be considered purely private; their behaviours are not simply their own (Kaul, Grunberg, and Stern 1999), as what they do at the human-animal interface may have implications for others in their communities, their country and ultimately, the world. This thesis explores how PWP's constructions of risk inform their notion of what societal obligations they bear with regards to their own behaviours.

Having introduced the key focus of this study, discussion will now turn to the justification for the focus population of this research. To understand why and how existing research and attention has focused on people who work at the human-animal interface requires an understanding of the nature of the poultry industry in Indonesia. The following section will outline this context before introducing the research questions guiding this study.

Poultry in Indonesia: from farms and backyards to live bird markets

Poultry provide valuable income and nutrition to millions of Indonesians. Poultry production systems across the archipelago are diverse, ranging from large commercial poultry production of broiler chickens, to small-scale, backyard producers with only a few village chickens, ducks, or geese. Poultry production is near entirely nationally consumed, with very few exports (USAID 2013). Estimates suggest three million people are formally employed in the country's commercial

poultry industry, and that more than 22 million households in Indonesia raise village chickens (USAID 2013). Alongside different types of chickens, duck and geese are also reared for their meat and eggs across Indonesia (CIVAS and FAO 2006). Taken together these birds provide income for millions of Indonesian families, as well as the majority of meat protein in a country where most do not meet daily caloric needs, and where more than one-third of children are stunted (WFP 2015; FAO 2012).

The actual number of birds raised for their meat or eggs in Indonesia is difficult to determine (Rushton et al. 2005), as numbers no doubt shift frequently as supply and demand rises and falls.[4] Conservative estimates suggest a standing population at more than 620 million, with the annual turnover for broiler chickens alone estimated at over 1 billion birds (Sumiarto and Arifin 2008a). Others suggest the national standing population is closer to 2 billion (Simmons 2006). Of the 22 million households that have village chickens, or *ayam kampung*, more than one million raise more than 30 birds (USAID 2013). While chicken are the most common bird raised for consumption, estimates suggest there are more than 30 million ducks (CIVAS and FAO 2006). Although the number of poultry in Indonesia is difficult to determine, at any point in time, there are likely hundreds of millions of birds raised for consumption across the archipelago.

The Food and Agriculture Organization (FAO) of the United Nations delineates the poultry trade into four sectors (FAO 2004). Sector 1 refers to industrial integrated production where birds and their by-products are marketed commercially. Sector 2 includes commercial poultry production systems with birds sold through slaughterhouses or live bird markets. Sector 3 indicates smallholder commercial poultry production with birds sold in live bird markets. Sector 4 refers to village or backyard production with birds consumed and sold locally. In Indonesia these sectors are not so clearly distinguished, and are often more blended and integrated than these discrete categories suggest (Forster and Charnoz 2013). Ultimately, the majority of all birds raised for consumption in Indonesia – roughly 80-90 percent – are slaughtered and sold at one of over 13,000 live bird markets found across Indonesia (Sumiarto and Arifin 2008a; USAID 2013). As this study is concerned generally with the live bird market environment, in the remainder of this study, I do not continually delineate between each of these four sectors.[5]

[4] Along with birds raised for consumption, many Indonesians also raise birds such as songbirds, pigeons, quail, and fighting cocks for personal, cultural, and economic reasons (Forster 2012; Naysmith 2011). As the focus of interest is on birds sold primarily for consumption via live bird market systems, I do not speak specifically about birds other than chickens, including village chickens, broilers, and layers, as well as ducks and geese; I also interview PWP who raise fighting cocks.

[5] These crude categories do not necessarily capture the variety of birds that are reared for consumption in Indonesia, and nor do they illustrate the range of birds that are kept for other reasons than consumption. This discussion is limited, in part because the aim here is to show that there are a large number of birds raised for consumption across the archipelago, and that regardless of where they are raised or how they are kept, the majority of all these birds will be sold via live bird market structures – the primary place of interest in this study. For more detail on the general poultry

Mirroring changes in demand for livestock across much of Asia in the past few decades (Liverani et al. 2013; P. K. Thornton 2010), in Indonesia the demand for poultry products has increased steadily, with total poultry meat consumption in the country estimated to have risen from 1,243,545 metric tons in 2007 to 1,613,683 metric tons in 2011 (USAID 2013). Much of this increase is attributed to demand for broiler and layer chickens, and their by-products: in 2011 approximately 1,628,720 metric tons of eggs were consumed in Indonesia (USAID 2013). There are around ten large companies that dominate the broiler market, but the three largest - *Charoen Pokphand, Japfa Comfeed,* and *Sierad Produce* - maintain roughly 70 percent of the market. Most of these companies rely on a system of contract farming, wherein they sell day-old chicks (DOCs) and supplies to farmers who raise these broilers until they are ready for slaughter - about 30-35 days - and then move them on to local markets (Simmons, Winters, and Patrick 2005; USAID 2013). Alternatively, these companies also sell DOCs directly to individuals who raise the birds independently to sell at local markets in a similar time frame (Forster 2012). Commercial layer chickens are reared on farms across the country for around 18 weeks before they start laying, a phase lasting up to around 18 months: over this time each bird may lay 400 eggs. After this, most layer chickens are sold for consumption in live bird markets (USAID 2013). Taken together, estimates of the number of farms in Indonesia that raise broilers and layers exceed 80,000 (Rushton et al. 2005).

Backyard poultry production is common in Indonesia, contributing protein and a degree of economic security for households raising poultry (USAID 2013). Roughly 60-70 percent of households on Java raise birds (Sumiarto and Arifin 2008a). In Bali, 90 percent of households surveyed kept birds at home (Santhia et al. 2009). The majority of those who keep birds at home keep *ayam kampung*[6] - native or village chickens - with fewer people raising ducks or geese in this way.[7] The size of these flocks can vary greatly, from a few birds to several hundred at more semi-intensive farms. Backyard birds are often raised for eggs and meat for in-house consumption, yet there is also a high-demand for these domestically-reared birds, especially during religious holidays in Indonesia, and, many village chickens, ducks, and geese will either be taken to market by their owner or bought by independent poultry traders to be sold through live bird markets.

While there is debate about whether commercial or backyard poultry are more responsible for maintaining and facilitating the spread of H5N1 in Indonesia

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trade in Indonesia see, for example: (USAID 2013; Sumiarto and Arifin 2008a; Forster 2012; Simmons 2006).

[6] There are many different breeds of chickens that are considered to be *ayam kampung*. I do not differentiate between these breeds. For more on *ayam kampung* in Indonesia see: (Diwyanto and Iskandar 1999)

[7] Although not routinely differentiated in this study, there are a three predominant local duck breeds in Indonesia: *Tegal, Alabio, and Bali*. For more on local breeds and traditional duck rearing in Indonesia see: (Setioko 1997; CIVAS and FAO 2006).

(Forster and Charnoz 2013; Loth et al. 2011; Yupiana et al. 2010), taken together these two broadly defined sectors provided myriad potential hosts when H5N1 entered the archipelago, sometime around 2002-2003. Once introduced, the extensive and intensive nature of the wider poultry trade in Indonesia helped shuttle the virus across the archipelago (Lam et al. 2012), enabling it to become entrenched in the wider poultry population system: along with poultry in Egypt, Bangladesh, parts of India, China, and Viet Nam, H5N1 is considered endemic in Indonesian poultry (FAO 2011). Indeed, the trade in live birds is considered a "major pathway" (Fournié et al. 2013, 1) for the spread of H5N1 viruses, and has been associated with disease events in poultry (Santhia et al. 2009) and people (Zhou et al. 2009), and with introducing these viruses into live bird markets (Wan et al. 2011).

In Indonesia, the trade in live birds has been implicated in the spread of the virus (Santhia et al. 2009; Roche et al. 2014), and this trade coalesces around live bird markets, in which the vast majority of birds slaughtered and sold for consumption in the archipelago pass through (Sumiarto and Arifin 2008a; USAID 2013). These markets act as hubs for traders, who can introduce H5N1 viruses into these environments either through the birds they trade or on their equipment (Fournié et al. 2013). In LBMs in Indonesia, H5N1 viruses have been found in birds as well as on different surfaces used for the slaughter and sale of birds (Indriani et al. 2010; Santhia et al. 2009). Live bird markets may provide repeated contact points for birds and people to be exposed to the virus, either via an infected bird or a contaminated surface or material (Samaan et al. 2011), and LBMs have been identified as the likely source for infections in birds (Webster 2004; Fournié, de Glanville, and Pfeiffer 2012) and in humans (Kandun et al. 2008, 200; Zhou et al. 2009; Mounts et al. 1999). Under the right circumstances, once H5N1 is present, some live bird markets can act as viral reservoirs contributing to the maintenance, evolution, and dissemination of these viruses (Webster 2004; Fournié and Pfeiffer 2013). With poultry traders coming and going from markets, these LBMs can serve as a potentially "continuous source of infection for the poultry sector" (Fournié et al. 2013, 1). Whether H5N1 viruses can persist, evolve, and move on to new hosts from LBMs depends on a range of biological and anthropogenic factors, such as the particular type of H5N1 virus involved, and the behaviours and trading practices of those who sell and slaughter birds. In part for these reasons, LBMs are the location of interest for the current study, and the key respondents here are people who trade, slaughter, and sell poultry in and around three different LBMs in Indonesia – two in Sumatra and one in Java.

There are three further reasons for focusing on people working at the human-animal interface in LBMs in Indonesia. First, contact with infected poultry is associated with most human cases of H5N1 (M. Van Kerkhove et al. 2011; M. D. Van Kerkhove 2013; Patel et al. 2014), and human cases in Indonesia have been attributed to exposure in LBMs (Kandun et al. 2008). Human cases in Indonesia are particularly severe, with a crude fatality rate exceeding 80 percent in some populations (Patel et al. 2014). Moreover, H5N1 viruses have been identified in

poultry as well as on multiple surfaces in Indonesian LBMs (Indriani et al. 2010). And, despite the fact that currently circulating H5N1 viruses do not appear to disproportionately infect people working in LBMs (Toner and Adalja 2012), they are still considered a potential bridge population for disease transmission because they work at the human-animal interface, and may be among the first to become infected should H5N1 become more transmissible to humans (J. H. Kim et al. 2011; Bridges et al. 2002).

Second, as LBMs are identified as potential viral reservoirs (Fournié et al. 2013) capable of contributing to the maintenance, evolution, and dissemination of avian influenza and other zoonotic pathogens (Webster 2004; Fournié and Pfeiffer 2013; Guan et al. 2003) these markets, and those who work in them, have become a primary focus for avian influenza control initiatives in Indonesia (Samaan et al. 2012; Samaan et al. 2011; Santhia et al. 2009) and elsewhere (Fournié and Pfeiffer 2013; Fournié et al. 2013; Amonsin et al. 2008; Abdelwhab et al. 2010). These interventions can have negative economic and nutritional consequences for people who rely on poultry for their livelihoods, and this may in turn limit adherence to programming (Fournié and Pfeiffer 2013; Naysmith 2013b), as those negatively impacted by interventions may be "unlikely to widely adopt" (J. H. Kim et al. 2011, 2320) disease control efforts in LBMs if they are seen to impede their interests or well-being.

And third, despite this concerted focus on live bird markets, there are limited qualitative studies focusing on constructions of risk and associated behaviours among people working at this human-animal interface in Indonesia. This population may be central to the success of efforts to both prevent disease in birds, as well as in limiting environmental contamination, and ultimately the potential for zoonotic transmission. Having outlined the justification for focusing on people who work with poultry in Indonesian LBMs, the next section will outline the research questions guiding this study, followed by a description of the major contributions made by this research.

Guiding research questions

This qualitative study broadly investigates three related topics of inquiry:

One, how do people who work with poultry construct the risks associated with H5N1 for human health, animal health, for their own livelihoods, and for external involvement from political authorities? Do these constructions vary significantly across the three study sites?

Two, what kinds of evidence are employed in order to make these assessments about risk? What insights into risk perceptions are provided by attention to the familiarity or timing of particular risks for particular individuals or communities? What is the relationship between competing types of risks – for instance, between

the risks perceived to stem from animal disease and those presented by impacts to economic livelihoods?

Three, to what extent do these constructions of risk – about human health, animal health, economic impacts, political pressures - inform or underpin PWP's behaviours at the human-animal interface?

Research contributions

This study makes several original empirical and methodological contributions to existing knowledge. First, by indicating how constructions of risk among people who work with poultry diverge significantly from the constructions of risk reflected in some dominant disease narratives, findings from this study lend empirical support to Rhodes' challenge to a "single rationality of risk avoidance" (2002). Leach and Dry argue that the constructions of risk represented in the dominant disease narratives creates "the appearance of a consensus about the risks of global outbreaks" (2010, 3) that obscures the diversity of conceptualizations of risk in relation to avian influenza. By highlighting the processes of risk assessment undertaken by PWP, results from this study align with Keck's notion that various "rationalities of risk" rather than a single, correct' construction of risk are reflected in diverse disease narratives.

Second, in exploring constructions of risk and associated behaviours across three different field sites, this study provides insights into the range of experiences with avian influenza within a single country. Policy makers have been urged to recognize sub-national differences and design interventions accordingly (FAO/OIE/WHO 2007). However, there are no known qualitative studies of this nature across multiple sites in one country; nor are there studies that examine these topics across multiple sites with different epidemiological profiles. Furthermore, given that findings from this study are mostly consistent across the three sites suggests that certain aetiological beliefs, constructions of risk, and associated practices may be common among PWP, a supposition that could be investigated further in future research.

Third, this research provides empirical insights into factors that may challenge current interventions used to impart information about avian influenza with the aim of changing behaviours. Such interventions are often predicated on the notion that different conceptualizations of the risks associated with avian influenza reflect certain deficits of knowledge, and as such, can be remedied through the provision of additional information. Yet findings from this study suggest that PWP derive their assessments of the risks posed by avian influenza to themselves, their animals and their livelihoods through direct observations and experiences. These assessments are, therefore, unlikely to be dislodged in the face of external pronouncements. These data further suggest that, as PWP do not feel there are any deficits in their knowledge or understanding of poultry diseases, they may be reluctant to engage with established veterinary or public health authorities. Indeed, most PWP report little to no contact with these officials, suggesting that as long as they perceive the

problem of avian influenza to reside exclusively with their poultry, they have no reason to invest trust or confidence in external sources of information.

Fourth, this study suggests a methodological approach that circumvents some of the limitations of existing research on emerging infectious diseases (EIDs). In attempting to develop an understanding of individual's perceptions of risk and associated behaviours, studies in the extant literature often employ self-reporting measures, which are susceptible to social-desirability bias. By employing both semi-structured interviews and in-depth observations, this study was able to triangulate between data sources and derive a more comprehensive picture of how PWP assess risk and what implications these assessments have for their behaviours.

Fifth, in employing qualitative methods, this research contributes to discussions on how such studies can complement interdisciplinary, and mixed-method research on emerging infectious diseases (Kleinman et al. 2008b; Janes et al. 2012). As will be discussed in more detail in Chapter 3, the One Health agenda is the most prominent of several initiatives to encourage interdisciplinary scholarship. Defined as "collaborative efforts of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and our environment" (Coker, Rushton, et al. 2011), the One Health framework underscores the importance of bringing different disciplinary perspectives into conversation. To date, however, there remain a dearth of social science literature on EID drawing on qualitative methodologies, leading some to suggest that the presence of social science in the list of disciplines with important insights to bear on EID is a merely tokenistic inclusion (Craddock and Hinchliffe 2015, 1). By offering insights into the constructions of risk and associated behaviours among a population of interest to wider studies of EID, this thesis helps to delineate how qualitative social science research can contribute to future studies of emerging infectious diseases at the human-animal interface. It further provides substantive reflections on the practice and ethics of conducting qualitative research in EID contexts where researchers must seek to mitigate opportunities for infection among themselves and their research assistants, while also avoiding stigmatizing respondents.

Thesis outline

The remainder of this chapter briefly discusses the organization of each chapter in this thesis.

Chapter 2: The science of influenza focuses on influenza viruses generally, with a specific focus on H5N1. The origins of the virus are discussed, and this leads into a detailed discussion on the relative risks that H5N1 poses to birds and to humans. Ultimately, this chapter shows that there are a range of factors that influence whether or nor a bird is infected, a human is exposed and infected, and whether H5N1 can persist in an environment such as live bird markets.

Chapter 3: Dominant narratives introduces the concept of "epidemic narratives" as a way of viewing perspectives on a particular disease and the pathways of response that stem from these accounts. Three different dominant narratives are highlighted, pointing, respectively, to avian influenza as a significant threat to global public health and security, as a problem largely confined to animal health and the livelihoods of those who depend on livestock, and as an overarching challenge to both animal and human health requiring interdisciplinary collaboration. Though all these narratives draw attention to important features of EID, limitations and omissions exist within each, and are reflected in alternative narratives, the subject of the following chapter.

Chapter 4: Alternative narratives introduces four epidemic narratives that diverge in important ways from those presented in the previous chapter, drawing attention to different accounts of disease and the various pathways of response that follow from them. First, the livelihoods narrative emphasizes the disproportionately negative impacts that both disease and disease control programming can inflict upon poorer populations who raise, sell, and eat animals that can harbour zoonotic pathogens. Second, the risk environment narrative highlights the wider contextual environment in which zoonotic diseases proliferate. Third, the governance narrative draws attention to disjunctures in the presumed consensus surrounding global governance of infectious diseases, as well as challenges faced by national and local level governments in calibrating responses to diseases with available means. Lastly, the fourth alternative narrative draws on the notion that those who live and work in close proximity to disease events and the responses that aim to contain them undoubtedly have important insights and perspectives to offer. Focusing on the local realities of these individuals also highlights the diverse ways that risk is conceptualized and constructed, and allows for an examination of their behaviours in light of these insights.

Chapter 5: Conceptualizing constructions of risk at the human-animal interface introduces the conceptual commitments shaping this study. It outlines the objectivist tradition in risk perception research, which exhibits a tendency to represent risk as a rational, objectively-established phenomenon, and contrasts it with the constructivist perspective, which characterizes risk as a subjective, contextually-determined notion. Drawing on the concept of "rationalities of risk" (Keck 2008), this chapter then outlines the key conceptual ideas that are employed in this study to explore the processes of deliberation used by lay populations to question the source and veracity of scientific data about risk. These include: the salience of experiential risk rationalities drawing on observations and experiences; the influence of heuristics and biases in the formation of risk assessments; the attention to multiple, simultaneous risks in the Cultural Theory of risk (Wildavsky and Dake 1990), and the emphasis on how different constructions of risk lead to diverse pathways of response.

Chapter 6: Methodology and methods explains the methodology of the approach in this project, the methods used during fieldwork, and the fieldwork process, as well

as offering reflections on my positionality, and that of my research assistants. In particular, the advantages of a focused ethnographic approach are highlighted and the methods, or research tools, used to collect data are outlined, including semi-structured interviews, participant observation, and photography.

Chapter 7: Ethical and practical considerations of doing this research highlights some of the challenges experienced in undertaking this research, including how to keep my research assistants and myself safe. This chapter concludes with a more general discussion of some of the ethical and practical considerations that arise in qualitative social science research on emerging infectious diseases.

Chapter 8: The research context focuses on the wider environment in each site. The first section briefly outlines general health considerations across Indonesia. Following this, the remainder of this chapter outlines the trade, slaughter, and sale of poultry in each of the three markets, starting with Aceh, then Lampung, and finally Banten. Similarities and differences between these sites are discussed, as are different factors that may contribute and amplify risks for humans and poultry. Ultimately this chapter situates the research context and provides a background for data presented and analysed in Chapters 9 and 10.

Chapter 9: Constructions of risk about avian influenza among PWP explores the manner in which PWP construct the risks about avian influenza for themselves, their animals, and their livelihoods. It argues that, in general, PWP conceive of avian influenza as a new name for a familiar disease that can only affect poultry and as such, the risks associated with H5N1 for humans are considered implausible. As a result, the most salient risks associated with avian influenza are the wider threats posed by disease outbreaks or by interventions to control the spread of the virus. PWP assess these risks by drawing on their long histories of working with poultry and their present-day observations of diseases among humans and animals, illustrating how constructions of risk are founded on PWP's experiential risk rationalities.

Chapter 10: Understanding behaviours of PWP at the human-animal interface examines certain behaviours among PWP in LBMs, juxtaposing these practices with recommended behaviours that have been identified in the WHO's recommended *Measures to reduce transmission of avian influenza in wet markets in developing countries* (2006). In doing so, this chapter identifies gaps that exist between the WHO prescriptions that reflect the dominant outbreak narratives' preoccupation with averting human exposure to H5N1, and the constructions of risk among PWP that frame avian influenza largely as a disease that does not affect humans. Behaviours among these respondents appear to reflect their constructions of risk, described in Chapter 9, and as such, seem not to be significantly influenced by concern for human vulnerability to avian influenza infection, or considerable concern about infection in their birds. Thus PWP do not mitigate the potential for exposure by employing preventative behaviours, such as wearing personal protective equipment. Data from interviews and observations show that economic

priorities to maximize profit and minimize loss are a primary influences on PWP's behaviour.

Chapter 11: Conclusions summarizes the key findings from this study as they relate to the research questions posed in Chapter 1, highlighting similarities and differences across the field sites, how constructions of risk are formed by PWP, and with what implications for behaviours. It then identifies five unique methodological and empirical contributions from this study, before examining policy implications of these data for avian influenza control programming. Lastly, it outlines two researchable hypotheses stemming from findings, and concludes by outlining study limitations, and pointing to priorities for future research and policy.

Chapter 2: The science of influenza and associated risks for poultry and people

Introduction

This chapter focuses on the science of influenza viruses, and avian influenza A H5N1 specifically, and consists of four sections. The first section establishes how influenza viruses work, and concludes by expanding on the evolution of H5N1 viruses since they were first diagnosed in geese in southern China in 1996. The second section looks at avian influenza viruses in different types of birds, and illustrates that the severity of disease in birds depends on a range of factors, and concludes that ducks may act as viral reservoirs, helping to maintain and disseminate H5N1 viruses. The origin of H5N1 is explored in the third section, along with how these viruses spread and became entrenched in some poultry populations, and concludes in outlining risk factors associated with disease in poultry. The final section in this chapter looks broadly at H5N1 infection in humans. A major concern is that a variant of H5N1 will emerge that can both efficiently infect people and also transmit between them. While sporadic human cases continue to be reported in some countries, available evidence suggests that in its current state, H5N1 viruses - although a major risk for many people's livelihoods – can neither readily infect people, nor transmit between them.

Influenza viruses and the emergence of highly pathogenic avian influenza A H5N1

Influenza viruses belong to the family Orthomyxoviridae, a family made up of RNA viruses that include five genera: Influenza A, Influenza B, Influenza C, Thogotovirus, and Isavirus; for the purpose of this study the latter two genera will not be discussed further.[8] Influenza A, B, and C viruses can infect humans and other mammals, such as seals, bats, pigs, horses, and felines, yet human infection with influenza C is rare (Kimura et al. 1997).[9] Both influenza A and B viruses can cause seasonal epidemics in humans, which occur typically during the winter months, with two distinct waves of infections in the southern and northern hemispheres. Combined, these seasonal epidemics can annually kill hundreds of thousands of people globally (Shindo 2010; Molinari et al. 2007). Only influenza A viruses are considered capable of spawning a pandemic. Pandemics can occur when a novel influenza A virus – one in which humans have little to no immunity against – emerges and has the ability to infect people and readily transmit between them. Influenza viruses considered to have "pandemic potential" include influenza A H5N1 and influenza A H7N9, both of which occasionally infect humans but at present have limited to no ability to transmit between people.

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[8] For more information on these genera see: (Jones and Nuttall 1989).

[9] Influenza C infection in humans is extremely rare. Since this type of virus does not cause epidemics or pandemics (Drobniewski, Pogoryelova, and Nikolayevskyy 2009), influenza C will not be discussed further in this thesis. For more on influenza C viruses see Kimura *et al.* (1997).

Influenza A viruses are classified into subtypes, delineated by the presence of two viral surface proteins, haemagglutinin (HA or H) and neuraminidase (NA or N), both of which are integral to disease spread. In brief, haemagglutinin enables infected cells to bind to uninfected cells and, once bound, facilitates the transfer of the virus into the uninfected cells. Neuraminidase, put simply, helps open the host cells, essentially releasing the virus and promoting its spread to uninfected cells.[10] Influenza A viruses are continually evolving in this way over time and as they mix with other viruses. There are currently eighteen HA subtypes and eleven NA subtypes[11] - a number that recently grew with the discovery of novel influenza viruses in bats (Tong et al. 2013; Tong et al. 2012).[12]

Humans and other susceptible species can be subclinically infected with influenza A viruses, and also build a degree of immunity to genetically similar variants. The genes of influenza A viruses, however, are continually evolving, marked by small and large changes in their surface haemagglutinin and neuraminidase. Small changes to the haemagglutinin occur routinely, and can result in variants of influenza A viruses that people do not have immunity against. This process is called *antigenic drift,* and these minor changes are sufficient and frequent enough to amount to the "virological basis for seasonal epidemics" (Drobniewski, Pogoryelova, and Nikolayevskyy 2009, 5) in humans. Whereas antigenic drift is a continuous process that occurs in both influenza A and B viruses, *antigenic shift* is rare and occurs only in influenza A viruses. For this reason, only influenza A viruses are capable of spawning a pandemic.

Antigenic shift refers to an abrupt and significant change in the haemagglutinin, and/or a novel haemagglutinin and neuraminidase combination. This can occur when two distinct viruses merge in a host and evolve. Such processes can result in a novel virus that can both infect immunologically susceptible humans, and consistently and efficiently transmit between people (Drobniewski, Pogoryelova, and Nikolayevskyy 2009).[13] The outbreak of influenza A H1N1 in 2009, for example, resulted from the reassortment of avian, human, and swine viruses (G. J. D. Smith et al. 2009). More recently, the emergence of influenza A H5N6 in poultry in southern China (Bi et al. 2015), came from the reassortment of H5N1 viruses and H5N6 viruses (Wong et al. 2015). While at present this novel virus primarily afflicts birds, the first human case of H5N6 resulting in death was reported in Sichuan province, southern China in November 2014.[14]

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[10] This is a very simplified explanation of how haemagglutinin and neuraminidase facilitate viral replication and disease spread. For a more thorough discussion see Mitnaul and colleagues (2000).
[11] See *Influenza Type A Viruses* at: http://www.cdc.gov/flu/avianflu/influenza-a-virus-subtypes.htm Accessed: April 22, 2015.
[12] Previously, the sixteenth HA subtype was isolated from shore birds in 2004 (Fouchier et al. 2005)
[13] CDC. *How the Flu Virus Can Change: "Drift" and "Shift".*
http://www.cdc.gov/flu/about/viruses/change.htm Accessed: October 2, 2013.
[14] Human cases are currently rare, yet there is concern about more disease in humans as H5N6 has been isolated from poultry in Vietnam, South Korea, Japan, Vietnam and Laos (Heine et al. 2015).

While many vertebrate and mammal species can be infected with influenza A viruses, wild birds - geese, ducks, swans, gulls, shorebirds and terns - are the natural reservoir for most subtypes of influenza A viruses (Webster et al. 2007), and *avian influenza*, or *bird flu*, is common nomenclature for most of these viruses.[15] Infected wild birds are often asymptomatic, with most avian influenza viruses showing little change in these hosts, as if in evolutionary stasis (Gorman, Bean, and Webster 1992). After transmission to susceptible species, however, some avian influenza viruses – including H5N1, as discussed more below - can show rapid evolution and "extensive diversity in pathogenicity" in different species of bird (Webster et al. 2007, S4). If avian influenza viruses cause severe morbidity and mortality in chickens in a laboratory setting, they are classified as highly pathogenic avian influenza (HPAI). Conversely, if they cause limited or no symptoms in chickens in a laboratory setting, they are classified as low pathogenic avian influenza (LPAI). Although all known HPAI viruses come from subtypes H5 or H7 viruses, "not all H5 or H7 viruses are HPAI"(Q. Liu, Liu, and Yang 2013, 1258). Moreover, as exhibited with rising incidence of LPAI H7N9 infection in humans, LPAI viruses can concurrently reside as a subclinical infection in some poultry while posing a significant risk to susceptible human populations.

H5N1 was first identified in geese in the southern Chinese province of Guangdong in 1996 (Chen et al. 2005; Xu et al. 1999). Thereafter H5N1 spread to poultry stocks across the Eastern Hemisphere (Wallace et al. 2007), and has since evolved into multiple genetic lineages, all of which retain part of the progenitor virus. These different variations of H5N1 are organized into clades (WHO/OIE/FAO H5N1 Evolution Working Group 2012). A clade is a group of organisms from a genetically common ancestor, and can be described here simply as a sub-family of H5N1 viruses (Drobniewski, Pogoryelova, and Nikolayevskyy 2009). There are three first-order clades – Clade 1, Clade 2 and Clade 7 – and 20 distinct subclades defined as second-, third-, or fourth-order clades (WHO/OIE/FAO H5N1 Evolution Working Group 2012).[16] As discussed below in relation to the risk H5N1 poses to poultry and people, depending on the susceptible population or species, some H5N1 clades may be more pathogenic than others and, over time, some clades may go out of circulation while new variants emerge.

H5N1 clade 2.1 was first detected in Indonesian poultry in 2003, and thereafter diversified into three distinct lineages – clades 2.1.1; 2.1.2; 2.1.3. From 2004, however, viruses of clades 2.1.1 and 2.1.2 "apparently disappeared" (Fournie, de Glanville, and Pfeiffer 2012), while clade 2.1.3 continued to evolve, necessitating reclassification into fourth-order clades - 2.1.3.1; 2.1.3.2; 2.1.3.3. In recent years, the majority of H5N1 viruses isolated in Indonesia belong to clade 2.1.3.2, suggesting

[15] Although all avian influenza viruses are influenza A, not all influenza A viruses are avian influenza. Two distinct influenza A viruses have recently been found in bats (see Tong and colleagues (2013; 2012).

[16] For a more thorough discussion on the designation of H5N1 clades see the WHO: http://www.who.int/influenza/gisrs_laboratory/h5n1_nomenclature/en/ Accessed: October 4, 2013.

that this is now the dominant genotype circulating in Indonesian poultry (Koel et al. 2014). As this research was undertaken in Indonesia over the years 2009-2012, H5N1 viruses circulating in poultry across the archipelago at that time likely belonged to clade 2.1.3.2. H5N1 viruses in Indonesia and elsewhere will continue to evolve.

In recognizing their dynamic nature, for the purpose of the current study, HPAI H5N1 viruses may sometimes be discussed as a monolithic entity. However, to establish a foundation for understanding relative risks associated with H5N1 in birds, the next section outlines the contextual nature of H5N1 infection and disease severity in different birds, underscoring that H5N1 does not uniformly afflict all birds, and nor does it spread between them in a consistent pattern. While the following discussion outlines existing knowledge about avian influenza in different birds, it is important to recognize that serious gaps in knowledge persist (Forrest and Webster 2010).

Avian influenza viruses in different birds

Avian influenza infection in birds can occur through direct and indirect contact with the virus, with transmission mainly via a faecal-oral route, although viruses may also transmit via the respiratory route (Webster et al. 1992; Webster et al. 2007). Infected birds can shed live virus in bodily fluids, such as saliva, nasal secretions, and faeces (Kurmi et al. 2013). Virus in these secretions and excretions may remain infectious for days and, in certain conditions, these viruses can contaminate environments and create fomites (Horm, Gutiérrez, Nicholls, et al. 2012; Spekreijse et al. 2012; Horm et al. 2013). The persistence of H5N1 outside of a host hinges on many environmental factors, including temperature, moisture, and salinity, if the virus is in water (J. D. Brown et al. 2007). H5N1 may be sustained in the faeces of infected birds for multiple weeks, with time increasing as temperature decreases (Kurmi et al. 2013). H5N1 viruses can also persist in feathers (Yamamoto et al. 2008), as well as the meat and by-products of slaughtered poultry (Mase et al. 2005; Nazir et al. 2011). In part, it is for these reasons that live bird markets where poultry are housed, slaughtered, and sold, are considered exceptional environments for the maintenance and spread of avian influenza viruses and other pathogens (Webster 2004).

H5N1 can infect both domestic and wild birds, including migratory birds, free-ranging ducks, free-ranging native chickens, fighting cocks, commercial breeders and layers, quail, and pigeons, among other species and breeds (Alexander and Brown 2009). The majority of H5N1 outbreaks in poultry, for example, are found to occur between January and March (Durand et al. 2015), suggesting a seasonal pattern of infection in some birds, with disease events associated with decreasing temperature. H5N1 infection, however, does not affect all birds equally. Field studies and observations, as well and laboratory studies, show that the severity of disease resulting from H5N1 infection in birds depends on a range of factors including the clade and the species, as well as the age of the bird, with variation in

disease ranging from subclinical enteric infection in some ducks to high mortality in some chickens (Mary Pantin-Jackwood et al. 2013; Martin, Pfeiffer, et al. 2011; Martin, Zhou, et al. 2011; Sturm-Ramirez et al. 2004; M. J. Pantin-Jackwood and Swayne 2007). The amount of virus shed by infected birds also depends on the species that is infected, and the condition and health of the bird in question (Spickler, Trampel, and Roth 2008; J. G. B. van Dijk et al. 2015).

In most wild birds avian influenza A viruses reside subclinically, causing limited morbidity and mortality; H5N1, however, has proven an exception, with extensive diversity in the range of pathogenicity in infected wild birds, extending between non-pathogenic subclinical infection to highly pathogenic and lethal (Webster et al. 2007). The exceptionality of H5N1 in wild birds was made apparent in May 2005, when more than 6000 wild birds died in Qinghai Lake, in western China, a mass die-off attributed to avian influenza A H5N1 (J. Liu et al. 2005); further die-offs in this region underscore the potential impact of H5N1 in wild birds (Y. Li et al. 2011). The severity of disease in wild birds, however, varies between species and can depend on many biological and contextual factors. In experimentally infected swans and geese, for example, H5N1 causes higher mortality in swans, with marked difference in the amount of virus shed and clinical illness experienced depending on species (J. D. Brown, Stallknecht, and Swayne 2008). Some pigeons infected with high concentrations of H5N1 virus show only limited morbidity and mortality (J. D. Brown et al. 2009). Indeed, some wild birds, such as pigeons and starlings, for example, may have partial resistance to H5N1 viruses (Boon et al. 2007). Conversely, H5N1 viruses in some sparrows can lead to high morbidity and mortality (J. D. Brown et al. 2009). Wild ducks infected with H5N1 viruses can also develop severe clinical disease, with infection ultimately resulting in death (J. D. Brown et al. 2006). Along with differentiation of disease severity by species, different H5N1 viruses may be more or less severe for wild birds (Boon et al. 2007). Whereas earlier clades produced clinical disease in geese (Leigh Perkins and Swayne 2002), more recent clades have been found to be less pathogenic for geese (J. D. Brown, Stallknecht, and Swayne 2008). Infected wild birds also shed different amounts of virus, and are thus not all equally capable of contaminating environments and potentially infecting other species. Starlings, for example, may shed more virus than pigeons (Boon et al. 2007). The duration of viral shedding can depend on the severity of clinical infection (J. D. Brown et al. 2006). In brief, H5N1 viruses do not impact wild birds equally, with the likelihood of infection, the severity of disease, and the amount of virus shed, dependent on a range of considerations. And while wild birds have been implicated in the transmission of H5N1 to other birds (Kilpatrick et al. 2006) and to people (Gilsdorf et al. 2006), many infected wild birds do not efficiently transmit virus (M Pantin-Jackwood and Swayne 2009), and are thus likely less of a risk for the maintenance and inter-species dissemination of H5N1 than domesticated ducks and chickens.

Ducks can be infected with avian influenza viruses without presenting clinically (Sturm-Ramirez et al. 2005; Songserm et al. 2006; Wibawa et al. 2013), and some duck species may be naturally resistant to H5N1 viruses (J. K. Kim et al. 2009). H5N1

viruses, however, have been found to cause severe morbidity and mortality in some ducks, notably in two Hong Kong parks in 2002 (Sturm-Ramirez et al. 2004). H5N1 infection in ducks is not uniform, and the severity of disease depends on many factors. Muscovy ducks, for example, may exhibit more severe symptoms and higher mortality than Peking ducks (Mary Pantin-Jackwood et al. 2013). The age of the duck may also help determine the severity of H5N1 infection; so too may the particular clade responsible for infection (M. J. Pantin-Jackwood and Swayne 2007), and the health of the duck prior to infection (J. G. B. van Dijk et al. 2015).

Aerosol transmission of avian influenza between ducks is not likely. Most ducks are probably infected with avian influenza viruses through an oral-faecal route (Webster et al. 1992), with susceptible ducks likely ingesting the virus in water or feed contaminated with faeces or other excretions from an H5N1 infected host. The primary site of avian influenza infection in ducks is the intestine, although some ducks test positive for upper respiratory tract infection (J. K. Kim et al. 2009). H5N1 was found to cause paralysis and sudden death in some ducks in Cambodia (Theary et al. 2012). In Indonesia, for example, systemic viral spread has been found in H5N1 infected ducks during histological examinations post mortem (Wibawa et al. 2014). Whether or not a duck infected with H5N1 presents clinically, they can shed virus that contaminates environments and poses a risk to other birds and people. Experimentally infected ducks reportedly shed infectious virus for 2-5 days following inoculation, though some ducks may shed for upwards of 17 days after infection (Hulse-Post et al. 2005). Ducks have also been found to efficiently transmit disease to uninfected birds. For example, 5 ducks experimentally infected with an Indonesian H5N1 virus efficiently spread the disease to 5 ducks that were placed in close contact (Wibawa et al. 2014). Indeed, as ducks shed higher concentrations of virus than chickens, ducks have been identified as playing a crucial role in the maintenance and spread of H5N1, and may act as asymptomatic reservoirs of infection – a so-called "Trojan horse" (J. K. Kim et al. 2009). Further discussed below in relation to risk factors for H5N1, it is in part for these reasons that ducks are associated with disease events in other birds (Tiensin et al. 2009; Henning et al. 2010).

H5N1 can infect different breeds of chicken including broilers, layers, free ranging village chickens, and fighting cocks (Alexander and Brown 2009). H5N1 infection in chickens is particularly severe, however, as the virus moves quickly between most breeds, resulting in high morbidity and morality in chicken flocks following disease introduction (Perkins and Swayne 2001). The severity of infection in chickens can depend on the clade responsible for infection (Suzuki et al. 2009), as well as the type of chicken infected. Some suggest native chicken breeds are more resilient, and not as severely impacted by H5N1 as commercially bred broiler and layers (Suba et al. 2015). This is the case in Indonesia, for example, where commercial broilers are associated with disease events in poultry (Yupiana et al. 2010; Loth et al. 2011). Nonetheless, H5N1 causes high morbidity and mortality in most chickens, and clinical manifestations may include: ruffled feathers and comb, neurologic dysfunction, diarrhoea, paralysis and organ failure (Perkins and Swayne 2001;

Theary et al. 2012). Avian influenza, however, has no pathognomonic signs, with clinical presentation of H5N1 infection in chickens, for example, similar to that resulting from infection with Newcastle Disease (Balasubramaniam et al. 2012; Gardner and Alders 2014; Alders and Bagnol 2007), making it difficult – if not impossible - to correctly identify H5N1 infection in birds without laboratory diagnosis. Newcastle disease is not uncommon in Indonesia, and is mostly found in backyard poultry (Sonaiya and Swan 2004).[17]

H5N1 infected chickens can begin to shed virus in their faeces and respiratory secretions in one or two days after infection (Spickler, Trampel, and Roth 2008), during which time they may release high concentrations of virus (Wibawa et al. 2013). Along with a short latency period, estimates suggest that H5N1 infected chickens may only remain infectious for a few days before most birds succumb to the virus (Bouma et al. 2009). While seroprevalence studies in chickens have identified sufficient antibodies to indicate past infection with H5N1, there are, for example, far fewer chickens found with antibodies than there are ducks (Henning et al. 2011), further confirming that most chickens infected with H5N1 likely die.

The above discussion on H5N1 and different birds suggests that regardless of the species or breed, a combination of factors help to determine the severity of disease in different birds, and the amount of virus that an infected bird can shed in different environments. Although these myriad factors make it difficult to generalize, available data identify ducks as playing a pivotal role in the maintenance and dissemination of H5N1. The next section identifies some of the wider contextual factors that helped maintain and disseminate H5N1 following emergence in China in 1996, paying particular attention to the factors found to be associated with disease events in poultry.

The dissemination and maintenance of H5N1

H5N1 likely started as a low pathogenic avian influenza virus in wild birds that spread to susceptible domesticated birds in southern China and then underwent significant mutations in becoming HPAI H5N1 (Vijaykrishna et al. 2008). While this initial viral introduction to domestic poultry is unclear, contact between wild birds and domestic poultry may be frequent, providing myriad instances for such viruses to spill into susceptible populations (Prosser et al. 2013; Henning, Pfeiffer, and Vu 2009; Kung et al. 2007). Once H5N1 emerged the virus quickly exploited immunologically naïve poultry.

In 1997 the virus was identified in poultry in Hong Kong, followed by the first human cases of H5N1 (de Jong et al. 1997; Subbarao et al. 1998). While this disease event was promptly contained, afterwards, H5N1 continued to circulate extensively

[17] While I do not seek to identify different diseases in different birds, poultry are susceptible to many diseases, including viruses, mycoplasma, bacteria, and fungus. See, for example: (Sonaiya and Swan 2004). For more on Newcastle Disease in village chickens see: (Alexander, Bell, and Alders 2004).

in southern China, and spread throughout the region (Wallace et al. 2007). In 2001 there were isolated cases identified in poultry in live bird markets in Viet Nam (D. C. Nguyen et al. 2005), and again in poultry and captive wild birds in Hong Kong in 2001-2003 (T. M. Ellis et al. 2004). From November 2003 to February 2004, H5N1 was identified in poultry in Cambodia, China, Indonesia, Japan, Laos, South Korea, and Thailand (K. S. Li et al. 2004). Genetic analysis of H5N1 viruses in Indonesia suggest H5N1 likely entered the archipelago through a single introduction to poultry somewhere in East Java between November 2002 and October 2003 (Lam et al. 2012). From east and south east Asia, H5N1 was identified across the Eastern Hemisphere, and was soon isolated in wild birds and poultry in parts of south Asia, Russia, the Middle East, Europe, and Africa.

To date, over 60 countries have report H5N1 disease events in birds. And while most of these countries eliminated the virus and have been able to limit and control viral reintroduction, H5N1 remains endemic in poultry stocks in parts of Bangladesh, China, Egypt, India, Viet Nam, and Indonesia. Disease introduction in most countries likely occurred through some combination of migratory birds and/or the extensive and intensive trade in birds and their by-products (Fournié, de Glanville, and Pfeiffer 2012).[18] Regardless of the initial route of introduction, in countries where H5N1 remains entrenched, poultry are the primary hosts for H5N1 viruses. In these places, the structure of the poultry sector plays an integral role in the dissemination and maintenance of these viruses.

The emergence of H5N1 coincided with rapid changes in livestock production systems, characterized by an increased demand for protein and a concomitant, and rapid rise in the numbers of animals raised for consumption (Liverani et al. 2013). This "second livestock revolution" started around the 1980s with the intensification of poultry and pig production, and was facilitated by developments in therapeutic and preventative veterinary medicine, which allowed for densely housed animals, and expedited turnover (Coker, Rushton, et al. 2011). While the growth in livestock production has been global, there have been particularly pronounced changes in poultry production systems in much of Asia (P. K. Thornton 2010). In China, for example, between 1985 and 2005 the number of ducks and chickens bred for trade and consumption increased from approximately 1.98 billion birds in 1985 to 5.33 billion in 2005 (FAO 2008). The spectacular increase in the number of birds bred provided ample potential hosts for H5N1 viruses after they emerged.

A defining feature of this livestock revolution is the industrialization of poultry production systems, made-up of large-scale industrial farms that intensively raise large numbers of birds. Yet the poultry sector in many countries that have

[18] The exact role that both wild birds and trade played in the initial spread of H5N1 remains debated. However, as the current study is primarily focused on what happened following disease introduction and the further entrenchment of H5N1 in poultry, this debate on the early spread of the virus is not discussed at length here. For a more thorough discussion see (Fournié, de Glanville, and Pfeiffer 2012).

experienced this revolution remains diffuse and diverse, with the majority of birds raised for consumption still sold through traditional marketing structures such as live bird markets (Sumiarto and Arifin 2008b). In Indonesia, for example, although large-scale poultry production companies may initially hatch the majority of birds raised for consumption, most of these birds will be sold to smaller contract farmers for finishing, and then perhaps to other poultry traders and farms, and eventually on to consumers through LBMs (Forster 2012; USAID 2013). What this can amount to in countries like Indonesia and China, with billions of poultry at any one time, is a diffuse and extensive trade network where poultry traders and farmers move birds between rural and urban environments, between farms and trading yards and markets, and further afield, across both domestic and international boundaries.

This trade likely facilitates the spread of disease between flocks (Sims 2007), and poultry traders, who may move between multiple farms and communities each day, have been implicated with spreading H5N1 between farms and poultry trading yards (M. Van Kerkhove et al. 2009). In Hong Kong, an increased risk for disease transmission at farms was associated with poultry traders visiting (Kung et al. 2007). In Viet Nam, traders may spread H5N1 between divergent administrative units (Magalhães, Pfeiffer, and Otte 2010). In Indonesia, disease events in village chickens have been associated with the transport of poultry to and from communities (Santhia et al. 2009). Illegal inter-island trade in birds in Indonesia is considered a potential source for disease spread (Millar et al. 2015). Trade in poultry between countries is also responsible for disseminating H5N1 viruses. The border between southern China and northern Viet Nam, for example, is a particularly busy transfer point for poultry traded in both legal and illegal ventures (T. Nguyen et al. 2009; Sims et al. 2005; Fournié, de Glanville, and Pfeiffer 2012), and this route has been identified as a key point of entry for H5N1 viruses into south east Asia (T. Nguyen et al. 2009; C. T. Davis et al. 2010), with H5N1 isolated in Malaysia, Thailand, Laos, and Cambodia traced back to Viet Nam and their poultry trade with China (G. J. Smith et al. 2006; M. Van Kerkhove et al. 2009; Buchy et al. 2009).

The diffuse and extensive structure of the contemporary poultry trade facilitated the spread of avian influenza between and across countries, and is also considered a primary factor in the maintenance and circulation of H5N1 in endemic countries (FAO 2011). Indeed, poultry sectors in endemic countries are generally characterized by increasing demand for all type of poultry, rapid growth in poultry production and distribution, a significant proportion of ducks, and complex trade networks where most birds are sold through traditional marketing structures. Other contextual features common to endemically infected countries include limited resources and relatively weak public and private animal health services, as well as inadequate commitment to H5N1 control and eradication programming among officials and the public (FAO 2011). In identifying features of the wider poultry sector that help maintain and disseminate H5N1 viruses in endemic countries, the question arises: are there other variables – or risk factors - associated with virus persistence and disease outbreaks in poultry?

Discussed in further detail in the last section of this chapter, contact with infected poultry is a primary risk factor for human infection with H5N1 (M. D. Van Kerkhove 2013), and thus identifying the pathways associated H5N1 spreads through poultry, may help reduce zoonotic risk. Although different clades may be linked to variations in transmission and pathogenicity in different birds (Pfeiffer et al. 2011), studies across endemic countries identify a broad range of factors generally associated with H5N1 in poultry across different countries. These can be demarcated into three broad categories: anthropogenic factors, such as roadways and human density; the presence of ducks; and, abundance of water and proximity to water (Gilbert and Pfeiffer 2012).[19]

Human population density in urban and rural environments is associated with H5N1 risk in poultry (Farnsworth et al. 2011; Gilbert and Pfeiffer 2012; Loth et al. 2011; Loth et al. 2010; Yupiana et al. 2010; Martin, Zhou, et al. 2011). Other anthropogenic factors include the density of road networks, (Fournié, de Glanville, and Pfeiffer 2012), which are identified as risk factors in Bangladesh (Loth et al. 2010), China (Fang et al. 2008), Thailand (Paul et al. 2010), and Viet Nam (Pfeiffer et al. 2007). Road density is also significantly associated with outbreaks in poultry in West Java, Indonesia (Yupiana et al. 2010, e803). In Java, Sumatra, and Bali, road length, human settlements, market locations, and transport were significantly related to H5N1 disease events in backyard poultry (Loth et al. 2011). In Bali, frequent transport of poultry in and out of villages is a risk factor for outbreaks among domestically raised chickens and ducks (Santhia et al. 2009).

Ducks can harbour H5N1 asymptomatically and can shed high concentrations of virus for extended periods. In analysing existing studies on risk factors, Gilbert and Pfeiffer state that, while not all studies found associations between the density of ducks and H5N1, the "factor found to be most frequently associated with HPAI H5N1 presence was the density of ducks", with a positive association found across most countries (2012). In brief, ducks appear to act as reservoir for H5N1 viruses, and are likely central to the maintenance and dissemination of these viruses in endemic countries.

A final risk factor identified across studies was the presence of water. Discussed above in relation to environmental contamination, H5N1 viruses can live for days in water. As Gilbert and Pfeiffer (2012) suggest, this may help explain why water is

[19] This is not an exhaustive review of risk factors for poultry. Indeed, other studies identify several additional factors associated with H5N1 outbreaks in poultry, including, for example, the presence of fighting cocks (Tiensin et al. 2009), cultural holidays, such as Chinese New Year (Soares Magalhães et al. 2012) and Vietnamese New Year (Pfeiffer et al. 2007; Minh et al. 2009), interactions between wild birds and poultry (Biswas et al. 2008), and bird slaughtering in live bird markets (Indriani et al. 2010). The aim of this section is not to identify every factor associated with disease in poultry, but to identify broad patterns and factors associated with risk across countries. For a more thorough discussion and analysis of these different factors associated with H5N1 risk in poultry see Gilbert and Pfeiffer (2012).

associated with H5N1 risk: perhaps ducks shed virus into streams and waterways in which other birds, and in particular chickens, rely on for drinking water. Having established prominent factors associated with disease in poultry, the next section focuses on avian influenza A H5N1 in humans, highlighting that while occasional poultry-to-human transmission continues, there is considerable debate about the actual risks associated with H5N1 and human health.

H5N1 and risks to human health

In human history, there have been several infamous influenza pandemics resulting from the genetic reassortment of human and avian influenza viruses (Q. Liu, Liu, and Yang 2013). There is great concern about avian influenza A H5N1 because it continues to infect humans with a high fatality rate and is considered to have the potential to mix with another influenza virus and evolve into a strain that readily transmits between people. The first known human case of H5N1 was identified in a child in Hong Kong in May 1997, and was followed later in the year with 17 additional human cases, and 6 resulting deaths (Claas et al. 1998). The next human case was not diagnosed until late 2003, and from then to June 2015 there have been 842 diagnosed human infections with H5N1 reported to the WHO, with 447 deaths (Table 1). Most reported infections and deaths have been in three countries: Egypt, Indonesia, and Vietnam. While Indonesia long reported the highest number of human H5N1 infections, cases in Egypt now surpass those in Indonesia, following a surge of new infections in late-2014 and 2015.[20]

There are debates as to whether the numbers presented in Table 1 accurately represent the number of people who have been infected with H5N1, and those who died as a result. These debates focus in large measure on the case fatality ratio (CFR) - the number of deaths from the disease divided by the number of known cases of the disease confirmed using WHO guidelines.[21] The CFR is important because it is used to provide an indication about how dangerous a virus is to humans, which is in turn used to inform policy makers.[22] The CFR for humans infected with H5N1 is over fifty percent globally, and exceeds 80 percent for those infected in Indonesia (M. D.

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[20] Source: http://www.emro.who.int/surveillance-forecasting-response/surveillance-news/avian-influenza-ah5n1-in-egypt-9-april-2015.html Accessed: April 9, 2015.

[21] Source: *WHO case definitions for human infections with influenza A(H5N1) virus, available at:* http://www.who.int/influenza/resources/documents/case_definition2006_08_29/en/ Accessed: April 10, 2015. For a human case of H5N1 to be confirmed along these WHO guidelines, they must be presenting with unexplained acute respiratory illness with temperatures about 38 degrees Celsius, and, in the previous seven days, for example, have had contact with somebody infected, exposure to infected poultry, their by-products, or a potentially contaminated environment, or consumed uncooked poultry in an area with known outbreaks in animals. As discussed above, these guidelines are critiqued by Palese and Wang (2012) as too restrictive, failing to capture many cases that do not seek medical assistance at hospitals, or assistance at hospitals that do not have the capacity to accurately diagnose H5N1 infection or draw samples to send to a WHO-approved laboratory.

[22] The CFR of H5N1 was at the centre of considerations of whether or not to publish the controversial studies on the modification of the H5N1 virus that made it more readily able transmit between ferrets (Toner and Adalja 2012). For extrapolating human health implications of influenza A viruses like H5N1, ferrets are the most ideal laboratory mammal for studying virus-host interactions of infection (Belser, Katz, and Tumpey 2011).

Van Kerkhove 2013; Adisasmito et al. 2013; Patel et al. 2014). Such numbers suggest that H5N1 is an exceptional risk to human health, especially in Indonesia, with most of those infected likely to die.

Table 1: Cumulative number of confirmed human H5N1 cases and resulting deaths reported[23] to WHO 2003 – 23 June 2015[24]

Country	**Cases**	**Death**
Azerbaijan	8	5
Bangladesh	7	1
Cambodia	56	37
Canada	1	1
China	52	31
Djibouti	1	0
Egypt	344	114
Indonesia	199	167
Iraq	3	2
Lao People's Democratic Republic	2	2
Myanmar	1	0
Nigeria	1	1
Pakistan	3	1
Thailand	25	17
Turkey	12	4
Vietnam	127	64
Total	**842**	**447**

There is considerable debate, however, about whether the case fatality rate is accurate. Both the numerator – the number of known deaths from the disease – and the denominator – the number of known cases – used to calculate the CFR are subject to error. These numbers can be affected by the capacity of different health systems and populations' utilization and access to health care, in that not all hospitals will be able to provide accurate diagnosis of H5N1 cases and not all people will be willing or able to seek medical assistance. Some argue that the CFR of H5N1 reported by the WHO is "likely orders of magnitude too high" (Palese and Wang 2012, 2212), failing to capture potentially "millions" of subclinical cases that go

[23] Reporting of H5N1 cases in humans to WHO varies by country. Indonesia reports bi-annually whereas other countries report each month. This has the effect of delaying true comparisons across countries to the mid-point and end of each year.

[24] Source: http://www.who.int/influenza/human_animal_interface/H5N1_cumulative_table_archives/en/Accessed: July 4, 2015; Updated numbers from Egypt reported at: http://www.emro.who.int/surveillance-forecasting-response/surveillance-news/avian-influenza-ah5n1-in-egypt-9-april-2015.html Accessed: April 9, 2015.

undiagnosed, many of which may occur in rural areas away from medical systems equipped to diagnose H5N1 infection or send specimens to WHO-approved laboratories for confirmation (T. T. Wang, Parides, and Palese 2012). The inclusion of missed cases could alter both the numerator and the denominator significantly and may, as a result, lead the CFR to drop dramatically. While there is broad agreement that *some* infections and deaths of human H5N1 are being missed (M. Van Kerkhove et al. 2012), others argue that there is little evidence to suggest a substantial number of infections are going undiagnosed or unreported (M. Van Kerkhove et al. 2012; Osterholm and Kelley 2012; Toner and Adalja 2012). In short, the reported CFR is challenged by observations about the reliability of existing data on diagnosed cases and deaths.

One way of checking whether a vast number of cases are being missed is through serological, or seroprevalence studies. In humans, seroprevalence studies seek to determine how many people have serologic evidence of past infection with H5N1 by analysing their sera for the existence of antibodies (van Kerkhove et al 2012).[25] In doing so, seroprevalence studies can provide an indication of past infections in humans, and suggest whether the denominator in the CFR is accurate. Seroprevalence studies are, however, subject to their own limitations and weaknesses: they cannot precisely identify when or how somebody was infected, and they may not be sensitive enough to pick up all past infections as the presence of antibodies may become undetectable over time (Buchy et al. 2010). Furthermore, seroprevalence tests for H5N1 are not always reliable: "Some tests are plagued by false positives, others by false negatives; some may cross-react with other influenza viruses, and there may be limited correlation among the different tests" (Toner and Adalja 2012, 238). Some caution against "over-interpretation" of limited seroprevalence data, underscoring that serological evidence alone does not confirm acute infections (M. Van Kerkhove et al. 2012). They are also rarely generalizable across populations, as most studies examine a particular demographic considered at an elevated risk for exposure and infection (M. Van Kerkhove 2013)[26], such as people who raise or work with poultry (Ahsan et al. 1999; Santhia et al. 2009; M. Wang, Fu, and Zheng 2009; Huo et al. 2012; Schultsz et al. 2009; Uyeki et al. 2012; Ortiz et al. 2007; Kwon et al. 2012; Nasreen et al. 2015), health care workers and social contacts exposed to known human cases (Bridges et al. 2000; Schultsz et al. 2005; Apisarnthanarak et al. 2005; Liem and Lim 2005), and households and communities with known outbreaks in humans and poultry (Vong et al. 2009; Katz et al. 1999; Dejpichai et al. 2009). Nonetheless, while much remains unknown about H5N1 in humans, seroprevalence studies provide an important retrospective analysis about the extent to which a particular demographic has been infected.

[25] Different methods are used in different serological studies in humans. The criteria for serosurveys promoted by the WHO is considered most likely to identify "true positives" (Toner et al. 2013, 2), and thus upheld as the standard. For more on this see Toner and colleagues (2013).

[26] In a seroprevalence study in China that can be extrapolated more widely, no antibodies to H5N1 were identified (Zhang et al. 2011).

Regardless of demographic, most studies find either no evidence, or low levels of seroprevalence - <3% - even among those who are consistently in the presence of poultry in endemic countries (Toner and Adalja 2012; M. Van Kerkhove 2013). For example, seroprevalence studies in Indonesia – one in Bali (Santhia et al. 2009), and one in Java (Robert et al. 2010) - found no evidence of previous infection with H5N1, despite routine exposure to poultry among participants. Indeed, "even intense serological investigations" (M. Van Kerkhove et al. 2012, 1506–b) following human cases of H5N1 found very few, if any, undiagnosed cases. That people who rear, sell, and slaughter poultry in endemic countries do not show more systemic evidence of past infections in seroprevalence studies suggests that currently circulating H5N1 viruses cannot easily infect humans.

Seroprevalence appears to be higher in studies that examine early genotypes of H5N1, such as Clade 0, the virus responsible for disease events in poultry and humans in Hong Kong in 1997 (Toner et al. 2013). Looking at seroprevalence among poultry workers in Hong Kong at that time, Bridges and colleagues (2002), for example, found roughly 3 percent of their sample to have evidence of past infection. Similar rates were isolated among health care workers who were exposed to H5N1 positive patients in 1997 - evidence that the virus was then potentially capable of transmitting between people (Bridges et al. 2000). Clade 0, however, has not been detected since 1997. And while currently circulating strains are thought to have reassorted from this virus, serological studies since that time identify few positive cases, suggesting that Clade 0 may have been more infectious for people than contemporary H5N1 viruses (Toner et al. 2013). Although there appear to be "differences in the death rates associated with these different clades" (Toner and Adalja 2012, 237), and by age and by country (M. Van Kerkhove et al. 2012), whether these differences are in part or wholly attributed to genetic features or to differences in utilization and quality of health care is unclear.

Existing serologic evidence suggest it is unlikely that there are large numbers of mild or asymptomatic - and unreported - human H5N1 infections (Patel et al. 2014), and that, at present, H5N1 viruses do not easily transmit to humans. Nonetheless, the severity of illness and mortality associated with H5N1 infection in humans remains concerning: "Even if infections were being under-ascertained by a factor of 60… natural H5N1 viruses would still be 100 times as lethal as the 2009 H1N1 pandemic virus" (M. Van Kerkhove et al. 2012, 1506–b). Despite the relatively low likelihood of becoming infected with H5N1, the high fatality rate, and concerns that only a few mutations may make H5N1 more capable of human-to-human transmission (Horby et al. 2013), makes it important to question whether there are certain characteristics associated with infection and mortality.

There is variability in the clinical presentation of human infections with different influenza viruses. When humans are infected with H5N1, the incubation period – the time when somebody is infected but not presenting clinically – is around four days to one week. Common to H5N1 infections is severe pneumonia, and progression to respiratory failure that requires assisted ventilation, with many patients dying from

organ failure (Q. Liu, Liu, and Yang 2013). Men may be more at risk for infection with H5N1 than women, however, among those diagnosed, women appear to be more at risk of dying from infection (Mertz et al. 2014). The median age of human cases is 18 years. There is a greater likelihood of survival for those who are infected and under 4.5 years of age, especially in Indonesia (Patel et al. 2014). Overall, people who are infected in Egypt are more likely to survive than those infected elsewhere (Patel et al. 2014), suggesting disease severity and mortality may be in part related to different clades. There appears to be increased disease severity and mortality associated with delays in seeking medical treatment in Indonesia (Adisasmito et al. 2013) and China (Yuen et al. 1998); it is not known if this is the case elsewhere. Starting antiviral therapeutics early is associated with decreased disease severity and mortality (Chan et al. 2012; Adisasmito et al. 2010); the topic of treatment for human H5N1 infection is taken up in more detail in Chapter 3. Smoking does not appear to be associated with increased risk of death from H5N1, although it may increase risk of infection (Bridges et al. 2002). There may also be genetic and immunologic determinants that influence disease transmission and the severity of human infection with influenza viruses, although this remains largely understudied (Horby et al. 2013). Ultimately, as few data are generalizable, much remains unknown about different demographic indicators, comorbidities, and other risk factors associated with human H5N1 infection and mortality across different countries, and different clades (Patel et al. 2014; M. Van Kerkhove 2013). Wider environmental and seasonal factors may, however, play a role in avian influenza transmission in both human and avian cases (Mathur et al. 2014; Durand et al. 2015).

Consistent with increased disease events in poultry, the majority of human H5N1 infections occur during the winter, when temperatures decrease (Mathur et al. 2014). Epidemiological studies find that the majority of human H5N1 infections are generally associated with exposure to live virus from sick or dead birds, contact with contaminated fomites, or indirect transmission in contaminated environments (M. Van Kerkhove 2013; M. Van Kerkhove et al. 2011; Patel et al. 2014). Though contact with infected wild birds is a risk for human infection (Gilsdorf et al. 2006), most human cases come from exposure to sick or dead domesticated poultry. In Viet Nam, for example, preparing sick poultry, or having sick or dead poultry in the household, are factors associated with human H5N1 infection (Dinh et al. 2006; Thorson et al. 2006). Similar findings are reported from Thailand (Areechokchai et al. 2006), and China (Zhou et al. 2009). The majority of human H5N1 infections in Indonesia are also associated with contact with sick or dead poultry (Yupiana et al. 2010; Sedyaningsih et al. 2007).

Human-to-human transmission of most influenza A viruses primarily occur via exposure to respiratory droplets of infected individuals that are aerosolized when they cough or sneeze (Cowling et al. 2013). Whether H5N1 can transmit between humans in this way, however, is debated. Of the few suspected cases of human-to-human transmission, most have occurred between blood relatives (Aditama et al. 2012; Aditama et al. 2011; H. Wang et al. 2008; Gilsdorf et al. 2006; Kandun et al.

2006). It is not certain, however, if these clusters of infections resulted from human-to-human transmission or exposure to a common non-human source. Some challenge suspected cluster infections, urging consideration of the many indirect ways that humans can become exposed to virus from sick poultry, for example, through touching unwashed hands, cooking utensils, and consuming food (Lee 2007). In this way, a number of infections can occur within a family that resembles a cluster infection – suggesting human-to-human transmission – though the true cause may be environmental contamination. However, as most suspected cluster infections occur between blood relatives, there may also be genetic and/or immunological influences on transmission (Horby et al. 2013). While aerosol transmission of H5N1 remains a potential threat and great concern (Herfst et al. 2012; Cowling et al. 2013), H5N1 has not been found to readily transmit via an airborne route (Lee 2007).[27]

More indirect routes are not well understood but there is evidence of human infections resulting from contact with virus in contaminated environments, such as water used for swimming and bathing (Cavailler et al. 2010; Vong et al. 2009). Faeces from infected birds that is used for fertilizer may also present a risk for human infection (Kandun et al. 2010). Such contamination results from the fact that H5N1 can live outside of a host species, for example, on fomites (Indriani et al. 2010), in rainwater (Horm, Gutiérrez, Nicholls, et al. 2012), dust (Spekreijse et al. 2012), and mud and soil (Horm, Gutiérrez, Sorn, et al. 2012) for days, depending on a range of factors such as temperature. Live bird markets that house and slaughter birds on site can provide an optimum environment for viral maintenance and replication, and have been associated with avian influenza transmission in poultry and in people (Webster 2004; Fournié, de Glanville, and Pfeiffer 2012; M. Van Kerkhove 2013; T. Anderson et al. 2010; Mounts et al. 1999). When Hong Kong experienced the first outbreak of H5N1 in 1997, 6 of 18 infected individuals were believed to have been infected in LBMs. Exposure to poultry at these markets has been associated with a four-fold increase of risk for infection (Mounts et al. 1999).[28] Indonesian live bird markets have been linked with human cases of H5N1 (Kandun et al. 2008), and in LBMs across the archipelago surfaces used for housing, selling, and slaughtering poultry have tested positive for H5N1 contamination (Indriani et al. 2010). Indonesian LBMs most commonly contaminated were those that have

[27] The debate over transmission routes is contentious partly because its conclusions would require very different public health responses to H5N1; as Brakston and colleagues 2007 point out, "Necessitating the use of airborne precautions [i.e. respirators] during a pandemic would require extraordinary resources and substantial advance planning; acknowledgement of a significant contribution of airborne transmission will affect where patients should be treated, how they would be triaged, the use of antiviral agents, and the choice of personal protective equipment" (2007, 257). Gardam and Lemieux, two authors of the above paper, further urge caution in relation to interventions: "We remain concerned that billions of dollars will be spent worldwide on respirators, with little understanding of their relative risks and benefits over surgical masks and control measures such as hand hygiene and neuraminidase inhibitors" (2007, 763).

[28] The virus responsible for this outbreak in Hong Kong was avian influenza A H5N1, clade 0. As discussed above, this clade may have been more infectious and caused more severe disease in humans than other H5N1 clades.

slaughtering facilities and those that market ducks. Other factors associated with H5N1 contamination included the presence of pigeons, as well as mixed-bird species caged together. The areas found to be most heavily contaminated in Indonesian LBMs were those where birds are slaughtered and defeathered, and where birds are sold (Indriani et al. 2010). The emergence of SARS in 2003, as well as the outbreak of H7N9 in early 2013 underscore the central role that LBMs continue to play in zoonotic disease processes (H. Yu et al. 2013; Guan et al. 2003).

Behaviours often associated with human H5N1 infections include visiting or working in a LBM, rearing poultry, making contact with sick and slaughtered birds, swimming in contaminated water, and cleaning faeces from bird cages (M. Van Kerkhove et al. 2011). That these common behaviours – undertaken myriad times daily in many countries - have not resulted in greater numbers of human infections indicates that H5N1 still does not easily transmit from poultry to people, or between people. Although transmission risk may increase for those in routine contact with high concentration of virus shed by poultry (M. Van Kerkhove 2013), human cases are not diagnosed near exclusively among people who slaughter and sell birds in LBMs. Whether PWP have built-up immunity from past exposure to influenza viruses, is but one important data gap that remains in understanding H5N1 in humans.

As this section demonstrates, establishing the risk posed to humans by H5N1 is contingent upon a host of questions. The CFR provides one indication of this risk, but is subject to several key weaknesses regarding an accurate calculation of the number of known cases and the number of known deaths. Seroprevalence studies provide important data about disease prevalence, but are open to distortion or error. From what is known about H5N1, it is reasonable to conclude that humans are not highly susceptible to infection. Yet, when human cases occur, they often lead to death, especially in Indonesia. And while most people who are infected with H5N1 have contact with a diseased or dead bird, much remains unknown about precisely how and when people are infected. PWP work at the human-animal interface and are of interest for understanding disease processes, not only because their habitual contact with poultry, but because if sustained human-to-human transmission were to occur, they may be among the first infected.

The data discussed in this chapter represent available scientific evidence of the risks posed by H5N1 for animals and humans. But these data do not exist in scientific isolation – they are incorporated into disease narratives, invoked to justify particular priorities, and operationalized into policy responses. These narratives and their associated policy responses will be the subject of the next two chapters.

Chapter 3: Epidemic narratives for H5N1: Implications for framing and responses

Introduction

This chapter introduces the concept of "epidemic narratives" as a way of viewing perspectives of a particular disease and the pathways of response that stem from these accounts. There are two dominant narratives of H5N1. The first focuses on the public health implications of the virus and frames avian influenza as a significant threat to global public health, and also global security and the economy, with policy responses primarily emphasizing the importance of mitigating human exposure and infection. The second narrative – the animal health narrative - draws on the absence of widespread animal-to-human or human-to-human transmission of the virus and contends that the main threat posed by H5N1 continues to be in relation to animals, and by extension the livelihoods of those dependent on poultry for production and marketing, and the well-being of consumers. Building on the insights and priorities of both of these narratives, a third, more recent narrative - the One Health narrative - emphasizes the importance of tackling the challenges posed by EID through interdisciplinary collaborative research and programming. Though all of these narratives draw attention to important aspects of avian influenza, and EID more generally, there are limitations and omissions within each that are reflected in alternative narratives, the subject of the following chapter.

Epidemic narratives

Throughout history, disease events in humans have triggered a range of familiar narratives, involving aspects of risk, fear, blame, control, and prevention, to name but a few. Termed *epidemic narratives* by Leach and Dry (2010), these accounts vary in how a disease threat is defined, who is seen as most affected, and what is viewed as the most desirable response. These narratives are not uniform: different actors and organizations, professions and populations, can invoke divergent, and sometimes competing narratives around the same pathogen. These narratives can also stigmatize certain people, places, and sectors who are seen as "at risk" of disease or potential vectors, all part of an *othering* processes which can lead to negative social, health and economic impacts (Leach and Dry 2010). They can also have other material consequences, in that some narratives are elevated above others, and ultimately utilized to distinguish and justify particular "pathways of response" (Leach and Dry 2010) - policies and interventions for containing and controlling the spread and impacts of infectious diseases.

In this thesis, I utilize the term epidemic narratives as an overarching framing tool, under which a range of narratives focusing on avian influenza can be distinguished and discussed. Attention to dominant and policy informing narratives circulating around H5N1 – the subject of this chapter - highlights those which remain

marginalized, including narratives about avian influenza among those working at the human-animal interface; these will be discussed in *Chapter 4: Alternative epidemic narratives*. Notably, these narratives often differ significantly in their constructions of the risk associated with H5N1, in what Keck conceptualizes as different "rationalities of risk" (2008, 209). There is indeed no agreed upon typology for epidemic narratives.

Though many epidemic narratives exist, dominant conceptualizations of emerging infectious diseases are as "outbreak narratives" (Wald 2008). "In its scientific, journalistic, and fictional incantations" outbreak narratives "follow a formulaic plot that begins with the identification of an emerging infection, [and] includes discussion of the global networks throughout which it travels, and chronicles the epidemiological work that ends with its containment" (Wald 2008, 2). Often commonly embedded within outbreak narratives are the identification of risk groups and localities where disease is said to flourish. Particular populations and places become framed as diseased or as potential vectors and, in a globalized era of interconnectedness and rapid transport, the communities and localities from where pathogens are said to emerge become discussed as near-neighbours that can threaten global public health security and the wider economy; HIV and AIDS and severe acute respiratory syndrome (SARS) are prime examples of how a once localized disease event can spread globally to impact divergent societies and economies.

Narratives about avian influenza (H5N1) have followed this tradition, with dominant outbreak narratives focused on the disease as a significant threat to global health and security. Scoones and Forster (2010) identify several different outbreak narratives circulating around H5N1.[29] The two most dominant narratives focus on human public health and animal health respectively. Of these narratives, public health commands the most attention and resources. This chapter identifies and discusses the implications of these two dominant narratives, paying particular attention to their material consequences by examining – and problematizing - the pathways of response (Leach and Dry 2010) that stem from them; when appropriate, I make reference to these programmes in Indonesia. In doing so, following Leach and Dry, I aim to "make explicit some of the implicit assumptions that shape scientific and policy perspectives" (2010, 4). While these two dominant narratives characterize early responses to avian influenza, more recently they have coalesced around a third narrative, found in the One Health approach. Apart from these dominant narratives, alternative narratives have also been documented, with most focusing on the experiences and perspectives of people at the human-animal

[29] Scoones and Forster (2010) identify a third dominant narrative they term *preparedness*. For them, this narrative centers on the notion that "a major economic and humanitarian disaster is around the corner and we must be prepared", and is represented by a wide network of businesses, different government agencies, humanitarian organizations, and civil society groups. While preparedness planning for avian influenza has been impressive – and extensive – I do not elaborate further on this narrative here because I see the preparedness narrative as representing perspectives and response pathways that largely dovetail with the other two dominant narratives.

interface. This chapter concludes the discussion of dominant narratives about H5N1 and leads into the following chapter's discussion of some alternative narratives in order to identify a unique contribution that this research makes towards understanding the construction of risk and behaviours among people who work in live bird markets in Indonesia.

The public health narrative

The public health narrative for H5N1 focuses on the potential for the virus to evolve to a form that readily transmits between humans, and derives from projections of potential mortality rates, coupled with knowledge of influenza's infamous past. Though influenza viruses have been a regular feature in recorded human history, the scale of the 1918-1919 pandemic, where estimates suggest 40 to 100 million people died (Johnson and Mueller 2002), has cast a long shadow over public debate and policy. Consideration of the contemporary ease of mass transport and the increasing interconnectedness of the global economy has fuelled attempts to estimate how many people may die from a pandemic similar to that of 1918-1919 if it occurred today: these range from 175-350 million deaths (Osterholm 2005).[30]

Alongside projections of potential mortality rates are wider fears that the virus poses an existential threat to global public health, the wider economy, and security, with some concerned over the potentially for avian influenza to be deployed as a bioweapon.[31] Taken together, these concerns have helped align the human public health narrative with the *securitization* of the virus. Securitization is defined as the process by which an issue is "presented as an existential threat requiring emergency measures and justifying actions outside the normal bounds of political procedure" (Buzan, Waever, and de Wilde 1998, 23–24). The securitization of avian influenza has helped shape preferred interventions, and is apparent in policy documents and popular commentary.

When H5N1 was found to have spread across much of Asia, and later to countries in Africa and Europe, the virus was already anchored to the legacy of the 1918 pandemic (Institute of Medicine (US) Forum on Microbial Threats 2005, 10). Echoing these concerns, in 2007, the World Health Organization labelled the H5N1 virus among "the most feared security threat[s]" (World Health Organisation 2007,

[30] In contrast to the predominantly negative projections stemming from the 1918 outbreak, Houssin draws attention to the comparative advantages of the present day: "Contrary to 1918 we are not in a situation that leaves us entirely unarmed. In 1918, our grandparents did not even know it was a virus, they had no capacity for identification, and they had no way to fight or prevent this phenomenon. We are not in the same situation. Today we have a network of surveillance and epidemiology that, even if it is not perfect, has a certain capacity to react. We know it is a virus. We even know it intimately. We know its genome from A to Z. We are able to produce and transmit information rapidly" (2006, 36).

[31] See, for example, the debates regarding the publication of the two scientific papers (Herfst et al. 2012; Imai et al. 2012) mentioned in the first chapter describing the molecular changes required for H5N1 to mutate so as to be able to transmit between mammals via respiratory droplets (Doherty and Thomas 2012).

45). An impending influenza pandemic leading to a global catastrophe was almost assumed:

> Virtually every expert on influenza believes another pandemic is nearly inevitable, that it will kill millions of people, and that it could kill tens of millions – and a virus like 1918, or H5N1, might kill a hundred million or more – and that it could cause economic and social disruption on a massive scale. This disruption itself could kill as well (Barry 2005, 5).

Similar concerns permeated public discussion and the media. Writing in 2005, United States' Senators Barack Obama and Richard Lugar penned an editorial arguing that avian influenza "could cause millions of deaths, destabilize southeast Asia (its likely place of origin), and threaten the security of governments around the world" (Obama and Lugar 2005). These fears were shared in the United Kingdom, with some officials deeming H5N1 "as serious a threat as terrorism" (Lean 2005). Writing in *Military Medicine*, Feldman and colleagues (2007) multiplied the security threat of old and new pandemics, arguing that co-infection of HIV and AIDS and H5N1 could result in military and political instability in Africa. Science journalist Laurie Garrett argued for ever more securitization as a way of preparing to meet the threat of a future influenza pandemic (2005).

Beyond potential morbidity and mortality rates, significant economic costs were associated with the virus (Herring and Lockerbie 2010). When H5N1 was first diagnosed, Asia's poultry industry was growing rapidly to meet demand for increasingly urbanized populations in Asia and further abroad: between 1994 and 2004 the number of birds raised for consumption in Asia rose from 4 billion to 16 billion (Liverani et al. 2013; Nikiforuk 2005). As outbreaks of H5N1 in poultry were diagnosed across parts of Asia and beyond, disease control efforts were undertaken at a great economic cost. In Viet Nam, for example, in 2003-2004 approximately 45 million birds were culled, with losses estimated at US $118 million (Rushton et al. 2005). Estimates suggest that agricultural growth in Thailand halved as a result of H5N1 in poultry in 2003-2004 (FAO 2004). The cost of H5N1 in Hong Kong in 1997 is estimated at hundreds of millions of dollars (FAO 2004). Approximately 150 million poultry have been culled since 2003, causing a loss of $470 million (Pongcharoensuk et al. 2012). Early estimates and projections suggested that H5N1 could lead to a decrease in demand for poultry products that could ultimately cost southeast Asian countries upwards of US$ 280 billion (E. Bloom, Wit, and Jose 2005). The costs associated with controlling avian influenza in poultry do not impact all sectors equally (Coker, Hunter, et al. 2011). Along with agriculture, other sectors, such as tourism, can also suffer. While it is difficult to estimate the costs of H5N1 to small-scale producers, some contend that these producers, and those reliant on poultry for their livelihoods, shoulder the majority of losses stemming from H5N1 in birds (Verbiest and Castillo 2004). In brief, H5N1 has been presented as an extraordinary threat to the global bird trade, and to the wider economies of many countries (Cooper and Coxe 2005).

Older concerns about the potential of infectious diseases to be weaponized and deployed in an act of bioterrorism resurfaced (Washer 2010). H5N1 was fodder for some public health and national security officials in the United States who argued that preventing a bioterrorist attack would require further incorporation of the "agencies and institutions of the life sciences and public health into the national security establishment" (Lakoff and Collier 2008). The threat of a rogue state or terrorist organization deliberately spreading an infectious disease agent continues to sway research and policy on avian influenza, as seen recently in the controversy surrounding two studies in which the H5N1 virus was made more transmissible among ferrets (To et al. 2012). In short, avian influenza was "one of the most prominent international health issues to have become securitized over the past decade" (Elbe 2010a, 478).

Securitization can function as an "accenting device" (Snow and Benford 1992), elevating an issue to be a top political priority, forcing unwilling governments to take action (Buzan, Waever, and de Wilde 1998), and can lead to the re-assignment of policies and re-allocation of resources (Aldis 2008). The securitization frame thus leads particular forms of evidence and research methodologies to be favoured and funded, in effect conferring "legitimacy upon particular aspects of reality while marginalizing other aspects" (Lawrence 2000, 93). Particular response pathways can follow and are manifest, in relation to avian influenza, in some of the more prominent interventions to contain and control the spread and impact of the virus.

Public health narrative: response pathways

The public health narrative for avian influenza - and influenza more generally – favours and promotes 'proven' preventative and therapeutic interventions, identified as such by epidemiological modelling data. As data are often limited, especially at the outset of a novel disease event, these models combine historical and contemporary data to simulate different control strategies for potential disease events, to ultimately evaluate their efficacy and identify the "interventions most likely to impede the spread of influenza" (M. Davis, Stephenson, and Flowers 2011, 5). Put another way, these models rely on "heroic assumptions – such as diseases spreading in concentric circles, the relative insignificance of borders of countries and districts, and the easy prevention of people from moving" (I Scoones 2010, 151) – in making predictions about how a disease event will transpire and spread, and in predicting the ease and outcome of using a particular intervention.

Influenza pandemics, however, are unpredictable events. In this uncertainty, policy makers are drawn to models to determine interventions because they offer a degree of statistically assessed certainty (Leach and Scoones 2013), allowing them, "when confronted with an existential threat… to justify expending scarce resources in purchasing statistically validated, proven means" (Kamradt-Scott 2012, S121) to

protect public health. Leach and Scoones[32] highlight how two models of H5N1 in Thailand (Ferguson et al. 2005; Longini et al. 2005) "fed perfectly into the 'outbreak' narrative gripping policymakers" (2013, 11), and were used as the base of evidence for global bodies and national governments. These papers conclude that to quell the spread of influenza, should it mutate to transmit between humans more efficiently, requires the rapid dispersion of antivirals as prophylaxis, to either everybody in a five kilometre radius of a confirmed case (Ferguson et al. 2005), or to all those ill, as well as their social contacts (Longini et al. 2005).[33] The success of mass prophylaxis is understood to hinge on prompt detection of new cases as well as the imposition of strict quarantine and other social distancing measures. This set of interventions – surveillance, antiviral therapeutics, and social distancing - combined with vaccine development and other non-pharmaceutical measures have long been affixed to the public health narrative of influenza, and were favoured in public health strategies for avian influenza.

Surveillance[34] has been an essential feature of pandemic planning since 1952, when the Global Influenza Surveillance Network (GISN) was established with the aim of connecting National Influenza Centres (NIC) located around the world with WHO Collaborating Centres, known as WHO reference labs.[35] In brief, these labs identify and categorize influenza strains sent from NICs, ultimately to monitor antigenic changes in influenza viruses and to develop vaccines (WHO 2013). Today, surveillance involves a range of state and non-state actors focused on detecting novel and recurring disease events.[36] Detection, however, is not verification. Ministries of Health are primarily responsible for verifying cases, and for passing on viral samples to the WHO for laboratory confirmation: processes that necessarily precede an intervention, especially one on the scale advocated by Ferguson and colleagues (2005). While surveillance is essential to detect novel disease threats, and in developing preventative and therapeutic pharmaceuticals, it suffers from

[32] In their discussion of the differing assumptions of each model, Leach and Scoones highlight the importance of considering the factors influencing the social life of models. This includes hierarchies within and between disciplines that may influence what data are privileged, and "scientists' social values and positions in shaping their particular readings of the world" (2013, 15). For more detailed discussion of the sociology of modeling see: (Mansnerus 2013; Mattila 2005).

[33] The number of treatments deemed necessary to disperse in order to contain the hypothetical virus differs between the two papers: whereas Ferguson and colleagues (2005) suggest that 1 to 2 million drug will be required, Longini and colleagues (2005) suggest that between 100,000 and 1 million courses would be necessary.

[34] Surveillance systems extend beyond state and global institutions, to include private companies, such as Google, who undertakes global syndromic electronic surveillance of online search terms to determine where disease events occur. Google describes their surveillance programme: "We've found that certain search terms are good indicators of flu activity. Google Flu Trends uses aggregated Google search data to estimate current flu activity around the world in near real-time." See: http://www.google.org/flutrends/about/how.html Accessed: October 19, 2013.

[35] From 40 NICs in 1952, the GISN has now grown to comprise 135 centres in 105 countries, with six WHO reference labs in the United States, the United Kingdom, Japan, China and Australia.

[36] For more information on current, dominant surveillance strategies for influenza viruses see WHO 2013.

bureaucratic processes. Despite the International Health Regulations'[37] power to pressure countries to share information and samples from outbreaks, surveillance is easily disrupted by an unwillingness to report or share data.[38]

Vaccines have been a primary feature of the public health narrative since the 1950s, when developing a "safe and effective" vaccine was upheld as one of the "single most important public health tool for decreasing the morbidity, mortality, and economic effects" of a potential influenza pandemic (Poland 2006). Should human-to-human transmission of H5N1 increase, vaccines, "even if of low efficacy", are promoted as an intervention that "could significantly reduce attack rates" (Ferguson et al. 2006, 448). Despite "promising preclinical and clinical data" (Pica and Palese 2013), a universal influenza vaccine remains aspirational; virus-specific vaccines, or combination vaccines, are what, at present, are possible.

Human vaccines for avian influenza viruses, including H5N1, have proven far more difficult to develop than seasonal varieties (Subbarao and Joseph 2007). One problem is that H5N1 viruses are "lethal to the embryonated egg" where they are grown, meaning that the usual process of generating antigen using eggs is not possible. Thus with H5N1, attenuated strains are developed through reverse genetics, processes "which typically yield less than half of the antigen of that achieved with interpandemic strains" (Manzoli et al. 2009, 482). Because most populations are immunologically naïve to the virus, two doses of vaccine are considered necessary to elicit adequate immunity (Baz et al. 2013). Two doses become difficult to administer effectively, as it can take up to 6 months to develop an effective vaccine (Ferguson et al. 2006). Some suggest manufacturing capabilities cannot exceed 500 million doses within twelve months (I Scoones and Forster 2010), at which time any vaccine would likely be too late. In short, H5N1 vaccine development remains difficult because genetic and antigenic factors of different H5N1 subtypes are not fully understood, and because manufacturing capacity is limited (Luke and Subbarao 2014).

With efficient vaccines difficult to produce, antiviral therapeutics – and specifically *Oseltamavir*, generically called *Tamiflu* - were promoted by institutions informed by the public health narrative as a "second, more reliable" (Kamradt-Scott 2012, S116) measure for treating those infected with H5N1. In part determined by demographic, clinical, and biological factors, when administered promptly with the onset of symptoms, Oseltamavir is upheld as the most effective antiviral for treating H5N1 infection (Chan et al. 2012).[39] There are concerns, however, that an over-reliance on one antiviral for H5N1 infection could result in drug-resistant variants of avian

[37] See: http://www.who.int/ihr/en/. Accessed, October 22, 2014.
[38] See, for example, the discussion in Chapters 1 and 4 about the former Indonesian Health Minister Supari refusing to share virus samples. For more on this, see: (Elbe 2010b).
[39] In 2006, Indonesia established a policy objective to vaccinate 0.5-1% of its population with *Oseltamavir* (Pongcharoensuk et al. 2012).

influenza (Govorkova et al. 2013); combination therapies may offer more efficacious therapy (Dunning et al. 2014), but this too requires more research.

Exactly which clade will produce an influenza pandemic is of course unknown, making it difficult to predict and manufacture vaccines to adequately prevent infection, or an antiviral for treatment. Pursuing these strategies, however, remain a top priority, with vaccines and antivirals seen as "the two most important medical interventions for reducing illness and deaths" from influenza (International Monetary Fund 2006, 12). With multilateral bodies such as the WHO, the World Bank, and the International Monetary Fund "fixated" (Kamradt-Scott 2012, S117) on the efficacy of vaccines and antivirals, national governments were encouraged to prioritize these strategies in developing pandemic influenza preparedness plans (WHO 2005). Combined with the limitations of manufacturing capacity, costs of production, and barriers to distribution, the preference for vaccines and antivirals inevitably led to stockpiling by national governments, as well as individuals.[40] Limited access to vaccine and antivirals raised ethical and moral questions about the way in which these finite interventions are dispersed - To whom? And in what order? - in part challenging the very notion that public health is for all.

A less dominant response stemming from the public health narrative focuses on non-pharmaceutical options like public education and the promotion of social distancing should a pandemic occur. Public education is a preventative strategy that aims to increase the scientific literacy of populations deemed to have inadequate knowledge about aetiology, and preventative and therapeutic measures. These strategies derive from the idea that recall of some degree of scientific knowledge about a disease translates to behaviour change. In 2006 UNICEF became the UN agency responsible for altering people's behaviour at the human-animal interface to prevent the emergence of a pandemic influenza. Their behaviour change communication strategy comprised of four key messages: report sick or dead birds, cook poultry thoroughly, separate birds by species and by origin, and wash hands after any contact with poultry or related by-products.

Though public education campaigns do not command the same attention or resources as 'proven' technological solutions such as vaccines (I Scoones and Forster 2010), they are nonetheless considered integral components of long-term preventative public health programming for avian influenza, especially where the virus is endemic in poultry. Yet, public education about avian influenza does not necessarily translate into behaviour change (Neupane et al. 2012), and can have challenges in implementation (Alders and Bagnol 2007). This can be because structural and social factors impede individuals from altering their behaviours. As UNICEF recognizes, "perceptions of risk, poverty, difficult living conditions, poor access to resources and deep-rooted cultural practices" can "prevent people from

[40] Doses of Tamiflu were selling through the online retailer *eBay* far above its original cost.

practicing safe behaviours."[41] As will be discussed in relation to marginalized disease narratives, there are also inherent limitations in seeing a population as deficient of knowledge, rather than as possessing certain unique, alternative forms of knowledge arising from experience.

Efforts to change behaviours at the human-animal interface draw attention to the role that individuals play in aiding or hindering efforts to prevent or contain certain global disease threats. These efforts are sometimes cast in the public health narrative in terms of global public goods (GPG). Global public goods are defined as: "A good which it is rational, from the perspective of a group of nations collectively, to produce for universal consumption, and for which it is irrational to exclude an individual nation from consuming, irrespective of whether that nation contributes to its financing" (Woodward and Smith 2003, 9). Applied to avian influenza, this means that prevention and containment of the disease benefits everyone, irrespective of whether an individual, a community, or a country actively and equally contributes to its attainment (R Smith and MacKellar 2007). Given that certain types of behaviours are implicated in increasing the risk of avian influenza transmission (Janes et al. 2012), attention to global public goods means that individuals' behaviours cannot be considered solely their own - what they do has implications for others.

Another preventative non-pharmaceutical intervention promoted by the public health narrative is social distancing, a strategy that aims to keep people from congregating in large numbers. Manifest in the closure of schools, public transport, and other settings where people gather, keeping people apart and isolated in some US cities during the 1918-1919 pandemic was found to cut the death rate by up to half (Markel et al. 2007; Hatchett, Mecher, and Lipsitch 2007). These are convincing data for policy makers who understand the difficulties in procuring and dispersing pharmaceutical options should a pandemic occur.

Social distancing, however, is difficult to monitor and enforce, and can require active quarantining of infected individuals and others, as not all people willingly oblige to the measure. The current Ebola epidemic in west Africa illustrates that enforcing social distancing can require physical force to make sure that suspected infected individuals are kept isolated.[42] Thus, this may not be a sustainable preventative measure. Serious questions about the imperatives of human rights considerations versus those of the global public good arise. Should a generalized influenza pandemic emerge, social distancing would likely prove difficult to maintain, as not all people will have the resources to remain isolated for extended periods, and governments may be unable to enforce such measures for long periods.

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[41] See UNICEF Communication Strategies for Avian Influenza: http://www.unicef.org/avianflu/index_42666.html Accessed February 26, 2015.

[42] A video of fully-suited public health workers wrestling to constrain a suspected Ebola infected individual to ensure he is isolated from others is available at: http://www.channel4.com/news/fugitive-ebola-patient-wrestled-into-ambulance-video Accessed February 28, 2015.

A final response stemming from the public health narrative articulates the need for general strengthening of health systems, a long-term strategy that improves the ability to achieve and maintain certain global public goods such as the prevention and containment of certain communicable diseases such as avian influenza. This health systems approach focuses on building the capacity of local health structures, particularly in places where avian influenza is endemic, so that they are able to diagnose and respond to localized disease events. This ambitious focus appeals to the notion of protecting public goods, in that it argues for collective action to promote health systems around the world as a means of preventing global communicable disease transmission (R Smith and MacKellar 2007). Yet supporting health systems suffers from the constraints of funding and political cycles: few governments are able or willing to fund the development of another country's health system over the long-term, especially when the benefits that may accrue from such action amount to the intangible absence of infection.

As outlined above, the public health narrative is the dominant outbreak narrative, and is premised on a construction of risk that frames avian influenza as an existential threat to global public health, the economy, and security. Focussed on mitigating human morbidity and mortality, the public health narrative has commanded attention and resources. Predominant pathways of response are seen in the various programmes and interventions which spawn from the public health narrative, ranging from surveillance, vaccines, and therapeutics, to non-pharmaceutical options such as behaviour change, social distancing, and developing health systems. While all of these interventions form part of a comprehensive response to avian influenza, each can be hampered in implementation because of technological, structural, and social considerations. Moreover, as discussed below in relation to biosecurity and One Health, the pathways of response are changing. As the next section discusses, other narratives compete to shape priorities and direct policy for avian influenza, the most significant being the animal health narrative.

The animal health narrative

The emergence of H5N1 elevated the role of veterinarians in zoonoses control, and in turn fostered a dispute between the public health and animal health communities regarding appropriate constructions of risk of avian influenza, leading to questions about how the disease should be framed: Who, and what are at risk?; And what are the best responses? Two organizations institutionally represent and promote the animal health narrative: the World Organization for Animal Health (OIE) and the Food and Agriculture Organization (FAO) of the United Nations. While the human public health narrative positions public health experts as central to response efforts for H5N1, the animal health narrative also asserts an authority over the disease, largely drawn from the fact that avian influenza is foremost a disease in birds. In the absence of human-to-human transmission of avian influenza, the animal health narrative contends that the main threat posed by H5N1 continues to be in relation

to animals, and by extension the livelihoods of those dependent on poultry production and marketing.

Keck's study of these disciplinary disputes about avian influenza is illustrative of a general tension in how they view risk: "As an animal disease, it could be addressed either by veterinarians or by physicians, depending on whether the virus was considered from the perspective of its consequences for animals or its impact on humans" (Keck 2008, 198). These different "rationalities of risk" – or risk constructions - have material consequences for determining the optimal allocation of power and resources to respond to the disease. In contrast to the public health narrative, which in emphasizing the *potentiality* of an inter-human spread has favoured *precautionary* and *preparatory* activities such as the stockpiling of therapeutics and vaccines, the animal health narrative suggests that *prevention* of disease at its source – animals – is of upmost importance. Veterinarians, in Keck's estimation, have been agitated over the diversion of resources towards these precautionary activities, asserting that "actual problems require more attention than virtual catastrophes" (2008, 213).

The animal health narrative advocates for controlling H5N1 promptly at the source by using standard veterinary interventions, such as culling, or stamping out, poultry diagnosed or suspected to be infected with the virus, vaccination of birds, and routine surveillance. When it became clear that H5N1 was endemic in many country's poultry stocks, the animal health narrative evolved away from an emergency mode, towards more sustainable long-term programming, manifest in novel surveillance strategies and the promotion of biosecurity. In all of these measures, the animal health narrative recognizes the importance of limiting the impact of disease and interventions on those whose livelihoods or nutrition derive from poultry. Despite these goals, from the outset the aim was to establish disease-free areas, leading to eradication of H5N1 from endemic countries. "Control and eradication is feasible", the FAO and OIE assert, because

> The tools, methodologies and approaches… have been successfully used by many countries to control and eradicate HPAI infections in Europe (Italy and the Netherlands) and North America (Mexico, USA and Canada) (FAO/OIE/WHO 2005, 10).

Employing the interventions outlined above and discussed below, in 2005, the OIE and FAO "expected that in 1-6 years time" most Indonesian islands, except Java, "will be free" of H5N1 (2005, 9). Today, H5N1 remains endemic in poultry stocks across the archipelago.

These measures are employed from a normative, professional perspective that any intervention leading to the prevention of spread of disease between birds will reduce the incidence of H5N1 infection in bird populations, which will, in turn, decrease the likelihood for human exposure and infection, and thus the potential for a pandemic. In this way, standard veterinary measures are seen as complimentary,

rather than in opposition to public health priorities. And while they have been critiqued as too focused on disease eradication (I Scoones and Forster 2010), and for failing to adequately address questions about what to do in contexts of endemicity, the responses discussed below come from careful positioning and politicking among animal health officials who have ensured that avian influenza is seen as more than a public health concern.

Animal health narrative: response pathways

After initial jostling for resources in 2003 and 2004, the OIE and the FAO began to work collectively when it became clear there were plenty of resources (I Scoones and Forster 2010). This required the demarcation of professional roles between the two organizations. In brief, the OIE's task line includes technical advice for establishing interventions, analysing and disseminating information, support and capacity building for laboratory services and national veterinary services, and promoting the safety of trade in animal products (FAO/OIE/WHO 2007). The FAO's role has been more applied, broadly dedicated to supporting the implementation of programming in conjunction with government structures and through regional and country-based-offices, and focused on bio-security, agricultural development, and livelihoods.

Both the OIE and the FAO have a long history of working to control and eradicate animal diseases. With H5N1 it was recognized that disease events in animals, and control at source programming, take place amidst diverse contexts, and with potential negative implications for those losing animals (FAO/OIE/WHO 2005). Although the animal health narrative is animal-focused, the FAO in particular recognizes that in each country, along with biological and epidemiological considerations, there may be unique economic, political, and social factors influencing, and influenced by, disease events in animals (FAO 2004). To address these realities, early on, the FAO established a *Socio-economic Working Group* to examine the "human dimensions" of avian influenza – and intervention programmes – in terms of their impact on households and livelihoods, food security, and markets.[43] To this end, they produced an extensive list of reports outlining short- and long-term agendas. Central to these reports was recognizing that any intervention hinged on a number of factors, including: the importance of context-specific messaging and programming, the need to work with public and private interests, the potential for economic shocks across every sector of the poultry industry, and the role that incentives, such as compensation, play in fostering trust and in facilitating surveillance activities, and thus the implementation of control measures (Rushton, Morgan, McLeod 2006). Those advocating for greater consideration of socio-economic factors, however, often found themselves at loggerheads with veterinarians (Scoones and Forster 2010). And while socio-

[43] For more information on the *Socio-economic working group,* along with their numerous publications, see: http://www.fao.org/avianflu/en/seworkinggroup.html. Accessed: February 22, 2015.

economic concerns were widely recognized in policy documentation (FAO/OIE/WHO 2005), early on the priority underscoring the animal health narrative was control at source using established veterinary measures, with eradication the "ultimate goal of all efforts" (FAO 2004, 11).

Culling, or stamping out, poultry aims to reduce environmental viral loads and the potential for disease transmission (Perry, Isa, and Tarazona 2009, 36), and is the central focus of programming initially promoted by the animal health narrative (FAO 2004; FAO/OIE/WHO 2005; FAO/OIE/WHO 2007). Avian influenza was eradicated from Hong Kong poultry stocks in 1997 through aggressive and comprehensive culling (Mounts et al. 1999; Sims et al. 2009). Informed by this experience, and under the guidance of the FAO and the OIE, highly-affected countries in Asia (China, Thailand, Cambodia, Vietnam, Indonesia) adopted culling as a primary control method (Empres 2004). To date, hundreds of millions of birds are estimated to have been killed as part of culling programmes (FAO 2013b). With culling, the boundaries of implementation can vary, from killing all poultry in a household where H5N1 has been identified, to killing all birds within a particular radius of where H5N1 is diagnosed or suspected (Otte et al. 2008). Over time ring culling – killing all birds located in a fixed 3 kilometre ring, for example – gave way to more localized, focal culling of particular flocks, as the latter method had considerably less economic and social impacts (FAO 2013b).

Culling has been met with resistance by some who raise and sell poultry, in part because compensation - although long considered an essential component of culling strategies, (Rushton et al. 2005) – is often limited or non-existent, with many countries either unwilling or unable to compensate people who lose their birds (Sims 2013). There are many instances where poultry owners are paid no compensation, or compensated below market value for their slaughtered animals (Naysmith 2013b; Simmons 2006; Catley, Alders, and Wood 2012; Azhar et al. 2010). Compensation does not ensure compliance, but a failure to compensate such loss may impinge upon public trust of veterinary officials, leading some to actively withdraw from disease control programming (Johansen and Penrith 2009). Moreover, if people are worried about losing their birds and not being paid, they may hide their flock, or sell it through informal channels, potentially outside of the realm of existing surveillance structures. With national veterinary services largely responsible for culling and surveillance activities, any such loss of trust may impede the efficacy and implementation of animal health programming more generally. Importantly, in contexts of endemicity, culling may have only a short-term impact on disease presence, as restocking of poultry post-cull can result in the reintroduction of the virus.

Culling can also have a negative impact on incomes, food security, and nutrition (Rushton et al. 2005; McLeod 2010; Sonaiya 2007). This is especially the case in a country like Indonesia, where the population derive the majority of their meat protein from chicken (USAID 2013), and where compensation for culled birds is uncommon. Here nutritional and economic shocks can amplify the stark dual

realities of food insecurity and poverty. Estimates suggest around 20 million Indonesians are undernourished - roughly 8.6 percent of the population (FAO 2012). Almost 53 percent of Indonesians fail to consume the international threshold of 2000 calories per day (WFP 2015). Malnutrition is particularly acute among children: roughly 37 percent of children under 5 years of age are considered stunted (WFP 2015). While there has been a significant decrease in the number of Indonesians that are generally food insecure, malnutrition and under-nutrition remain considerable problems that can be amplified and extended when birds die from disease or through culling campaigns. On the whole, stamping out H5N1 in endemically infected countries became recognized as largely inefficient, detrimental to livelihoods, and ultimately unsustainable (Capua and Cattoli 2013). Indeed, in recognition of the financial costs associated with culling and under pressure from large and small scale poultry producers who were concerned about their livelihoods, Indonesia's policy makers became more favourable towards poultry vaccination (Pongcharoensuk et al. 2012).

Prior to H5N1, vaccines were not widely used for highly pathogenic avian influenza viruses.[44] With increasing outbreaks of H5N1 affecting parts of Asia, some countries implemented large-scale poultry vaccination without prior experience on a similar scale, and with no articulated exit strategy. From 2002-2010, over 113 billion doses of avian influenza virus were administered in birds worldwide; the vast majority of these vaccines were for H5N1 and used in Egypt, Indonesia, Vietnam and the People's Republic of China (Swayne et al. 2011). Together these countries are home to tens of billions of poultry, many of them reared in backyards. From the outset these programmes suffered from inadequate management, poor quality vaccines, and a number of political, economic, and social considerations (Alders et al. 2007; Swayne, Spackman, and Pantin-Jackwood 2014; FAO 2013b).

The efficacy of poultry vaccines is primarily determined in laboratory conditions. In reality, "the antigenic variability and diversity" of viruses in endemic countries challenges the level of protection offered by vaccines, making "generalizations on vaccine efficacy problematic" (Hinrichs, Otte, and Rushton 2010, 3). There is no one optimal vaccine for H5N1. In many vaccine programmes in endemic countries, myriad suboptimal vaccines were administered by individuals and private actors, often away from the gaze of central government and national veterinary services. This matters primarily because the misapplication of vaccines of sub-optimal quality may hide clinical symptoms without actually reducing transmission (Desvaux et al. 2013); monitoring for the presence of H5N1 in poultry is more difficult if they are asymptomatically infected. Importantly, mass vaccination for H5N1 does not indicate adequate protection (serologically measured), and vaccines do not necessarily offer the same level of immunity in all target hosts: ducks, for example, can require larger doses of vaccine to induce immune responses than other species (Desvaux et al. 2013). Some vaccines and species require two to four doses per bird,

[44] In Pakistan in the mid-1990s, a vaccine was used for a highly pathogenic avian influenza virus, in this case H7N3.

each separated by three-week intervals, to trigger immune responses capable of conferring long-term immunity (Capua and Cattoli 2013). And many vaccines require a cold-chain (FAO 2011). This kind of vaccine schedule is expensive and can prove difficult to implement and monitor, especially in backyard environments, and contexts where billions of birds are reared and bred to be slaughtered within a few months (Hinrichs, Otte, and Rushton 2010).

In Indonesia, administering vaccine in commercial settings, where birds are caged and controlled, proved to be quite different from rolling out the campaign in backyards and villages, where birds roam freely (R. Thornton 2007). Although vaccination, in contrast to culling, was seen as an intervention "likely to gain much greater community support" (FAO/OIE/WHO 2007, 17), vaccines are considered by some small-hold farmers in Indonesia to be the source of disease (Naysmith 2010). And when vaccine teams in Indonesia were identified to have inadvertently spread the virus between locations, some populations actively resisted vaccination for their flocks (Sumiarto and Arifin 2008a; Normile 2007; FAO 2011). Though a mass vaccination campaign was proposed in 2004, with 300 million doses to be provided free to small hold farmers across Indonesia, financial constraints and limited supplies restricted government-led vaccination strategies to 12 provinces; commercial producers implement vaccination programmes independently. Studies testing the efficacy of vaccines in Indonesian poultry find different species developing varied levels of immunity (Sawitri Siregar et al. 2007). A combination vaccine for H5N1 and Newcastle disease was recently found to reduce disease events in semi-commercial and backyard birds in Indonesia (Bett et al. 2015). While such advances offer promise, ultimately there are still many technical and logistical difficulties in implementing H5N1 vaccination effectively (Swayne, Spackman, and Pantin-Jackwood 2014).

In most countries mass vaccination programmes have given way to more targeted interventions (FAO 2013b). And while routine vaccination is recommended for some poultry sectors in endemic countries (Domenech et al. 2009), "if reliance is placed on vaccination alone… it seems inevitable that not only will the virus spread to free areas but will become or remain endemic" (Capua and Cattoli 2013, 119). Learning from experience, it has become clear that vaccine for H5N1 is best utilized in conjunction with other systems and interventions, such as surveillance strategies and the implementation of biosecurity measures.

As in humans, surveillance of disease events in animals is essential to H5N1 control programming, and consists of many different elements (I Scoones 2010; FAO 2013b). Despite being central to monitoring the evolution of viruses, containing disease events, and in the development of effective pharmaceuticals, general "surveillance of human diseases that originate in animals remain in the nineteenth century" (Nature 2009, 889). Surveillance of H5N1 in animals is evolving, and can broadly be demarcated as either active or passive. In brief, active surveillance entails routine searching for disease in communities, along the market chain, and in live bird markets, and requires constant financial and logistical inputs. Passive

surveillance, by contrast, is more decentralized, and relies largely on voluntary reporting from community members who are supported by animal health officials, and who may receive some form of compensation for reporting. While active surveillance remains essential to monitor virus evolution, along with the success of control measures, as the endemic nature of H5N1 in countries like Indonesia became understood, active surveillance gave way to more passive surveillance systems that relied largely on the participation of poultry rearing communities (FAO 2013b).

Veterinarians started using participatory methods in the 1980s, and they have since become popularized in animal disease control programming (Catley, Alders, and Wood 2012). When H5N1 was identified in Indonesia, an early priority was establishing disease presence and distribution across the country's poultry stocks. The enormity of the task was apparent and, early on, it was recognized that community participation could assist more traditional, vet-led surveillance systems that had neither the resource nor capacity to undertake this work alone. Participatory Disease Surveillance and Response (PDSR) was introduced in Java in 2006, and focused near exclusively on small-hold, backyard farming communities. PDSR is considered both an active and passive form of surveillance, in that it relies on community members sharing information about disease events in poultry, and centres on training district-level animal health officials to conduct rapid surveillance, containment, and prevention activities when disease events are confirmed, along with raising community awareness (Azhar et al. 2010).[45] By 2011 PDSR was operating in 76 percent of all districts, in 29 out of 33 provinces (FAO 2011). At its height, the PDSR programme consumed almost 100 percent of the FAO's H5N1 response budget in Indonesia, though that number dropped to less than 50 percent. Of the 25,525 villages where PDSR activities were undertaken, approximately 11 percent were identified or suspected as having infected birds (Perry, Isa, and Tarazona 2009). The PDSR programme in Indonesia also consisted of a wider educational component, and roughly 150,000 meetings and consultations were held with communities and their leaders, households, and people working in the poultry trade (Perry, Isa, and Tarazona 2009; Azhar et al. 2010; Halton et al. 2013). The success of PDSR is largely found in the bolstered surveillance systems at the district level, in building relationships between communities and government officials, and in the training of thousands of animal health workers to detect and respond to disease events (Halton et al. 2013). Much like other animal health programming, however, the success of PDSR can hinge largely on whether people want to partake in programming.

PDSR represents an attempt to address the highly localized, context specific determinants of disease emergence, and in this, there is recognition that people can be active agents in the process of disease surveillance and control. And while active surveillance makes up a large part of PDSR, the programme is largely determined by

[45] Though *surveillance* and *response* activities were originally conceptualized as distinct (reflected in separate teams for each task), these two activities were merged in late-2007.

the willingness of community members to report disease events and accept resulting interventions. Although it has long been recognized that compensation can help determine participation (Rushton et al. 2005), such incentives are largely absent in Indonesia. The integration of PDSR into provincial Animal Health Services will further strengthen the capacity to detect and respond to zoonotic diseases. Sustainability of these programmes, however, will be in part determined by whether those who raise birds see benefit from participating. PDSR characterizes an evolution in the animal health narrative of H5N1 towards a more contextualized understanding of disease and its impacts, a transition that is also underscored by the promotion of biosecurity.

Biosecurity is defined broadly as "the product of all the actions taken to prevent the introduction of disease agents into a specific area and to safeguard the health of living organisms from hazards" (FAO 2013b, 50). In practice, biosecurity promotes the goals of both public health and animal health narratives. Three broad priorities underscore biosecurity: segregation, cleaning, and disinfection. Segregation implies creating and maintaining barriers to keep infected animals from uninfected sites; cleaning refers to cleaning all materials – potential vectors – entering uninfected sites; and, finally, applying disinfectant on these cleaned materials. Exclusion and containment of pathogens are primary. So too is the promotion of hygiene, as routine cleaning and daily disposal of market waste are associated with less environmental contamination in markets (Indriani et al. 2010). To meet these ends, biosecurity measures are primarily preventative. They work in combination, and in practice can include: creating barriers between commercial flocks and wild and domestic birds, routine cleaning and disinfection, appropriate waste removal policies, public education campaigns, behaviour change programming, market restructuring, the implementation of rest days, and market closure strategies. The appropriate mix of measures is recognized as necessarily contextually determined.

Biosecurity marks a shift away from heavy prioritization on culling and vaccine - more traditional veterinary measures - towards long-term thinking about the dynamic processes of disease maintenance and transmission in endemic countries, and in particular sites. In this, it is recognized that the virus is mostly spread along the market chain by the actions of people; human behaviours can both facilitate and hamper interventions. It is readily acknowledged that biosecurity needs to be difficult to avoid and easy to comply with (FAO, OIE, and WHO 2008). Economic incentives are identified as potentially necessary to ensure compliance, and thus the efficacy of programming.

Over the long term the range of measures promoted under the banner of biosecurity aim to restructure and update – modernize - poultry marketing systems, particularly in developing countries. Attention to biosecurity leads to the identification of particular locations and livelihoods as facilitating or maintaining disease. Whereas industrial producers in many countries are seen as capable of implementing adequate biosecurity independently, and largely left alone to do so, backyard farmers and live bird markets are identified as high-risk, and in need of

modernization (I Scoones and Forster 2010). And while biosecurity is considered necessary across different sectors in the wider poultry trade, attention and resources have primarily focused on the promotion of biosecurity among small-hold farmers and traders, and particularly in LBMs. As the focus of this research is LBMs, biosecurity measures are largely discussed in relation to these markets.[46]

Market-restructuring initiatives, as well as temporary and permanent market closures are central features to the promotion of biosecurity in LBMs. When appropriately designed and implemented, market restructuring activities can reduce and help to eliminate environmental contamination over the long-term (WHO 2006; FAO 2013a). Restructuring can entail large market renovations, building cages to keep poultry separated by flock and by species, as well isolated from people, providing potable water and soap, creating sloped drainage to remove effluent, as well as behaviour change initiatives. Participatory consultation with PWP was found to improve biosecurity following restructuring project in 2 Indonesian LBMs; some PWP in these markets were dissatisfied because they recorded lower sales than before the restructuring (Samaan et al. 2012). Market restructuring in Jakarta found PWP there also not entirely satisfied with the alterations in their markets (and market chains) because of associated economic loss (Forster 2012). Although restructuring can reduce risks on a long-term basis (FAO, OIE, and WHO 2008), it is a massive and expensive undertaking in a country with thousands of LBMs like Vietnam, China, and Indonesia.

Temporary and permanent market closure are increasingly utilized biosecurity measures (FAO 2013a). Government closures of LBMs in China during recent outbreaks of H7N9 are credited with limiting disease spread and human cases (H. Yu et al. 2013). Such tactics were also associated with eliminating H5N1 from LBMs in Hong Kong following the first round of disease events there in 1997 (Sims et al. 2003). In other cases, the benefits of this tactic are less clear. Indonesian officials temporarily closed a market in Bali in 2012 after fighting cocks tested positive for H5N1. Although this market closure was intended to last three weeks, it was not effectively enforced and the trade in live animals continued largely unabated (Naysmith 2013b). The trade in live birds does not necessarily stop simply because a formal LBM is closed; market closure may in fact push poultry marketing into informal channels that are more difficult to monitor for disease than currently operating LBMs (Fournié and Pfeiffer 2013). Moreover, market closures in places like Indonesia, where most meat protein is from chickens, may negatively impact access to meat and the consumption of protein, and thus further exacerbate existing food insecurity and malnutrition (WFP 2015).

If temporary market closures are employed they should be used only as a short-term solution, in concert with the disinfecting of the market, the provision of sufficient compensation for affected PWP, and when alternative venues are available to market poultry and meet demand (FAO 2013a). Permanent market closure

[46] For more on biosecurity see: FAO 2008; FAO 2013; Sims 2013; Capua and Cattoli 2014.

should only be considered as part of a long-term strategy. In either case, it may be necessary to ensure customers are able to access the birds they want, especially during holidays, otherwise alternative markets may emerge. Any such closure will likely require constant enforcement by officials – a form of centralized authority more characteristic of the political landscape in China and Hong Kong than that of decentralized Indonesia. Further research is required to understand how market closures impact PWP, and to determine whether an effective means can be found of preventing market closures from leading to a total reconfiguration of the poultry trade in a way that can amplify the spread of disease or limit access to food.

Importantly, when markets are closed, access to disease sentinels may be lost, making monitoring for novel pathogens and disease spread more difficult. Market closure, however, may not be necessary. A recent modelling paper suggests that interventions in certain centralized markets - "hubs" – can have a significant impact.

> The implementation of thorough, daily disinfection of the market environment as well as of traders' vehicles and equipment in only a small number of hubs can disconnect the network dramatically, preventing disease spread (Fournié et al. 2013, 1).

These interventions may be less detrimental to PWP than market closure. Targeting particular hub markets may also be more cost-effective and sustainable, considering that Indonesia, for example, has more than 13,000 LBMs.[47] Other interventions include the implementation of rest days at the market, strict movement of poultry, and routine use of disinfectant (FAO 2013a; Fournié et al. 2011). In the absence of coercion and strict enforcement, the likelihood of success for any biosecurity measure is greatly increased when target populations see a benefit in their active participation. Participation, however, does not guarantee that an intervention will be wholly successful, as Samaan and colleagues (2012) found. On the whole biosecurity broadens and extends the animal health narrative, promoting long-term programming along with a more comprehensive understanding of disease processes.

A major theme that arises from the application of dominant interventions stemming from the animal health narrative is that the particularities of the virus and the environment, as well as human behaviours, can interrupt their efficacy in practice. While initial programming focused on more emergency-like methods of immediate containment and eradication, as the embedded nature of H5N1 in places like Indonesia became apparent, programming became more progressive, linked to a long view of disease control that combined elements of the public health and animal health narratives, and culminated in the One Health approach.

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[47] Supported by the FAO and the Indonesian Ministry of Agriculture, a cleaning and disinfectant programme was implemented at 43 poultry collection yards and 14 LBMs in Jakarta in 2011. More on this programme is available at: http://www.fao.org/avianflu/En/news/jakarta_market.html Accessed April 13, 2015.

The One World, One Health narrative

The *One World, One Health* approach evolved from the *One Medicine* concept coined by Schwabe (1984), which posited a shared paradigm between human and veterinary medicine as a result of commonalities in animal and human physiology and pathophysiology (Zinsstag et al. 2011; Frank 2008). Other initiatives, such as the Veterinary Public Health (VPH) approach of the FAO and the WHO, offered insights from one discipline to the other but fell short of a truly holistic perspective on the interactions of human, animal and environmental health (Zinsstag et al. 2011). For many, this came in 2004, when a symposium in New York City on emerging infectious diseases produced a list of priorities and recommendations termed the 'Manhattan Principles'[48] for responding to infectious diseases from a broader perspective (FAO/OIE/WHO/UNSIC/UNICEF/The World Bank 2008, 51). These principles became the basis for the One World, One Health agenda, defined as the "collaborative efforts of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and our environment" (The American Veterinary Medical Association 2008, 13).

Endorsed at the *International Ministerial Conference on Avian and Pandemic Influenza* in New Delhi[49] in 2007, the initiative has since been upheld as the way forward for interdisciplinary collaborations to control zoonosis, and is now formally endorsed by a range of government bodies and global institutions, including the US Centers for Disease Control, the World Bank, the European Commission, as well as the WHO, the FAO, and the OIE – the three primary multilateral bodies charged with global policy development for avian influenza and other zoonotic pathogens. Scoones and Forster suggest that the One Health narrative provided a "last chance to rekindle support and interest" for collective efforts to control H5N1, partly by providing a platform for animal health to be "on par with the major players in the global scheme of things" (2010, 28).

As an agenda for research and policy development for EID, One Health has a compelling narrative, encapsulated in the name itself: the concept of One World, One Health conveys both the "global and inter-species sharing of health concerns and interests" alongside a call for expertise to be pooled from diverse disciplinary perspectives (Craddock and Hinchliffe 2015, 1). Both these qualities significantly differentiate the One Health narrative from the more siloed disciplinary perspectives and priorities of the human public health and animal health narratives. The authors of the Manhattan Principles were aware of the novelty and boldness of their proposal, concluding their guiding priorities by declaring: "Solving today's threats and tomorrow's problems cannot be accomplished with yesterday's approaches. We are in an era of 'One World, One Health' and we must devise adaptive, forward looking and multidisciplinary solutions to the challenges that

[48] See: http://www.oneworldonehealth.org/. Accessed, February 26, 2015.
[49] See: http://pib.nic.in/newsite/erelease.aspx?relid=33862. Accessed, February 28, 2015.

undoubtedly lie ahead" (FAO/OIE/WHO/UNSIC/UNICEF/The World Bank 2008, 52).

As could be expected, the implementation of a novel, integrated approach is more challenging than the declaration of it (Zinsstag et al. 2011).[50] Although the pooling of disciplinary insights to solve shared interspecies concerns is novel, the One Health narrative does not depart markedly from the approach and responses favoured by the other dominant narratives. In reinforcing the notion that controlling and eradicating H5N1 through emergency-type globally coordinated responses is a global public good, it aligns itself with the top-down normative standards of both the public health and animal health narratives. A central goal stated in the One Health strategic framework reads: "To diminish the threat and minimize the global impact of epidemics and pandemics due to highly infectious and pathogenic disease of humans and animals, underpinned by enhanced disease intelligence, surveillance and emergency response systems at national, regional and international levels, and by supporting them through strong and stable public and animal health services and effective communication strategies" (FAO/OIE/WHO/UNSIC/UNICEF/The World Bank 2008, 5). While enhanced surveillance and emergency responses may be necessary, they are insufficient in and of themselves. For this reason, some have cautioned that One Health must go further to avoid being "a new technical super-discipline, where two outbreak narratives are combined more forcefully and with more resources". In other words, "Old wine must not be placed in new bottles" (I Scoones 2010, 157).

One of the most promising potential consequences of the One Health agenda is the bringing together of multiple disciplines to respond to EID. As the Joint Strategic framework on One Health states, "the complex interactions of biological, ecological, environmental and socio-economic factors that act at the animal-human-ecosystems interface require multidisciplinary and multisectoral approaches" (FAO/OIE/WHO/UNSIC/UNICEF/The World Bank 2008, 33). For this, the One Health agenda – also called a "movement" - aims to build a "better sectoral balance" to address zoonotic health threats, particularly between public health and animal health, but also "to increase the participation" from ecologists, environmental and wildlife health professionals, and "social scientists and development actors." The "common theme is collaboration between sectors."[51] The One Health agenda in action, however, primarily amounts to collaboration between physicians, veterinarians and ecologists.[52] Although the One Health movement "has gained

[50] Zinsstag et al (2011) note, in particular, the persistence of siloed thinking about health issues, particularly in the public health sector. They cite the example of a H1N1 outbreak in Canada where coordination between the animal health and public health authorities remained elusory.
[51] See the One Health Global Network Webportal, *What is One Health?*: http://www.onehealthglobal.net/what-is-one-health/. Accessed March 12, 2015.
[52] See the US Centers for Disease Control One Health homepage: http://www.cdc.gov/onehealth/. Accessed March 12, 2015.

significant momentum" in the past few years, and is now "moving fast",[53] Scoones' earlier observation, that there is a need for greater inclusion of alternative forms of expertise in the One Health agenda, especially those that "extend beyond formal, accredited sources to encompass local experiential knowledge" (2010, 158), holds true today.

Notwithstanding overtures about including social science methodologies and methods in One Health approaches, in practice this is largely tokenistic inclusion, designed more to maintain the appearance of a multidisciplinary approach than to truly engage with the methods and findings of social science research (Janes et al. 2012; Craddock and Hinchliffe 2015). Indeed, despite the One Health agenda's call for interdisciplinary collaboration, some suggest that "the approach and the programme has tended to offer few opportunities for serious social scientific contributions or engagement" (Craddock and Hinchliffe 2015, 1). In some formulations, the main value-added of social scientists has been to facilitate "the ability of society to understand and accept scientific evidence and guidance for one health" (Zinsstag et al. 2012). This speaks to social scientists playing a bridging role between those who generate scientific facts and the public rather than legitimate generators of scientific facts themselves.

While "significant human behaviours" are at the centre of "propagation, prevention and transmission" of infectious diseases there is a paucity of social science research regarding efficacious approaches to understanding human behaviours and decision making processes (Lapinski, Funk, and Moccia 2015, 53). Social sciences offer methodologies and methods to understand, for example, "epidemiologically notable behaviours" in context – a necessary step towards designing effective interventions (Janes et al. 2012). Alongside appreciating all that the human and animal health narratives bring to avian influenza programming, as discussed above, their limitations also become apparent. Much remains to be understood about the experience of those living and working at the human-animal interface. Understanding the predominance of these dominant narratives in framing avian influenza and designing responses gives rise to important questions regarding what perspectives are "missing, obscured, hidden or blocked?" (I Scoones and Forster 2010, 39). What can alternative narratives about epidemic disease in general and H5N1 specifically reveal? This is the subject for discussion at the outset of the next chapter.

[53] See the One Health Global Network Webportal, *What is One Health?*: http://www.onehealthglobal.net/what-is-one-health/. Accessed March 12, 2015.

Chapter 4: Alternative epidemic narratives

Introduction

This chapter introduces a number of epidemic narratives that reflect alternative accounts of disease and distinct pathways of response to those of the dominant narratives described in the previous chapter. The alternative narratives outlined underscore the impacts of disease events and interventions on livelihoods, on the wider contextual influences on individual-level risks, on the variation in interpretations and responses among national and local level governments, and on the experiences of people living or working in contexts where disease may be part of the daily reality. This chapter argues that alternative narratives offer competing and complementary frames that, taken into consideration, have the potential to inform more equitable and efficacious pathways of response.

Introducing alternative narratives

There are myriad ways in which to interpret and define a disease event in animals and in people. Understanding the predominance of the dominant narratives in framing avian influenza and designing responses gives rise to important questions regarding forms of knowledge and alternative narratives that are overshadowed, side-lined, or missed. What accounts are not encapsulated in these mainstream formulations? And what can these alternative narratives reveal?

In discussing alternative narratives, several caveats are required. Alternative narratives are not necessarily framed in direct opposition to dominant narratives, but rather, are often articulated within the core organizations and structures that promote the dominant narratives. As discussed below in relation to the livelihoods narrative, for example, some at the FAO recognized early on that avian influenza can negatively impact the lives of those who raise poultry, and thus advocated for greater consideration of livelihoods when designing responses. Nonetheless, there is a difference between advocacy and action, and when alternative perspectives are discussed within the dominant narratives, it is often as "a polite add-on, before proceeding to the main argument" (I Scoones and Forster 2010, 39). Additionally, that some alternative narratives are voiced by subaltern, or marginalized communities that are most directly affected by disease does not mean that they should be taken to wholly, or more authentically represent a disease. As Leach and Dry (2010) contend, we should not simply replace dominant narratives with those that are alternative or marginalized.

Individual narratives provide only a partial account of disease. Despite this partiality, alternative narratives require consideration because they offer competing and complementary frames on disease that can inform more just, equitable, and efficacious pathways of response (Leach and Dry 2010). Attention to a multiplicity

of narratives highlights different "rationalities of risk" (Keck 2008) surrounding disease - that is, the manner in which the risk is constructed by a particular group. Forster, for example, has noted the "significant disconnect between the global construction of risk associated with H5N1 and the Indonesian one" (2010, 158), an observation that this thesis takes forward by examining, in part, constructions of risk among people who work with poultry in LBMs in Indonesia. These rationalities of risk shape what is seen as a threat, who is seen as affected, and how pathways of response are generated. Importantly, if response pathways are pursued without considering such alternative narratives, they may be at odds with local people's perceptions and priorities, which may in turn affect their willingness to engage, support or participate in disease programming (Leach and Dry 2010).

Though the discussion that follows does not claim to be a comprehensive account of alternative epidemic narratives about zoonotic diseases, or avian influenza specifically, it draws on experiences across disease control programming to briefly outline more prominent alternative narratives, which focus on livelihoods, risk environments, governance, and local realities.

Livelihoods and poverty narrative

One alternative narrative focuses on livelihoods[54] and underscores the disproportionately negative impact that both disease and disease control programming can inflict upon poorer populations who raise, sell, and eat animals that can harbour zoonotic pathogens. Culling, for example, can eliminate poultry or pig farmers' source of income and food security. As a result, interventions may face resistance from local populations. They may also find that, as Farmer has observed, "those least likely to comply are usually those least able to comply" (2004), in that interventions focused on behaviour change may face challenges if people perceive significant disincentives to alter their practices.

The relationship between dominant and alternative narratives is complex in relation to the livelihoods narrative. As discussed above, aspects of the livelihoods narrative are taken up by some core global organizations. Indeed, from early on, the FAO and others identified livelihoods protection and promotion – largely through compensation schemes - as necessary components of avian influenza programming (Rushton et al. 2005; FAO 2004). Livelihood considerations remain seen as a priority to the FAO and other policy bodies (FAO 2013b), as well as in the One Health agenda. Yet in practice, and seen in several country's responses to influenza – both H5N1 and H1N1 – livelihoods are largely neglected in interventions premised on dominant disease-focused narratives. For example, as discussed in Chapter 3 with reference to the animal health narrative, culling hundreds of millions of birds

[54] Though some scholars have interpreted "livelihoods" in broad terms, referring not only to "the satisfaction of material needs" but also "the satisfaction of emotional, spiritual and intellectual needs" (Bebbington 2000), for the purposes of this discussion, "livelihoods" are interpreted as "the means that a household uses to achieve that well-being and sustain it" (Messer and Townsley 2003, 8).

as part of H5N1 programming in endemic countries has had negative impacts on the livelihoods of low-income populations.

The consequences of marginalizing poor people's livelihoods can also be seen in government-led interventions in Egypt for H1N1 – the 'Swine Flu'. Blame and disease attribution are common communal responses to disease events, and those painted as responsible are often marginalized minorities lacking power or political representation (Washer 2010). In Egypt, in response to H1N1 the government invoked a common outbreak narrative, replete with blame and accusation, when justifying and enacting interventions (Tadros 2010). Despite all cases of swine flu reportedly imported by those arriving from elsewhere, the Egyptian government was quick to identify the pigs raised by *Zabaleen*, a primarily Coptic Christian minority of garbage collectors, as the source of disease, and ordered the pigs to be culled. Because of their profession and their beliefs, the Zabaleen had long suffered from discrimination and stigmatization. Culling was pursued, not because the pigs were the source of disease, but because of sectarian preferences of the Muslim majority, and because it enabled the government to exhibit strength and solidify political support. Zabaleen who resisted were physically forced to relinquish their pigs. With limited compensation and no consideration for how the pigs' value extends beyond the cost of their meat, the livelihoods of the Zabaleen were effectively "taken away" (Tadros 2010). The government culled the pigs in the name of public health. However, as garbage was left to rot across Egyptian cities, the culling programme effectively created a major health hazard.

This example illustrates how response pathways stemming from an outbreak narrative can negatively impact livelihoods, and simultaneously, depending on a range of factors across different countries, provide an element of cover for officials to target particular populations. Embedding a livelihoods narrative means undertaking a more long-term developmental agenda, one that recognizes the wider, structural factors that predate and facilitate disease outbreaks, rather than short-term disease-focused emergency responses. The example of the Zabaleen in Egypt also alludes to the importance of another alternative narrative that is discussed below and focuses broadly on the governance of infectious diseases.

Risk environment narrative

Another alternative narrative focuses on understanding the wider risk environment (Barnett and Blaikie 1992; Rhodes 2002) in which zoonotic diseases emerge and proliferate. Attention to risk environments expands the lens of focus from "simple linear causal relationships between risk drivers and disease emergence and/or spread" (Liverani et al. 2013, 875), to understanding the complex, and often unique, sociobiological factors that contribute to the presence or absence of zoonotic risk in diverse contexts.

A risk environment can be defined as the "space, whether social or physical, in which a variety of factors exogenous to the individual interact to increase" or

decrease health risks (Rhodes et al. 2005, 1026). The narrative provides a "simple heuristic for researching multiple environmental factors that produce health risk" (Rhodes and Simic 2005, 222), departing from the outbreak narratives' overemphasis on "individuals' cognitive decisions and immediacy of interpersonal relations" (Rhodes et al. 2005, 1027). In this, individual behaviours are understood to be *variably risky* as opposed to *definitively* or *intrinsically risky*, depending on a range of contributing factors that amplify or diminish risk, and which are largely outside of a single person's control. This distinction is explored in relation to HIV/AIDS:

> …sexual intercourse (of whatever variety) is not intrinsically a 'risky' (in the popular sense) behaviour beyond the obvious risk of conception. However, when a deadly disease appears *and* the social and economic environment is such as to facilitate rapid and/or frequent partner change, then that environment may be described as a *risk environment* and the act of sexual intercourse becomes a *risk behaviour* (Barnett and Whiteside 1999, 207).

Like HIV, avian influenza is an infectious disease where the risk of infection is in part determined by environmental influences. As discussed in Chapter 2, LBMs are considered particularly risky environments (Fournié, de Glanville, and Pfeiffer 2012), and are associated with multiple human infections with H5N1 resulting in death (M. D. Van Kerkhove 2013; M. Van Kerkhove et al. 2011). While LBMs are often presented as uniformly, intrinsically, and definitively risky environments for public and animal health (Webster 2004), live bird markets are better understood as variably risky environments where, alongside biological considerations, a range of contributing factors may amplify or diminish zoonotic risk. For example, a man slaughtering a chicken in a live bird market in Indonesia is identified as engaging in a risk behaviour in an environment with zoonotic risk. Yet an individual's risk in a LBM is determined not only by their behaviours, but by a range of factors that make this particular behaviour risky – beginning with the prevalence of disease in poultry, the physical layout of the market, the structure of live bird trade in Indonesia, as well as the length of time they spend in "the particular environments in which risk is produced" (Rhodes and Simic 2005, 220).

The risk environment narrative thus usefully highlights the range of factors contributing to disease risk, directing attention to wider structural issues that might be neglected in more restricted analyses. Liverani and colleagues, for example, highlight the importance of examining the complex dynamics of livestock production as part of a comprehensive analysis of risk environments.
Attention to the complex interactions between seemingly disparate factors, "from viral genome sequencing to animal keeping" (2013, 875), reorients analysis towards interrogating the many "social situations, structures and places" (Rhodes et al. 2005, 1027) in which disease risks are produced. In doing so, the risk environment narrative ultimately merges the epidemiological *identification* of risk environments

with social science *explanation* and *contextualization* of these places and processes (Rhodes and Simic 2005).

In emphasizing broader contextual factors, this narrative also highlights the importance of considering the influence of the global political economy and governance structures on conceptualizations of, and responses to, disease risk. The following alternative narrative on governance takes up this emphasis in greater specificity.

Governance narratives

In dominant narratives for avian influenza, and outbreak narratives more generally, there is an assumption that global institutions, regional organizations, and national governments are 'on board' with the priorities and pathways of response that such narratives promote. Policy documents present the notion that "there is a global consensus on what to do and that this can then be implemented through an international architecture, based on the principles of cooperation and respect" (Scoones and Forster 2010: 43). The pathways of response associated with dominant narratives for avian influenza, such as surveillance, rapid response, and vaccine development all rely on this presumed consensus. And while H5N1 has catalysed unprecedented coordination in addressing emerging health threats across multiple UN and developmental agencies, the appearance of consensus can mask underlying tensions and constraints in addressing diseases across different countries and different regions. In south east Asia, for example, despite substantial gains in coordination between countries, there remain significant challenges to enacting effective surveillance systems across transnational borders (Coker et al 2011). Attention to diverse narratives surrounding the governance of disease, both challenges assumptions of consensus in policy, and highlights more practical limitations for some governments to implement particular pathways of response.

At times, national governments may lack the willingness to partake in coordinated activities in cooperation with international bodies, and in pursuit of a purported global public good. Surveillance, for example, hinges on active reporting of novel outbreaks by national governments. Some governments, however, fearing economic backlash, suppress news of novel disease events when first diagnosed; a prime example seen in the Chinese government's initial foot-dragging in reporting human infections with SARS in 2002/2003 to the WHO (G. Bloom 2010). Other governments vocally challenge the notion that dominant pathways of response, advocated by global institutions, lead towards a so-called 'global public good', and thus actively disengage from such coordination. Here, Indonesia's disengagement from sharing avian influenza viruses provides an example.

In 2006, former Indonesian Health Minister Siti Fadilah Supari observed that global demand for therapeutics for H5N1 had surpassed their supply. In February 2007, she triggered a virus-sharing dispute when she announced that Indonesia would stop sending H5N1 virus samples through the Global Influenza Surveillance

Network, and on to WHO reference laboratories. In her book, *It's Time for the World to Change* (2008) Supari outlines the process that led to this decision: Indonesia was unable to secure advance purchase agreements from pharmaceutical manufacturers for an H5N1 vaccine under-development, despite the fact that the genetic material used to develop the vaccine originally came from Indonesia; the Indonesian virus sample that she referred to had been passed on to an Australian pharmaceutical company via the WHO reference labs. Moreover, the cost of the vaccine, Supari argued, was prohibitive, and part of a system that was exploitative and reinforced inequalities between high- and low-income countries (Coker, Hunter, et al. 2011). Supari's actions and calls for recalibrating the GISN to enable greater access to pharmaceuticals was met with condemnation from some (Holbrooke and Garrett 2008), yet found support from other governments, including India, Brazil, and Iran. Following months of negotiations, and a World Health Assembly resolution promoting more "transparent, fair and equitable" use of genetic materials and the benefits that come from their use (WHO 2007), in 2008, the Indonesian government agreed to start sharing H5N1 virus sequencing, but not actual viral samples.[55] While Supari's actions reinforce the fragile nature of assumptions of global consensus, underscoring how dominant pathways of response ultimately hinge on national governments' *willingness* to participate, there are also instances when governments lack the *ability* to implement programming aligned with the dominant narratives advocated for by the core global organizations.

The ability of national governments to enact interventions and prevent infections depends largely on available resources and the form of political system. The quality and capacity of health systems differs greatly across and within countries. The recent Ebola epidemic in west Africa, for example, has been partly attributed to the limited capacity of health systems in that region to quickly and comprehensively respond to early outbreaks (Bausch and Schwarz 2014). Early on, limits to the capacity of national governments' health and veterinary services for responding to H5N1 were identified (FAO/OIE/WHO 2005). Health systems in many south east Asian countries, however, still suffer from significant shortages of health workers and resources, and are thus at "risk of being unable to adequately respond to emerging threats from new and re-emerging diseases or surges in demand that might accompany these diseases" (Coker, Hunter, et al. 2011, 606). Attention to governance refocuses the need for long-term structural changes in some countries' health systems, while illustrating that, even if officials prioritize a particular intervention, they may not have the necessary funding or capacity to do so. As discussed above, compensation for those who lose animals in culling initiatives, for example, proved too expensive and difficult to implement in Indonesia.

Additionally, not all governments have the same ability to enforce particular interventions. The means and methods of a government largely depend on the form of the political system. In looking at national responses for cholera, smallpox, and syphilis in Europe between 1830-1930, Baldwin argues, "It was not the nature of the

[55] For more on the virus-sharing dispute see (Elbe 2010a; Kamradt-Scott and McInnes 2012).

disease which specified how it would be prevented and limited, but the kind of political regime under epidemic attack (1999, 13). While this may gloss over important distinctions between diseases – smallpox has no human hosts, for instance, whereas avian influenza is considered endemic in Indonesian poultry and has myriad potential vectors (Sumiarto and Arifin 2008a) – the implications of different forms of governance for disease control can be clearly seen in relation to avian influenza. The closure of live bird markets - and preventing informal trade networks outside of formal surveillance structures - for example, is much easier to enforce in China (Fournié and Pfeiffer 2013) than in other countries where avian influenza is endemic (Naysmith 2013b; Fournié et al. 2013). A historical look at Indonesia's different political systems underscores how divergent systems have different abilities to respond and implement infectious disease programming.

Under Suharto (1967-1998), when Indonesia was a centralized, autocratic state, officials tasked with implementing disease-control programmes employed both soft and hard coercive tactics to eradicate smallpox (Naysmith 2013a). When the Indonesian government implemented the Smallpox Eradication Program (SEP) between 1966-1974, the central government mobilized the army, local defence forces – *Hansip* - and the police to track unvaccinated persons, enforce quarantines and vaccination, and ensure that all outbreaks were reported.[56] Similar strong-armed tactics were employed by Suharto's government in other public health initiatives such as population-control programming (Hull 2005). While these tactics were not the only factor leading to the SEP's success – the fact that there were no non-human vectors meant that it was possible to eradicate the virus if surveillance and vaccination activities were efficient (Henderson 2009) – the strong arm strategies of the government certainly facilitated and hastened along the aims of the SEP in Indonesia. A focus on governance in contemporary Indonesia shows constraints in employing similar methods in disease control programming today.

Indonesia's rapid and systemic political decentralization after the fall of Suharto in 1998 ushered in a drastically different form of government. With guidance from the International Monetary Fund and the World Bank, health in post-Suharto Indonesia came under the purview of provincial and district level health authorities working within a multiparty democracy for the first time. These officials were made responsible for setting priorities and allocating funding for health-related programming. While decentralization was intended to promote local ownership and the prioritization of context-specific needs, there were some negative unintended consequences. When health officials were encouraged to look inwards at localized concerns, the coordination of health related activities across different political

[56] These data derive from the World Health Organization's archives in Geneva and the United States' National Archives and Records Administration, collected when I was a visiting research associate in the Department of History at Columbia University in summer 2011. Here I participated in the Hertog Global Strategy Initiative, a summer programme then focused on the history of pandemic threats and related policies. I report these findings in an unpublished manuscript on the history of the Smallpox Eradication Program in Indonesia titled: *Modernizing disease and the politics of the intensified smallpox eradication program in New Order Indonesia, 1966-1974*.

jurisdictions was weakened (S. Kristiansen and Santoso 2006). Some district level-officials did not prioritize or fund health concerns, "as reflected by the near collapse" of infectious disease surveillance systems in some parts of the country.[57] Decentralization also diluted the central government's responsibility for veterinary services (Forster 2012), making the control of zoonotic diseases such as avian influenza more difficult.

Indonesia's current system has been contrasted with avian influenza control programmes in other countries that bear a more authoritarian form of government. Peter Roeder, an FAO animal health officer, remarked, "Indonesia lacks the strong central government and established veterinary capabilities that enabled top-down bird flu control programmes to work in Thailand, which relied on aggressive culling, and Viet Nam, which introduced massive vaccination" (Normile 2007, 31). Beyond culling and vaccination, movement control is another measure where success is derived in part from the system of government in place. Movement controls aim to limit the introduction and spread of avian influenza viruses to previously disease-free areas. In Indonesia this is difficult, as the extensive trade in poultry sees myriad birds routinely transported over the boundaries of Indonesia's 34 provinces and 465 districts. Here, controlling the spread of disease in birds is weakened if local officials do not prioritize the need to monitor and control avian influenza in poultry, or seek to coordinate with neighbouring counterparts.

In short, governance narratives about avian influenza direct attention to the opportunities and constraints for disease control derived from a country's governance system and political actors and institutions. Indonesia's non-authoritarian, decentralized political structure makes it difficult to coordinate responses and poses additional challenges to ensuring population compliance with government interventions. The oft-cited culling and compensation example is but one case showing how undesirable interventions can be met by some populations with derision and active disengagement from programming (Naysmith 2013b). These challenges, coupled with the nature of avian influenza as a virus with multiple potential vectors, means that efforts to control the spread of H5N1 hinges in large measure on the extent to which PWP – including small-hold farmers, traders, and market workers, among others - are concerned about the disease in question, and whether they are willing to partake in interventions. Indeed, Indonesia's adoption of a widespread poultry vaccination policy was determined, in part, by the influence of poultry producers, who worried that widespread culling would decimate their business and pressured the government accordingly (Pongcharoensuk et al. 2012). Government officials and others implementing avian influenza control programming must consider the processes and incentives that both help inform people's understanding of disease and which shape their behaviour at the human-animal interface.

[57] See: http://www.ino.searo.who.int/en/Section3.htm. Accessed March 25, 2015.

Local realities narrative

Infectious diseases are inherently social as well as biological phenomena (Basch 1993; Cline 1995). The dominant narratives for avian influenza, however, remain focused on the "pathogen itself – its molecular machinery, processes of reassortment and mutation, and how these factors indicate risk for human-to-human transmission" (Janes et al. 2012, 1884) – and largely neglect the social and cultural dimensions of the disease including factors that influence human behaviours. Absent from the "apocalyptic scenario" attached to outbreak narratives about H5N1 has been a "rigorous analysis of the local contexts in which flus arise and in which the effects of a pandemic would most strongly be felt" (Kleinman et al. 2008a, 1). An important, and often overlooked, alternative narrative focuses on local realities, with particular attention on the perspectives, experiences, and behaviours of local populations who are disproportionately affected by diseases, particularly those who live and work at the human-animal interface.

Such local realities have long been recognized as central for understanding disease events, and in developing public health interventions (Trostle 2005; Inhorn and Janes 2007; Nichter 2008). Yet many crucial social factors about avian influenza are not fully understood (Janes et al. 2012). It is important to consider the local realities of people living in close proximity to poultry as a way of aligning disease control interventions more closely with their priorities and perceptions. As Scoones and Forster remind us, "Everyone agrees that local perspectives matter, but without effective articulation with locally embedded understandings of risks, diseases, animals and epidemics, externally derived interventions often fail" (2010, 216).

Consideration of local realities replaces dominant narratives' assumption of "cultural shortcomings" (Kleinman et al 2008b, 1), allowing for the possibility that interventions can draw on local populations' beneficial indigenous or experiential knowledge in relation to diseases, including potential treatments and prevention strategies. Rather than viewing people's behaviour as the result of a lack of knowledge, a local realities narrative pays attention to what people *do* know about disease, and what factors motivate their behaviour. In their case study of an Ebola control programme, Hewlett and Hewlett (2008) show how a narrative focused on local realities can provide valuable, complementary solutions to the pathways of response indicated by dominant narratives. Observing that local people "had an existing cultural model to explain the nature, transmission and prevention of epidemic illness", they sought to integrate this knowledge into responses (Leach and Hewlett 2010, 58). For instance, the *Acholi*, in Uganda, have an illness concept called *gemo*, which, once identified, lead to the implementation of a local protocol in response to disease events, with practices comprising a "broad spectrum approach to epidemic control" (Leach and Hewlett 2010, 58), including: isolating patients at least 100m away from others, using survivors of the epidemic to provide care for patients, marking affected houses, limiting general movement between households and villages, and keeping patients who are no longer symptomatic in isolation for one lunar cycle. While these responses mirror – and complement – dominant response pathways, they differ in that they are drawn from the practical and

everyday experiences of people living closely with disease, rather than the methods and methodologies associated with the human and animal health narratives. Of course not all local realities, and the diverse perspectives and responses that stem from them, will reinforce dominant response pathways. Nonetheless, attention to diversity of places and perspectives, of local knowledge and behaviours, may actually prove central to the efficacy of programming, and in identifying disease emergence (I Scoones 2010).

Another facet of the local realities narrative is the observation that local people have long lived with outbreaks of disease and may, in fact, experience them less as crisis events than as "something to be accommodated when possible and occasionally suffered when not" (Leach and Dry 2010, 5). In parts of Indonesia, for example, some of those who raise and sell birds consider disease events in poultry normalized, even seasonal, and reject the notion that avian influenza can infect humans (Padmawati and Nichter 2008). Such insights highlight how local constructions of disease can differ significantly from more dominant, global perspectives. In Cambodia, while responses to H5N1 are "driven by the perceived risk of an influenza pandemic and its associated costs to Organization for Economic Co-operation and Development Countries"(Coker et al 2011: 328), those who raise and sell poultry perceive little risk from the virus. Attention to local realities reinforces the notion that the concept of *risk* in relation to avian influenza is not uniform, but rather subjective, and understood in different terms in different places. Indeed, in looking at diverse "risk rationalities" (Keck 2008) of avian influenza, a perceived "mismatch between local and expert understandings of disease, its dynamics and consequences" (Scoones and Forster 2010, 211) is apparent.

A final element of the local realities narrative is the insight it provides into the rationale for certain human behaviours that can facilitate the spread and evolution of zoonotic pathogens. Eating wild animals – bush meat - such as simians, rodents, and bats are but one example of human behaviours that can lead to zoonotic transmission (Wolfe et al. 2005). These kind of "epidemiologically notable behaviours" are in part socially mediated, with particular actions driven by cultural norms or societal expectations (Janes et al. 2012). Despite their importance in disease emergence and spread, the social factors influencing human behaviour at the human-animal interface remain poorly understood. Focusing on diverse local realities helps to identify and explain human behaviours related to zoonotic transmission, in turn providing useful data for more efficacious and ethical responses.

The inclusion of local realities is particularly important for avian influenza because the virus is considered endemic in poultry stocks in countries including Indonesia, Egypt, and Viet Nam and eradicating the virus has proven difficult. As discussed above in relation to the governance narrative, strong-armed tactics may help facilitate interventions in the short-term but they may not be possible over the long-term in all countries. In some endemic settings effective programming may hinge on

the participation of affected communities, in turn underscoring a need for greater consideration of diverse local realities.

Conclusion

This chapter outlines a range of interpretations and perspectives contained in alternative disease narratives, including consideration of the importance of livelihoods in shaping people's priorities, the relevance of considering the wider contextual environment in which particular forms of risk are experienced and constructed, the imperatives and constraints that exist for government responses at the local, provincial and national level, and the insights into disease and containment and control programmes that become available when local realities are taken seriously. An overarching message derived from these alternative narratives is that "there is always more than one way to tell a story, or 'frame' a particular issue" (Leach and Dry 2010, 5). One of the most important distinctions between these different ways of framing avian influenza is how the risk associated with the disease is constructed: as a threat to global health and security in the human public health and outbreak narrative, as a chronic issue to be managed by improved animal husbandry in the animal health narrative, as a challenge situated at the nexus of animal and public health in the One Health narrative, or as a persistent though largely un-troubling issue best managed through long-established informal protocols derived in part from practical experience among local populations. Tensions can emerge between constructions of risk that represent avian influenza as a threat in need of rapid, intensive responses and those that downplay such emergency imperatives, suggesting instead that routinized local practices are sufficient to manage the problem. In such cases, those practicing indigenous control measures or resisting large-scale interventions may be viewed as lacking in accurate knowledge about the disease. The following chapter examines different approaches to conceptualizing the notion of risk in relation to avian influenza, and concludes by outlining the conceptual commitments of this study.

Chapter 5: Conceptualizing constructions of risk at the human-animal interface

Introduction

As detailed in the previous two chapters, there are vastly different ways that avian influenza can be framed, and responded to, by different global, national and local actors and institutions. Of interest in this thesis are alternative disease narratives focusing on the local realities of people working at the human-animal interface, and in particular those who work with poultry on a daily basis in LBMs. As highlighted in the introduction of this thesis, this is both because PWP are in routine contact with animals and environments that can harbour and transmit disease, and are thus considered a potential "bridge population" for transmitting viruses across species, and for spreading the virus between humans (Gray and Kayali 2009; Gray, Trampel, and Roth 2007), and because interventions and responses for avian influenza often focus on live bird markets and those who work in them (Neupane et al. 2012; Samaan et al. 2012).

People who live and work at the human-animal interface have revealed significant divergences in constructions of the risk posed by H5N1 to humans between these local communities and those presented in much of the scientific literature and international policy documents (Forster 2010; Padmawati and Nichter 2008). For example, Forster and Scoones report an Indonesian study showing that 97% of respondents were aware of avian influenza but only 15% regarded it as a direct threat to themselves and their families (2008, 158). Reflecting on this disparity, one informant stated, "The awareness among at risk groups is quite high but the perception of the risk is low, and changes in behaviour and practices are less than optimal" (Ian Scoones and Forster 2008, 156). These divergent constructions of risk range from people thinking that avian influenza does not pose a threat to humans because it does not exist, or because it cannot infect humans, to viewing outbreaks as a normalized, seasonal event (Padmawati and Nichter 2008; Forster 2010; Naysmith 2010; Naysmith 2013b).

Presented with these findings, the question then becomes: How do we conceptualize assessments of the risks posed by avian influenza to humans that depart significantly from those represented by the dominant outbreak narratives? This chapter outlines several competing theories of risk perceptions, highlighting how each conceptualizes assessments of risk that depart from those primarily presented in dominant narratives and how each is operationalized in contemporary research on avian influenza in Indonesia. Discussion then turns to outline the conceptual framework employed in this study, which draws together several concepts and theories of risk perception to form a series of empirical questions that guide this research.

Objectivist conceptualizations of risk

One of the dominant theories of risk perception draws on the objectivist-realist interpretation of risk, which conceptualizes risk as the domain of the expert scientist, to be communicated to members of the passive public (Irwin 1995; Irwin and Wynne 1996). Studies emerging from this tradition focus on individual cognitive processes and levels of knowledge, whereby individuals are thought to assess "the probability of risks and the magnitude of specific consequences" in ways that may or may not align with techno-scientific analyses (Kasperson et al. 1988). Risk assessment, in this formulation, refers to "a structured, systematic process to determine the likelihood of the occurrence of an event and the likely magnitude of the consequences following exposure to a hazard" (The Council of Canadian Academies 2011). Of crucial importance is the relationship between having the *correct* knowledge about the risk in question and forming *appropriate* – meaning in line with technical - risk perceptions. Yet members of the public are seen primarily as "irrational individuals" who are prone to either underestimate their risk from habitual behaviours, such as smoking or not wearing a seat belt, for example, or develop an "exaggerated fear of hazards which experts consider to be relatively safe", such as nuclear power (Plough and Krimsky 1987, 6).

As a result, when people conceptualize risk in ways that deviate from scientific data, the objectivist interpretation suggests they do so because they lack sufficient awareness or information (Wynne 1991; Wynne 2006). For instance, PWP who do not recall or confirm biomedical knowledge about H5N1 are presented as "confused" and in need of education (Fielding and Lam 2007). This interpretation is often termed the *knowledge deficit* perspective, whereby "public dissent from expert pronouncements therefore must be due to public rejection or ignorance of the risk science" (Wynne 2008, 23).

The knowledge deficit interpretation of divergent risk perceptions is typically operationalized in knowledge, attitudes, and practices, or behaviours, surveys (KAP or KAPB)[58] (WHO 2008; Medecins du Monde 2011; Green 2001; Manderson and Aaby 1992; Launiala 2009; Nichter 2008).[59] In KAP surveys of avian influenza,

[58] KAP surveys were designed in the 1950s to measure whether particular populations were hostile to family planning programmes, and, more generally, to identify local knowledge, attitudes, and practices regarding fertility (Cleland 1973). As international aid for public health increased in the 1960s and 1970s, KAP surveys became a standardized tool to measure what people know, believe, and do in relation to particular health concerns. Since that time, KAP surveys have been employed to gather such data and inform interventions for infectious diseases (Nichter 2008), including HIV/AIDS (Launiala 2009), tuberculosis (WHO 2008), and avian influenza (American Red Cross in Indonesia 2009).

[59] KAP surveys are popular, in part, because enumerators and other field-staff can be trained quickly, so that the surveys can be implemented relatively rapidly, and because they provide quantifiable data that are easily generalized to a wider population and utilized for cross-cultural comparison (Bhattacharyya 1997). It is generally assumed that what people know and perceive influences what they do, and KAP surveys are primarily used to identify gaps in people's knowledge, their perceptions of risk, and other influences on behaviour (Nichter 2008). For policy makers focused on infectious-disease control, data from KAP surveys are used to identify priorities, such as building

knowledge is narrowly defined as biomedical knowledge focusing mostly on symptoms, risks, and preventative behaviours, with respondents questioned on their ability to recall biomedical understandings of H5N1.[60] Similarly, risk perceptions of disease are elicited primarily in order to establish whether a target population's assessment of risk align with scientific data.

Ensuring that PWP's risk perceptions align with scientific data is seen as important because KAP measures, though technically not predictive, are used alongside other data about intentions, self-efficacy, and subjective norms, to inform models predicting potential health behaviours (C.-M. Liao and You 2014; Leppin and Aro 2009). Such models include the Theory of Reasoned Action (Fishbein and Ajzen 1975), Social Cognitive Theory (Bandura 1977), the Theory of Planned Behaviour (Ajzen 1991), and the Health Belief Model (Janz and Becker 1984). This latter model is particularly popular in conceptualizing and predicting health-related behaviours, and includes a measure of "perceived susceptibility" to establish an individual's own risk assessment for a particular health issue. As Neupane and colleagues report, "most evidence accumulated within the context of SARS, H5N1 and the H1N1 outbreak in 2009 is consistent with these models' assumptions about the relevance of risk perceptions and beliefs in the efficacy of protective behaviours" (2012, 2). Conceptualizing the importance of risk perceptions in this way naturally leads to the recommendation that "improving the KAPs of poultry workers could provide an effective means of preventing AIV infection in humans" (Q. Yu et al. 2012, 315).

Yet in conceptualizing risk perceptions as either "correct" and "rational" (i.e. aligned with more technical risk assessments) or "incorrect" and "irrational" (i.e. informed by misperceptions or misinformation) (Plough and Krimsky 1987, 8), the objectivist-realist interpretation of risk assumes a "shared, even single, rationality of risk avoidance", wherein "rational behaviour" is synonymous with "risk avoidance" (Rhodes 2002). It further promotes a narrow definition of risk that is denuded of context and based exclusively on scientific principles and norms, ignoring the extent to which perceptions of risk can be shaped by a diverse range of subjective contextual, emotional, and social influences (Q. Liao et al. 2014; Plough and Krimsky 1987; Fischhoff, Watson, and Hope 1984). As will be discussed in more detail below, alternative paradigms for conceptualizing risk indicate that other characteristics, in addition to levels of knowledge, are significant in shaping public perceptions of risk. Thus, different characteristics of risk, such as whether the risk is engaged in voluntarily or involuntarily (Shepperd et al. 2002), whether a risk evokes dread, whether a risk is seen to bring benefits or not, create significant differences in individual responses (Fischhoff, Watson, and Hope 1984).

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epidemiological literacy among target populations or altering high-risk behaviours, and inform interventions, as well as to analyse the impact and efficacy of such interventions.

[60] As an example of how knowledge is defined, a recent study derived their questions about AI knowledge from a WHO fact sheet (Neupane et al 2012).

Rhodes argues that viewing risk perceptions primarily as the product of individual cognitive processes assumes an "overly calculative and context free vision of risk decision-making, neglecting to capture how risks and their perceptions are context dependent" (2002, 86). In short, by conceptualizing divergent risk perceptions primarily as the result of deficits of knowledge, to be resolved by interventions to boost scientific literacy, the realist-objectivist conceptualization of risk perceptions does not fully capture underlying rationales for individuals' assessments of risks in a given situation.

Experiential risk rationalities

Not surprisingly, "it has been difficult to find common ground between the social world of risk perceptions guided by human experience and the scientists' rational ideal of decision-making based on probabilistic thinking" (Plough and Krimsky 1987, 5). An alternative theory of risk perceptions comes from the constructivist tradition of Cultural Theory, which conceptualizes risk perceptions as a socially and contextually constructed phenomena (Wildavsky and Dake 1990). Responding to some of the limitations of the objectivist perspective described above, this approach highlights the way subjective lay assessments contribute to a form of "experiential risk rationality" (Plough and Krimsky 1987, 8). This concept emphasizes the importance of considering the range of empirical observations that lay people marshal to evaluate a risk event, highlighting how "ideas about the world come directly out of human experience" (Plough and Krimsky 1987, 9). Rather than ignore or downplay the role that subjective judgements play in assessing risk, as can be the case in the objectivist perspective (Fischhoff et al 1984), the constructivist tradition explicitly highlights the way these "direct experiences" shape the way risk is constructed(Kasperson et al. 1988).

This concept of experiential risk rationality therefore draws attention to the processes of deliberation used by lay populations to question the source and veracity of scientific data, particularly when technical data deviate from their experiences and observations. Conceptualized in this manner, constructions of risk that deviate from technologically - and scientifically - informed constructions of risk do not necessarily reflect a lack of scientific literacy or ignorance, but rather a considered and socially contingent system for interpreting scientifically defined risk against a history of past experience coupled with contemporary observations (Fischer 2000). Importantly, this concept does not pit lay constructions of risk against expert interpretations but suggests that each can "be logical and coherent on their own terms" (Plough and Krimsky 1987, 8). In this sense, different constructions of risk reflect diverse disease narratives, showcasing differences "in how the problem is articulated, in the factors relevant to the analysis, and in who the experts are" (Plough and Krimsky 1987, 8).

The concepts and values underpinning experiential risk rationality have a long historical tradition. Scholars over centuries and across many disciplines have sought ways to conceptualize how certain individuals and communities come to know or

understand certain phenomena in their own environment (Kant 2007; Lévi-Strauss 1966; Geertz 1983; Butchvarov 1970), and there are multiple terms that frame these epistemological discussions (Corburn 2005). One such term is *local knowledge.* This term is used to refer to an "organized body of thought based on immediacy of experience" and also "practical, collective and strongly rooted in a particular place" (Geertz 1983, 167). Others define local knowledge as:

> knowledge that does not owe its origins, testing, degree of verification, truth, status or currency to distinctive... professional techniques, but rather to common sense, casual empiricism, or thoughtful speculation and analysis (Lindblom and Cohen 1979, 12).

In drawing on the tradition of local knowledge to situate experiential risk rationality, this study acknowledges that this term is not without critique or alternatives. The *local* in local knowledge has been interpreted as justifying romantic, essentializing notions of others (Agrawal 1995). Local knowledge may also reinforce moralistic, nationalistic, and ethnocentric beliefs, or be appropriated to infringe on minority rights (Corburn 2005). Alternative terms for what is broadly understood to be local knowledge include indigenous knowledge, folk knowledge, and traditional knowledge (Agrawal 1995; Chambers 1997; Grenier 1998; Irwin 1995).[61] Although general commonalities exist, these concepts can have slightly different meanings. Indigenous knowledge, for example, can be defined as "the unique, traditional, local knowledge existing within and developed around the specific conditions of women and men indigenous to a particular geographic area" (Grenier 1998). Indigenous knowledge, in part, is also described as knowledge and skills passed down orally between generations to provide necessary survival strategies.[62] While each of these terms differs slightly in its approach to understanding the way in which knowledge is "made", there is "enough overlap among the different definitions... to ensure a shared intersubjective understanding" (Corburn 2005, 48–49) in the term local knowledge.

While local knowledge is characterized to a degree by a form of "casual empiricism" (Lindblom and Cohen 1979), of sorting through observations and experiences, in recent years, scholars have pointed to more active constructions of local knowledge, emphasizing how individuals and communities actively inquire and develop new forms of knowledge. The notions of "street science" (Corburn 2005) or "citizen science" (Irwin 1995; Fischer 2000) emphasize the quasi-experimental attitude that members of the public bring to their inquiries of uncertainty and risk, highlighting how lay populations undertake data collection, analyse and interpret findings, and

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[61] *Existing Veterinary Knowledge* (EVK) is another term that is used to refer to local knowledge that is specifically related to animal health and animal rearing. I do not use EVK in this study, because this thesis goes beyond looking specifically at what people know about animals and their health.

[62] See, for example Ellen and Harris' *Concepts of indigenous environmental knowledge in scientific and development studies literature: A critical assessment* (1996): lucy.ukc.ac.uk/Rainforest/SML_files/Occpap/indigknow.occpap_1.html#Section3 Accessed: November 13, 2013.

seek collaboration with scientific institutions and personnel to ensure that their knowledge and insight have bearing on public policy. Importantly, one of the priorities that animate street science, for example, is the anxiety of individuals and communities about scientific developments and innovations (Corburn 2005).[63]

Previous work on avian influenza in Indonesia has situated its analysis of divergent constructions of risk primarily in these experiential risk rationalities, exploring the extent to which people who live and work at the human-animal interface are engaged in reasoned assessments of a range of risks in their lives based on their own empirical observations and experiences. In doing so, this body of work draws attention to the "different forms of practical logic" (Padmawati and Nichter 2008, 37) that motivate different perspectives on the degree of risk posed by H5N1 to humans. For example, Padmawati and Nichter describe the widespread belief that poultry farm workers and market workers are "weather vanes" for the presence of illness in the community: "Given that no butcher or poultry worker had been reported ill with avian flu, several people voiced the opinion that the risk of the disease to humans was exaggerated. Others were of the opinion that H5N1 was a disease of birds and not humans, just like Newcastle disease" (2008, 37). Forster (2012) reports a similar perception among his informants: "A woman buying slaughtered and butchered meat for her household's consumption said: "I see the market workers and if they look healthy I do not worry. If the chicken was dangerous, they would get ill first" (2012, 105). These accounts are important for the extent to which they offer insights into the specific reasoning processes involved in determining whether avian influenza is of risk to humans.

Guided by the experiential risk rationality conceptualization, key questions for the present study emerge: How do people who work and live with poultry construct the risk associated with H5N1 for humans? Put another way, what kind of evidence are PWP employing in order to make their assessments about the relative health risks posed by H5N1?

Heuristics and biases

Attention to the role of empirically-derived observations and experiences highlights a complimentary notion from the field of cognitive psychology, which suggests that risk perceptions are primarily derived from lay assessments that draw on heuristics and perceptual biases. Individuals rely on these cognitive shortcuts, the theory suggests, to help simplify the vast amount of information they are called upon to assimilate (Kahneman, Slovic, and Tversky 1982). Put another way, "people answer a hard question by substituting an easier one" (Kahneman and Frederick 2002). Most important among these heuristics is the availability heuristic, employed by

[63] Corburn's study (2005), in part, looks at how knowledge from low-income urban communities in Brooklyn, New York, is used, and combined with scientific – technical – knowledge, to inform policies that address local environmental risks. In this work, Corburn argues for a revaluation of local knowledge to complement scientific data, a process which ultimately "democratizes the inquiry and decision-making process", and which he labels *street science.*

people to "assess the magnitude of risks by asking whether examples can readily come to mind. If people can easily think of such examples, they are far more likely to be frightened than if they cannot" (Sunstein 2005, 14).

Three factors affect the availability of information about a particular risk. The first is familiarity, whether the risk in question is commonly known or obscure. A familiar risk, such as terrorism, is cognitively available to many people. The second factor is salience, or whether an example of the risk in question is prominent or not. To illustrate salience, some use the example of seeing a house burning versus reading about a fire in the local paper (Kahneman, Slovic, and Tversky 1982). Third, a recently experienced event is more cognitively available than one that occurred many years ago, meaning that time and space play important roles in availability. In short, an individual's assessment of risk is shaped by their awareness of the risk in question, by how dramatic or striking the risk, and by how recently the risk event occurred. Theorists note that in many circumstances, the use of the availability heuristic is "hardly irrational", indeed, "What has happened before seems, much of the time, to be the best available guide to what will happen again" (Sunstein 2005, 15).

The availability heuristic also provides a way of theorizing about differences in the construction and perception of risk across diverse populations, by suggesting that such divergences reflect how different groups in society have come into contact with different observations about a particular phenomenon. Savadori and colleagues, for instance, found that differences in risk perceptions between the north and the south of Italy were premised primarily on hazard familiarity (1998). Thus, in contrast to the notion of a "shared, even single, rationality of risk avoidance" (Rhodes 2002: 87), the availability heuristic aligns with Keck's plural notion of "rationalities of risk" (2008), in that the availability of different observations and experiences result in different constructions of the risk posed by the same pathology.

Applied to constructions of risk about avian influenza, the availability heuristic posits that those who perceive the risk of human infection with the virus as plausible, striking, and salient will develop corresponding constructions of risk about the disease in which it is viewed as posing a significant threat to humans. Different constructions of risk about avian influenza will develop in cases where individuals draw on different experiential contexts. As will be explored further in this thesis, such is the case among PWP, who live and work in environments where few opportunities exist to observe human infections with H5N1, in potential contrast to the opportunities to witness animal diseases, and the consequences of disease and related interventions.

The availability heuristic is alluded to in other studies of risk perceptions about avian influenza, though not by name. For instance, Padmawati and Nichter (2008) observe that informants "changed their poultry-related behaviour when front-page headlines about avian flu appeared, and then resumed their previous behaviour

when news waned" (2008, 41). This anecdote is meant to convey the mutability of risk perceptions and behaviours among some respondents, as well as indicate the difficulties in achieving long-term behaviour changed related to the handling of birds. Yet viewed through the lens of the availability heuristic, these perceptions and behaviours can be viewed as a rational assessment of the human risks from H5N1.

Attention to the implications of the availability heuristic raises key questions in this research: First, what does attention to the familiarity, salience or timing of particular risks highlight about the risk perceptions of those who work at the human-animal interface? And second, what other risks, other than the risk to humans – such as those perceived to stem from animal disease, from impacts to economic livelihoods, or from political pressures - are familiar, salient, or recently experienced in PWP's lives?

Conceptualizing multiple risks

While conceptualizing risk perceptions as contextually constructed phenomena highlights the range of social and cultural influences on a given risk, existing risk perception theories still exhibit a tendency to focus on a single risk as the object of study. In practice, of course, an individual is called upon to consider and assess a wide scope of risks in their daily lives. The exception to this singular focus is the claim in the Cultural Theory of risk that "selective attention to risk, and preferences among different types of risk taking (or avoiding), correspond to cultural biases – that is, to worldviews or ideologies entailing deeply held values and beliefs defending different patterns of social relations" (Douglas 1978). Yet in rooting individuals' analyses of different forms of risk in cultural worldviews rather than in practical empirical assessments, this theory may elevate the importance of ideological motivations while side-lining exploration of what leads certain risks to be elevated above others. This thesis takes forward Cultural Theory's attention to multiple risks while also drawing on the notion of experiential risk rationality to explore the manner in which different, competing risks are assessed in reference to empirical observations and experiences.

Existing studies on avian influenza have mainly presented evidence of the *existence* of multiple, competing risks, though a few have gone further, offering initial conceptualizations of the relationship between different forms of risk. Padmawati and Nichter, for instance, suggest that local authorities facing a range of threats construct "risk hierarchies" based on various pressures and incentives to act (2008), though no further elaboration on these hierarchies is provided. The notion of a risk hierarchy is echoed in Forster's (2012) work on the political economy of avian influenza in Indonesia. Having observed that Indonesians generally do not perceive avian influenza as a significant risk or threat, he suggests that this can explained, in part, by the myriad geological, political and humanitarian disasters that befall Indonesians. These dangers, he contests, are of such a magnitude and severity that the risks of avian influenza pale in comparison: "In these circumstances, it is

understandable that an invisible virus that has resulted in only the low hundreds of deaths over nearly ten years does not cause significant concern amongst the Indonesian population" (2012, 84). To some extent, this explanation hinges on the notion that "people worry most about the risks that seem most directly to threaten their well being at the moment" (Holdren 1983, 36). "What is wrong", Holdren continues, "with the simple idea – paralleling Maslow's stages of wants – that worries about more subtle and complex threats will materialize if, and only if, the most direct and obvious threats are taken care of?" (1983, 36). This notion both highlights the multitude of competing risks that Indonesians are called upon to assess in their daily lives, and offers the idea of a risk hierarchy to help conceptualize the relationship between different types of risk.

The present study expands on existing conceptualizations of multiple simultaneous risk assessments, focusing on how practices of experiential rationality are invoked to assess the different types of risks in a given society and for a given individual. In doing so, two questions emerge. First: How do PWP construct the risks other than those presented by H5N1 to humans, such as the risks that animals will become sick or die, the risks that a disease or a disease intervention will threaten economic livelihoods, or the risks that a disease or a disease intervention will put political pressures on local populations to adhere to external authorities? The second question emerging from this strand of risk perception research points to the importance of conceptualizing assessments of different types of risk, asking: What is the relationship between competing types of risks? Is a hierarchy of risks an accurate depiction of this connection?

Pathways of response

A final element of the conceptual approach in this study is the notion, discussed in Chapters 3 and 4, that the differing rationalities of risk evident in diverse disease narratives play a role in shaping how pathways of response are generated (Leach and Dry 2010). These pathways of response can be enacted at the international, national, regional, community, or individual level, whereby particular interventions, policies, methodologies, research agendas, or – at the individual level – personal behaviours – are judged appropriate. Behaviours can therefore be revealing as manifestations of specific constructions of risk.

Research from the objectivist tradition – such as KAP studies and models about health beliefs - have conceptualized the relationship between risk perceptions and behaviours largely as linear and predictive. As Liao and Yu summarize, "Generally, non-regulatory approaches to changing behaviours against influenza across individuals and populations have focused on using information-based interventions to persuade people of the risks they face and the potential benefits of change" (2014, 190).

There is some evidence to support the association between risk perceptions and behaviour. Brewer and colleagues suggest that "hazard-specific risk perception is a

predictor of the vaccination behaviour against infectious disease" (Brewer et al. 2007). Similarly, Barr and colleagues found higher levels of risk perceptions about influenza to be associated with greater willingness to comply with recommended public health behaviours (2008), while Rubin and colleagues indicated that believing there is a high risk of catching H1N1 and that catching it would have severe consequences was associated with behaviour change (Rubin et al. 2009). A study in Viet Nam suggested that respondents in communities affected by avian influenza who had a higher perceived risk of infection were more likely to seek health-care (Manabe et al. 2012). Yet not all studies report such definitive results. Fielding and colleagues suggest that "sickness anxieties did not predict buying or touching habits" among customers of live chicken markets in Hong Kong (2005, 682). Furthermore, they found that increasing people's anxiety about disease produced only "transient, inconsistent, and therefore often ineffective results as a means of reducing long-term high-risk behaviour" (2005, 681), and posited that this may be because respondents felt both a sense of control of, and familiarity with, the risk in question.

Despite the challenges of establishing a definitive relationship between risk perceptions and particular practices, it is nonetheless important to expand the focus of analysis beyond what people *say* about risks, to consider what they *do* in reference to them. Furthermore, simply indicating associations between perceptions of risk and behaviours does not provide insight into the rationale for particular behaviours. As Plough and Krimsky contend, these insights only become available "when people's cognitive behaviour is observed when they are threatened by a real risk event. It is only then that the full panoply of factors come into play that create a complete picture of a public response" (1987, 8). In other words, *risk* cannot be studied independently of the context where constructions of risk are generated and behaviours are performed. Observing PWP's behaviours in live bird markets, therefore, enables an exploration of the extent to which "perceptions of relative risks can powerfully determine pathways of response" (G. Bloom 2010, 87). Building on existing studies that indicate how human behaviours contribute to the spread of disease (Janes et al. 2012), this study explores the implications for varying constructions of risk on behaviours at the human-animal interface. Such behaviours can be considered to contribute to or detract from seeing efforts to contain avian influenza as a global public good, in turn raising important ethical questions about the extent to which PWP's behaviours can be considered purely personal or private. Thus, this thesis explores the question of how PWP's constructions of risk are invoked in determining their societal obligations to modify their own behaviours in LBMs.

Guided by this approach, this study asks: "To what extent are PWP's different constructions of risk – about human health, animal health, economic impacts, and political pressures – animating their behaviours?

Summarizing the conceptual approach and guiding questions for this study

In sum, the above discussion establishes the comparative advantages of viewing risk perceptions from a constructivist perspective, suggesting that risk is a socially and culturally constructed notion, unique to particular contexts. This approach enables an examination of the plural notion of the various "rationalities of risk" that are constructed by particular individuals at particular times, rather than the idea of a singular, rationally assessed perception of risk that exists independently of the wider perceptions, meanings and interpretations of individuals and communities. Drawing on the conceptualization of risk perceptions as "experiential risk rationalities", this study examines the extent to which these perceptions emerge from the range of empirical observations and experiences that are available to study respondents at a specific point in time. The cognitive psychological view that risk perceptions are developed partly as a result of heuristics is taken up by focusing on the availability, salience and timing of experiences with risk. In an attempt to conceptualize the relationship between the range of risks that an individual is called upon to consider in their lives, this study focuses attention on the notion that risk perceptions of a particular risk are only one of a multitude of risks under assessment. Lastly, as noted in Chapter 4, these rationalities of risk play a role in shaping what is seen as a threat, who is seen as affected, and how pathways of response are generated. This latter emphasis on the implications for various constructions of risk on responses at the national, regional, community and individual level find expression in this study through an in-depth examination of the human behaviours reported and observed at the human-animal interface.

In light of these conceptual commitments, the empirical questions being investigated in this study include:

1. How do people who work and live with poultry construct the risk associated with H5N1 for humans?
2. What kind of evidence are PWP employing in order to make their assessments about the risks posed by H5N1?
3. What insights into risk perceptions are provided by attention to the familiarity, salience or timing of particular risks for particular individuals or communities?
4. What other risks – other than the risk to humans – such as those perceived to stem from animal disease, from impacts to economic livelihoods, or from political pressures - are familiar, salient, or experienced recently in PWP's lives?
5. How do PWP construct the risks other than those presented by H5N1 to humans, such as the risks that ones' animals will become sick or die, the risks that a disease or a disease intervention will threaten economic livelihoods, or the risks that a disease or a disease intervention will put political pressures on local populations to adhere to external authorities?
6. What is the relationship between competing types of risks? Is a "hierarchy of risks" an accurate depiction of this connection?

7. To what extent are PWP's different constructions of risk – about human health, animal health, economic impacts, and political pressures – animating their behaviours?

In answering these questions, this thesis argues that PWP draw on various facets of experiential risk rationality to construct perceptions of H5N1 risk to humans, to animals, to their livelihoods, and to their political/institutional relationships. These constructions of risk largely do not shift or modify in relation to each other; an adjustment in the construction of risk posed by H5N1 to humans does not necessarily have a corollary effect on the construction of risk around economic livelihoods. Rather, informed by empirical observations and experiences, PWP conceptualize each type of risk based on its own merits and according to available evidence. These constructions of risk, in turn, are seen to influence their behaviours in live bird markets, leading to a prioritization of those practices and habits that have beneficial implications for PWP's economic livelihoods. So long as PWP perceive avian influenza to be a problem largely confined to animal health, they have little incentive to adjust their behaviours in significant ways. Indeed, interventions designed to bring PWP's constructions of risk into alignment with those of the international community and in so doing, bring PWP's behaviours into agreement with prescribed *best practices* for H5N1 disease control and containment, may be in conflict with the dearth of observable evidence to support constructions of risk that frame H5N1 as a significant threat to humans.

The following chapter outlines the overarching methodological approach used to explore these questions, and sets out how the conceptual commitments established in this chapter were operationalized in the data collection and analysis phase of this study.

Chapter 6: Methodology and methods

Introduction

This chapter introduces and situates the methodological approach that I employ in this project, along with the qualitative research tools utilized during fieldwork. In particular, I illustrate why I use a focused ethnographic approach to broadly explore how respondents construct and respond to the risks presented by H5N1 in the context of everyday life. From here, I qualify field-site selection, discuss participant recruitment and data saturation, and argue that findings from this study can be cautiously generalized.

Methodological approach

How avian influenza A H5N1 is perceived and assessed by those living at the human-animal interface, and with what tangible consequences for behaviour is the central focus of this study. To examine these issues this qualitative research is informed by anthropological traditions, and guided in particular by a *focused ethnographic approach*.

Malinowski defined ethnography as an approach designed "to grasp the native point of view, his reaction to his life, to realize his vision of his world" (1961, 25). Indeed, an ethnographic approach looks to gain a vantage point on everyday life (Jenkins 2008), and appreciates that "everything can be significant because the most potentially mundane and everyday activities can be as revealing as the spectacular ceremonies and rituals (which often seem like the mainstay of anthropology to lay perceptions)" (Spencer 2011, 47; Toren 1996). Applied to research on health and disease, an ethnographic approach enables an "empirically based grasp of the context specific nature of social processes" (Lambert and McKevitt 2002, 211) that can lead to ill health and disease events.

Criticism of traditional ethnography sometimes centres on how difference is represented. "There is a preference amongst many Ivy League anthropology departments", cautions Robins, "to send their students to Third World countries for close encounters with distant and exotic Others... [These] Studies of exotic Third World Others often reproduce a fetishization of difference and a proliferation of relatively esoteric studies devoid of any taint of policy or development application" (1996, 17). I strive to avoid this fetishizing tendency, in part, by focusing on the everyday, habitual routines of respondents at the human-animal interface.

In this study I am guided by a focused ethnographic methodology. I chose this approach for two reasons. First, focused ethnographies are designed to inform policy with tangible recommendations derived from primary ethnographic data. Second, a focused ethnographic approach balances the competing demand for increasing in-depth qualitative inquiry into the human-animal interface with the ethical imperative of limiting exposure to pathogens.

Focused illness ethnographies started to be used more frequently in international health in the 1980s and 1990s to provide specific data about a particular disease to public health professionals tasked with developing interventions (Gove and Pelto 1994). This demand for anthropological insight in public health was partially due to

> recognition by planners and policy makers that program success requires an understanding of human behaviour and knowledge of what will motivate people to do what programs prescribe. Conversely, there is [also] a demand to understand why programs aren't working and what is required to 'fix' them (Herman and Bentley 1992, 1369).

While focused ethnographies draw heavily from the methods used in traditional ethnographies, such as participant observation, some distinct features separate these two approaches. The field of investigation in traditional ethnographies is, to a degree, open and determined over the course of fieldwork, which is undertaken by an individual and typically characterized by extended, immersive time in the community or place of focus. As illustrated in Table 2, focused ethnographies are characterized as having a specific, closed field of investigation that is intensively examined with multiple methods, and may include more than one researcher undertaking the research.

Whereas the aim of most traditional ethnographies remains largely undefined until the fieldwork process, focused ethnographies identify and look at a particular population or phenomenon from the outset. Additionally, while traditional ethnographies are not policy oriented, focused ethnographies are "problem focused" with an ultimate aim of informing the development of policy (Higginbottom, Pillay, and Boadu 2013). Focused ethnographies are also usually limited by time, with fieldwork consisting of episodic stints. It is for this reason that focused ethnographies are sometimes criticized as too thin on time in the field, and thus characterized as superficial ethnographies that do not yield sufficiently in-depth data (Nichter 2008). Although I took a focused ethnographic approach to broadly examine H5N1 in context, fieldwork for this study was undertaken over multiple visits to each of the three field sites and not limited by time or hastened along by a need to immediately inform interventions. Moreover, I chose a focused ethnographic approach precisely because it does not rely on extended periods of fieldwork stretching out continuously over months or years.

Table 2: Comparing focused ethnographies to traditional ethnographies[64]

Focused ethnography	**Traditional ethnography**
Specific issue/aspect purposively studied	Entire social field studied
Closed field of investigation, determined by research questions	Open field of investigation, determined over the course of research
Background knowledge usually informs research	Researcher gains knowledge from participatory engagement
Informants are key participants, determined by their knowledge and experience	Participants are often those with whom the researcher has developed a close relationship
Intermittent and purposeful field visits based on particular timeframes or to coincide with an event	Immersion during long-term, experience-based fieldwork
Intensive focus on data analysis, often employing electronic devices such as voice recorder and still- or video-cameras	Focus on developing narrative
May utilize multiple researchers with knowledge of the research goals	Research undertaken and analysed by individual researcher

Contact with infected poultry and fomites, and passive exposure in contaminated environments like live bird markets are associated with H5N1 infection in humans (M. D. Van Kerkhove 2013). As the majority of this research took place in live bird markets, and at the human-animal interface, limiting the potential for either myself or my research assistants to be exposed to H5N1 or other pathogens during fieldwork was top priority. A traditional ethnographic approach may have amplified risk of disease exposure simply because the extended time spent in select field sites. By utilizing a focused ethnographic approach, I was able to broadly examine a particular disease in context while mitigating risk to my assistants and myself. The unique ethical and practical considerations of studying emerging infectious diseases with ethnographic methods are discussed in more detail in the next chapter.

The above observation, that ethnography of the everyday can be more revealing than ethnography of spectacular cultural ceremonies and rituals, presents a complex challenge in this research. As discussed in Chapter 2, H5N1 in Indonesia is relatively exceptional, in that Indonesia has reported the highest number of human deaths resulting from infection with H5N1, with a crude fatality rate exceeding 80 percent (Patel et al. 2014). This coexists with the anthropological reality of Indonesians working in live bird markets – the everyday. In recognition of this challenge, this study took a blended approach, combining the inward looking perspective of focused ethnography with three illustrative case studies, the latter enabling an outward-looking perspective, "aiming to delineate the nature of phenomena through

[64] Adapted from (Higginbottom, Pillay, and Boadu 2013, 4).

detailed investigation of individual cases and their contexts" (Cohen and Court 2003).[65] Through this approach, the everyday realities shaping constructions of risk among PWP are explored.

Research tools

This research is broadly concerned with examining how PWP construct the risks associated with avian influenza, and exploring what implications these constructions of risk have for behaviours in live bird markets. The study sites where this research took place are dynamic. Capturing the complexity and richness of the human experience in these environments requires combining multiple qualitative methods. If, for example, only interviews were employed, data collection would be "mediated by the invariably biased retrospections of interview respondents" (Holstein and Gubrium 2003, 28). Becker and Geer argue that participant observation provides a more direct way of accessing data (1957). Participant observation alone, however, would not describe *why* people behave in a particular manner. To better validate and interpret findings, this research thus combines three methods of data collection: semi-structured interviews, participant observation, and photography.

Semi-structured interviews

Qualitative studies that employ structured interviews pose a sequence of predetermined questions in a linear fashion to informants. Semi-structured interviews, on the other hand, are organized around thematic priorities or an interview guide yet leave respondents a fair degree of freedom to determine the tenor of conversation, what is said, how much is revealed, and the length of the interview. While the general theme of an interview can circulate around a particular phenomenon, or a series of related issues, the length of semi-structured interviews in this research was not fixed, but open-ended and determined primarily by the respondents' desire to talk. The flexible nature of semi-structured interviews allows new ideas and perspectives to be brought to light over the course of research – an iterative research method that allows researchers to probe respondents for more detail and tailor thematic priorities for different contexts, and to take account of new information that becomes available. The practical and ethical considerations of undertaking these interviews – such as the use of recording equipment during the first rounds of semi-structured interviews in each site – is discussed in detail in the next chapter.

Beside Padmawati and Nichter (2008), there are only a few qualitative studies examining lay perceptions of risk and H5N1 aetiology among people at the human-animal interface (Q. Y. Liao et al. 2009; Kuo, Huang, and Liu 2011). These studies, however, are rarely iterative, and often rely on "pre-specified criteria" to develop questions "used to initiate data collection" (Q. Y. Liao et al. 2009, 575), with data derived from one-off visits with no follow-up research. Rather than a fully

[65] Max Gluckman, a social anthropologist at the University of Manchester, popularized the use of case studies in anthropological research as a means for inferring a degree of generalizability. This case-study approach is a defining feature of the "Manchester School" of anthropology.

structured interview guide, in the current study, semi-structured interviews were used because of the nature of the interview environment and the research aims.

Most interviews were held during business hours, and I thus needed to be flexible to allow for interruptions and to facilitate the continuation of business as usual. Furthermore, given the public space in which most conversations occurred, one-on-one interviews sometimes became spontaneous focus-group discussions, with multiple other workers and customers from the market joining in and adding their views. This required a flexible method that could accommodate the expansion and contraction of participants. Additionally, the interview guide was designed to provide informants with the opportunity to speak openly about their experience and share their knowledge, without restricting them with overly structured set categories. In this way, informants could dictate the topic of conversation rather than be immediately prompted into a conversation specifically about avian influenza. Both my assistants and I actively wrote notes during the course of conversations, as timing permitted, and elaborated upon each interview afterwards. Each day we conferred about what each of us had heard, observed, and noticed, and then digitally transcribed each interview and fieldnote. Further discussion about the use of recording equipment during interviews is in Chapter 7.

Guiding research questions for this study's semi-structured interviews were adopted from Padmawati's and Nichter's (2008) focused ethnography of the poultry trade in Yogyakarta. These questions concentrate on what people know about avian influenza, popular perceptions of illness, and on behaviours that can contribute to disease spread or containment. My research assistants helped ensure that these questions would resonate with informants in each of my three field sites; these questions were revised iteratively as research progressed. Appendix 1 contains a list of questions used to inform semi-structured interviews.

Participant observation

Participant observation has been defined as a method in which "the observer participates in the daily life of the people under study, either openly in the role of researcher or covertly in some disguised role, observing things that happen, listening to what is said, and questioning people, over some length of time" (Becker and Geer 1957, 28). It is advocated as a means to document the practices and assumptions underlying behaviour, intended to complement or contrast with interview data (DeWalt and DeWalt 2002). "Many events", argue Becker and Geer, "occur in the life of a social group and the experience of an individual so regularly and uninterruptedly, or so quietly and unnoticed, that people are hardly aware of them, and do not think to comment on them to an interviewer" (1957, 30). In this way, participant observation can act as "a yardstick against which to measure the completeness of data gathered in other ways" (Becker and Geer 1957, 28).

Despite these advantages, participant observation has been criticized as a sort of fiction by some (Geissler 2013; Geertz 1973). Recognizing that one is never truly immersed in a respondent's environment, that one is always recognized as foreign

and different, and that this difference may shape the research encounter, I observe and note as much about the daily routine of market life as possible. Some scholars undertaking participant observation have tried to become more immersed by actually participating in a shared activity through imitative participation or productive participation (Mosse 2001; Knox 2009). While these approaches carry certain benefits for gaining entry in different contexts and can yield novel insights, I concluded that imitative or productive participation would be inappropriate for several reasons. First, had I offered my services in the slaughter and sale of poultry, I surely would have been less skilled than my respondents and thus functioned largely to slow them down in their business. Second, given the potential zoonotic risk of working intimately with poultry in LBMs, active participation could have proven ethically problematic for my assistants and myself. Ultimately, by remaining outside of the environment as a mere observer, I was able to document normal everyday practices of the market while mitigating the potential for exposure for my research assistants or myself.

Photography

Alongside semi-structured interviews and participant observation, I utilize still photography as a data collection method: photography ranked as the third priority among these three methods. In this thesis still imagery functions as a complementary empirical tool to draw out an extended narrative of everyday behaviour in live bird markets – a tool to capture the "seemingly unremarkable signs of everyday life" (Spencer 2011, 47). In utilizing photography, I recognize the ethically contentious and politicized nature of photographic imagery; I address these ethical considerations more thoroughly in the next chapter.

The primary aim of using photographic images in this study is to document everyday behaviours. Photographs add complexity to our understanding of the notion of zoonotic risk, and help question the degree of exceptionality attributed to an individual's behaviour at the human-animal interface. In this way I use photographs to further establish what is, in practice, normalized behaviour, habitually repeated in the live bird markets where this research was conducted. Leading from this, a secondary aim in using photographic images is triangulation. Taken with words and observations, photographs convey a reality of place. As Sontag contends:

> Photographs furnish evidence. Something we hear about, but doubt, seems proven when we're shown a photograph of it. In one version of its utility, the camera record incriminates... The picture may distort; but there is always a presumption that something exists, or did exist, which is like what's in the picture (1977, 5).

It is important to recognize that the realities shown in the selected images are subjective: technical standards are always selected and imposed by the photographer on the subject. Photographs do not show universalized truth or falsehood, nor do they constitute an "epistemological end-game to the debates about

reality" (R. Brown 2011, 201). They show *a* reality, selected by the photographer and open for interpretation - a reality that is concentrated on a particular moment, conferring on the captured "event a kind of immortality" (Sontag 1977, 11). In this way, photographic data are not immune from criticism but recognized as inherently subjective, in the same way as other qualitative and quantitative data.

While I had intended to utilize photography as complementary, yet subordinate, to interviews and observation, having a camera often facilitated access, opening conversations far more frequently than it closed them. On separate occasions Sari and Sammy both informed me that simply having a camera facilitated research, in that the presence of a camera led people to ask about us before we had the opportunity to introduce ourselves and speak with them. There were no more than a handful of instances where somebody asked not to have their image captured. Such requests were not overtly hostile but polite engagements that would often include a longer conversation. Of course, every time these requests were made they were acknowledged and conceded. Had there been more concentrated and systemic resistance to my taking of photographs, I would have unquestionably stopped. Ethics and discussion always took precedence, as discussed in the next chapter. In each site, we began by verbally introducing ourselves to people in the poultry trade and continued with a request to speak with them about their work and their experience, and, only thereafter followed by a request to use the camera. When I asked people whether I could take photographs of them, their work environment and their birds, I'd often gesture to my camera to make certain my request was understood. To this question, the vast majority of people answered *boleh*, essentially, "yes, you may".

Field site selection

Fieldwork was centred among people in the poultry trade in live bird markets in three distinct urban centres on Sumatra and Java: Bireuen, in Aceh province, Bandar Lampung, in Lampung province, and Serang, in Banten province (Map 1).

These three LBMs were selected for two main reasons. First, they were located within provinces that had been assigned particular risk profiles in relation to cases in birds and humans. Comparing and contrasting between these sites allowed me to explore the extent to which these risk profiles led to different constructions of risk about avian influenza. Second, these sites were physically located in different provinces across Sumatra and Java and thus represented different contexts and histories, as well positions within the Indonesian state. While I recognize that similarity of place does not necessarily confer similarity of experience or perceptions, ensuring that each site was physically disparate opened up space to determine whether there were unique contextual realities influencing respondents.

Map 1: Map of field site locations in Indonesia

Data courtesy of the U.S. Geological Survey

Specific market selection for this research is guided by the selection criteria informing the research design of three KAP surveys implemented by the American Red Cross and *Palang Merah Indonesia* (PMI), and conducted in households, live bird markets, and schools in October and November 2009. Site selection criteria for these three surveys were as follows:

> The first stage [of the survey design] was a stratification of the districts where PMI implements its avian influenza program into three 'severity' zones: Red, Orange and Yellow. These zones... were based on the number of avian and human avian influenza cases that had been reported by PMI Branches (Districts) in Java and Sumatra since 2005, with the Red zone having the most combined cases, the Yellow zone having the least, and the Orange zone representing the intermediate (American Red Cross in Indonesia 2009, 2).

After demarcating these risk profiles, the ARC and PMI clustered households, markets, and schools

> by severity zone and at two levels. The first level was the selection of four districts within each severity zone using probability proportional to size. The second was the random selection of five villages per district. These villages were then used for random sampling of households as well as access to schools and wet market. The nearest wet market and primary school to the village was selected (American Red Cross in Indonesia 2009, 3).

Informed with this criteria I selected one market in each of these colour-coded zones: Pasar Bireuen in Bireuen, Aceh, from a Yellow zone; Pasar Tugu in Bandar

Lampung, Lampung, from an Orange zone; and Pasar Rau in Serang, Banten, from a Red zone. In selecting these field sites I wanted to ensure that each market was located in a different province and some distance away from the others.[66] Selecting three markets in distinct areas across Sumatra and Java opened up the possibility for capturing whether local contexts and histories influence respondents' constructions of risk. Previous studies on risk perceptions and H5N1 have adopted a cross-national design, focusing on comparing and contrasting results from several countries in Asia (Q. Y. Liao et al. 2009). While this provides a regional snapshot of community beliefs and priorities, it obscures the extent to which variation can exist within one country, and may homogenize diverse risk environments. For instance, Java is the centre of Indonesian poultry production. Had I chosen three sites on Java, I might have missed the diversity of experience within Sumatra. Aceh, for example, sought independence from Jakarta and fought a decades-long insurgency with the central government that ended in 2004. The district of Bireuen experienced some of the most intense violence during this time (Aspinall 2009). Banten, on the other hand, is geographically proximate to Jakarta and was peacefully established as a province in 2000. These differing histories and experiences may impinge on people's perceptions of state authority in Jakarta, and by extension, the national government's health and disease control programming.

Additionally, each of these locations has had different encounters with multilateral and bilateral organizations. Between 2005 and 2010, millions of dollars in aid money and hundreds, if not thousands, of foreign workers descended upon Aceh for post-conflict, post-tsunami reconstruction and development work. By contrast, Lampung and Banten provinces have had no large-scale disaster in recent years, and the international community's presence there has been limited to smaller, localized aid programmes.

Finally, I wanted to contribute new knowledge and therefore, in selecting field sites, I avoided Indonesian provinces and cities that were the focus of other studies, such as Bali (Simmons 2006; Santhia et al. 2009), Yogyakarta (Padmawati and Nichter 2008), West Java (Forster 2012), North Sumatra (McLeod 2010), or Makassar (Samaan et al. 2012). I know of no other qualitative study undertaken in any of the three sites where this research was undertaken.

Repeated visits

Many of the studies investigating lay perceptions of risk and H5N1 aetiology employ a cross-sectional design characterized by one-off visits to field sites to collect data (Q. Y. Liao et al. 2009; deZwart et al. 2007; Fielding, Lam, Ho, Lam, Heley, et al. 2005; I. Kristiansen, Halvorsen, and Gyrd-Hansen 2007; Abbate et al. 2006; Barennes et al. 2007; Fasina et al. 2009; Gupta et al. 2006; Leslie et al. 2008). Employing a cross-sectional research design makes it difficult to say whether observations are

[66] Selecting research sites in different provinces does not of course exclude the possibility that there are economic or social links (broadly understood) between these provinces. This became clear, for example, when speaking to poultry traders in Banten about how they sometimes source birds from Lampung.

reflective of normal, everyday behaviour or motivated by some form of exceptional circumstances. People's knowledge and behaviour with regards to avian influenza can change with time and new information (Padmawati and Nichter 2008; Figuie and Fournier 2008). In order to explore the dynamism of perceptions of risk and behaviours, I undertook repeated visits to each field site. Though this study is not strictly longitudinal, as the intervals between my visits varied between the three sites, this left open the possibility of observing changes in respondents' attitudes and behaviours brought about by events or experiences going on around them.

The possibility remained that a disease event in poultry or in people would occur in one of the study sites during the course of fieldwork. A further advantage of this method of repeated visits was that, in the event of such an outbreak, I would have been able to explore the extent to which disease events shape or alter local perceptions and priorities. The fact that no such outbreak occurred during my fieldwork provided a different sort of insight, one derived from observing a market community in a state of relative normality, without the potential tumult or anxiety that an outbreak in poultry or a human case of H5N1 may provoke.

Participant recruitment, purposive sampling, theoretical saturation, and generalizability of findings

Primary respondents in this research are people who work with animals in live bird markets. It is important to preface what follows by noting that most people who sell poultry also slaughter poultry; labels such as *slaughterer* or *seller* do not fully capture the multiple tasks which these populations perform as part of their daily work routine in LBMs. While many people working in the markets self identify as *penjual ayam* – chicken seller – or *penjual bebek* – duck seller – I refer to these populations primarily as people involved in the poultry trade. To reiterate, I opt for more specific titles, such as slaughterer or farmer or trader where appropriate, but employ the acronym PWP to refer, in general, to people who work with poultry.

This research hinged on gaining access and being accepted by PWP. During the first visit to each field site the priority was to become gradually acquainted with the research environment and potential informants. Typically this process entailed walking the entirety of the market to become familiar with the physical layout, paying particular attention to where poultry sellers clustered. While my assistants and I did not focus on conducting interviews during these early visits, people were curious about why a *bule* – foreigner[67] – was in the market, and we were routinely approached and asked about the rationale for our being there. These encounters were never hostile and naturally led to more formalized introductions. When people

[67] *Bule* is a slang term referring to visibly identifiable foreigners but mostly reserved for white foreigners. Translated literally, *bule* means *albino* and is thus considered somewhat derogatory. I have been called a *bule* across the archipelago; children have called me a *bule* and pointed at me as I walk by schools, and adults working in the markets continued to call me a *bule* each time I returned. It is worth stating that throughout fieldwork I never once saw another *bule* in any of the markets where this research was undertaken. This, of course, does not mean that there were not other foreigners in the market.

enquired about our presence, we responded that we were students researching the poultry trade, looking primarily at the economy of *pasar traditional* – traditional markets – across different provinces in Indonesia. In these introductions we did not talk about disease because we did not want to prompt or stigmatize respondents. We wanted to give respondents the space to discuss avian influenza, or any other disease, on their own terms, in this way allowing them to inform us of what was salient in their lives, and their primary concerns. Following these initial introductions my assistants and I retreated to one of the many small *warungs* – small shops selling food and drink - to discuss observations and impressions. This routine continued for a few days, with each visit gradually extending to more in-depth conversations with PWP as they came to recognize and welcome us to the market each morning.

There were only a few people that we approached who did not want to speak with us. I recall one trader in particular who, after delivering birds to the market, said he was too tired to speak and instead sat beside us, smoking and drinking coffee, as we conversed with his colleague, another trader who had just arrived with dozens of birds attached to his motorbike. Any suggestion as to why other individuals did not want to converse would be mere speculation: some may have feared stigma or previously had a negative experience when speaking to another *bule*; they may simply have been shy. We always respected people's requests to be left alone and never asked these individuals to clarify why they did not want to speak with us.

Key respondents in the markets were selected according to purposive sampling guidelines: this means loosely identifying participants "according to predetermined criteria relevant to a particular research objective" (Guest, Bunce, and Johnson 2006, 61). In this research the criterion for participant recruitment was that informants work in the poultry trade in LBMs, including traders and farmers who deliver birds to other sellers but are not necessarily permanently established in the markets, with respondents primarily those who take care of, slaughter, and sell poultry in LBMs.

This study focused on those who work at the human-animal interface in LBMs for several reasons. First, these kind of poultry workers are considered a bridge population for disease transmission, and may be among the first to become infected should H5N1 become more transmissible to humans (J. H. Kim et al. 2011; Bridges et al. 2002). Second, as live bird markets are identified as environments that can both maintain and disseminate zoonotic pathogens (Webster 2004; Fournié and Pfeiffer 2013) these markets, and those who work in them, have become a primary focus of avian influenza control initiatives in Indonesia (Samaan et al. 2012; Samaan et al. 2011; Santhia et al. 2009; Indriani et al. 2010) and elsewhere (Fournié and Pfeiffer 2013; Fournié et al. 2013; Amonsin et al. 2008; Abdelwhab et al. 2010). And third, despite a concerted focus on live bird markets, there are few existing qualitative studies specifically focusing on people working at this human-animal interface. As a result, in this study I did not, for example, explore constructions of risk or associated practices among those who primarily rear poultry, either in large commercial

poultry production facilities, or in small backyard farms. There are, of course, important questions relating to these populations and their place in the poultry supply chain, and in turn avian influenza in Indonesia. For instance, more research is needed on the role of the commercial poultry industry in the maintenance and spread of H5N1 in Indonesia. Forster and Charnoz (2013) discuss the disproportionate attention that backyard poultry producers have received in relation to avian influenza maintenance and spread, in contrast to commercial producers, and suggest that this may be due to a number of factors. One, commercial poultry producers are seen as capable of controlling avian influenza internally; two commercial producers are closely intertwined with the political elite in Indonesia, and have thus been able to largely evade scrutiny from the national government and by extension international organizations; and three, the prioritization of a "Pro-"Poor" agenda among some international organizations[68] may have had the effect of disproportionately focusing attention on backyard poultry producers as both the source of H5N1 and as those most in need of assistance.

The locational focus of this research was LBMs, and here I purposively sampled people who were, out of their own discretion, at the slaughtering areas, the selling tables, and the wider space in which birds are traded, housed, slaughtered and sold in the markets. While PWP are the primary respondents, for supplementary data, I also interviewed various government officials, those working with NGOs, and representatives from global bodies such as the FAO and the OIE; the criterion for these respondents was defined as those working for an organization or government agency with a focus on avian influenza, as the disease relates to poultry and to people. In each site we interviewed district- and provincial-level officials, as well as employees of *Palang Merah Indonesia* who are, or were, responsible for the agency's avian influenza programme. Meeting with PMI officials in all three provinces was facilitated by a former head of avian influenza programming, Dr. Hambal. Roger Montgomery, visiting research fellow at the Asia Research Center at the LSE, connected me with federal government officials in Jakarta, among whom I spoke with people working for the Indonesian National Committee for Avian Influenza Control and Pandemic Influenza Preparedness (KOMNAS) and FAO officials in December 2010 and May 2011. In June and July 2012 I interviewed officials responsible for global programming for avian influenza and other zoonotic diseases at the OIE in Paris and the FAO in Rome. These supplementary discussions were often one-off interviews, although there were occasions when I met repeatedly with district-level officials. And while I reference interviews with government employees and people working in non-governmental and multilateral agencies, I utilize these data primarily to illustrate divergence of opinion, or to reinforce findings.[69] To be clear, the primary respondents in this study are people working at the human-animal interface in live bird markets in Indonesia.

[68] The Pro-Poor agenda underpins aspects of the FAO's programming for avian influenza. For more on this see: http://www.fao.org/AG/againfo/programmes/en/pplpi/hpai.html

[69] For a more thorough discussion of how these and other policy makers interpret and respond to avian influenza in Indonesia see Forster (2012).

Although studies suggest that women and children are the primary caretakers of poultry raised at home in Indonesia (American Red Cross in Indonesia 2009; Forster 2012), this research found that the vast majority of people actively engaged in the poultry trade in live bird markets are men. In Bireuen, Aceh, there are two female sellers who work with their husbands. In Lampung, roughly half of the sellers are women. In Serang there are no female sellers. Throughout fieldwork in all three sites I never met a single female who transported birds to and from markets. The majority of restaurateurs interviewed were also are men. Conversely, and in line with other studies from Indonesia (Sumiarto and Arifin 2008a), the bulk of the customers shopping for poultry for household consumption in the LBMs where this research was undertaken are women. Table 3 describes the research participants in each field site. The age of poultry traders interviewed ranged between 16 and 74, with most traders roughly between 20-60 years of age.

Table 3: Description of research participants

Description of respondent	**Bireuen, Aceh**	**Bandar Lampung, Lampung**	**Serang, Banten**	**Total**
Seller/slaughterer	23	25	23	71
Poultry trader or agent (*agen*/*mugee*)	13	5	4	22
Farmer/raiser of birds or fighting cocks	5	3	17	25
Customers	10	12	14	36
Government official: animal health and human health	12	8	7	27
NGO	3	2	5	10
Other market workers: cleaners and non-poultry seller	8	5	4	17
Total	**74**	**60**	**74**	**208**

The size of a purposive sample is determined inductively, with qualitative fieldwork continuing until theoretical saturation has been met. Theoretical saturation implies that no new themes or information arise in discussion with respondents. Indeed, Guest and colleagues state that saturation is the "gold standard" for determining sample size in qualitative health-related research (2006, 60). To conclude that theoretical saturation has been met, fieldwork and preliminary data analysis run concurrently (Wray, Markovic, and Manderson 2007). In this way researchers can determine when they no longer have to recruit new informants. Theoretical saturation in this research was achieved during the second visit to each field site.

Nonetheless, three rounds of fieldwork were undertaken in order to look for change over time. Other reasons for three visits to each site include the desire to capture the perspectives of informal poultry traders who come to the market to sell birds during holidays; the last round of fieldwork in Serang and Lampung coincided with Ramadan, a time of year when some informal sellers come to the markets to benefit from the increased demand for poultry.

There are divergent opinions on the actual sample size normally required to meet theoretical saturation. For ethnographic research Bernard (2000) believes that studies require thirty to sixty informants. Morse (1995) is slightly less conservative, recommending roughly thirty to fifty respondents. Bertraux (1981) contends that the sample size for qualitative research can be no less than fifteen informants. While this research was not strictly ethnographic, the sample size from each field site roughly falls in with the numerical bounds established by Bernard (2000), Morse (1995), and Bertraux (1981).

Achieving theoretical saturation in qualitative research raises the question of whether findings are generalizable to PWP in other Indonesian LBMs. This research readily acknowledges that respondents' constructions of risk and behaviours may be dynamic and constantly evolving with new information and experiences; indeed, in the time that has passed since this research was undertaken, respondents may have altered their beliefs and behaviours. Moreover, those interviewed can not represent the views of all people working in the poultry trade, as employees from larger commercial poultry companies, for example, are not represented. Nonetheless, as Krueger (1995) argues, cautious generalization to similar demographic groups can be asserted after multiple interviews with target populations have failed to produce new information. Thus data from this study can be read as cautiously generalizable to people working in the poultry trade in live bird markets in Indonesia, and particularly men who work in LBMs.

Conclusion

This chapter outlines how this study is methodologically informed by a focused ethnographic approach, and describes the methods used in this research. Additionally, this chapter justifies the selection of the field sites and the recruitment of participants, and illustrates how data from this study can be cautiously generalized. The next chapter elaborates and reflects on the practical and ethical considerations of doing this study.

Chapter 7: Ethical and practical considerations of doing this research

Introduction

This chapter addresses the wider ethical and practical implications of this study, as well as the everyday practice of undertaking fieldwork, and staying safe throughout the research process. Ethical approval was granted by the London School of Economics and Political Science, and ethical considerations informed each step, from research design, to the training of research assistants, and data collection and analysis. This chapter outlines and addresses how standard ethical considerations feature in this research, including: Informed consent and voluntary participation; Confidentiality and anonymity; Reciprocity in research: Compensation and gifting; and, Positionality. The discussion on positionality focuses first on how my identity shaped fieldwork, and second on how my research assistants' identity shaped the research process. Thereafter I examine the ethical dimensions of employing photographic methods. Finally, I conclude this chapter in discussing some practical and ethical issues for qualitative social science research on emerging infectious diseases.

Informed consent and voluntary participation

Prior to engaging in conversation about the poultry trade all key respondents were informed about this research and asked directly whether we could speak with them about their work. Consent was discussed orally rather than in writing, as we did not want to interrupt people's business, or to stigmatize any illiterate PWP. Oral consent was sought prior to interviews with government officials and representatives of NGOs and multilateral agencies. As illustrated in the discussion on photographic methods, oral consent was also obtained prior to capturing pictures of the environment or of individuals.

When introducing this research to respondents we made it clear that their participation was voluntary, that they did not have to speak with us, and that, if they chose to engage in conversation, they could exit at any time. While very few people refused to speak with us, many informants pulled away from our conversation to serve customers; my assistants and I tried to remain cognizant of our impact on people's business and sought to politely withdraw when customers approached. Informants were encouraged to ask questions about this research and we were forthcoming about the study when queried.

Confidentiality and anonymity

Informants were made aware that our conversations would be kept private, in that I would make no reference to specific individuals when presenting these data. I should state that at no time in fieldwork did respondents from the poultry trade ask me to avoid using their names or identities; there were a few times when informants from the government or NGOs asked to remain anonymous. As discussed above, from the outset of research, I decided to refer to people in the poultry trade by pseudonyms or more generically as *seller*s, *farmers*, *respondents* or *informants* –

or simply PWP. When referencing key informants from government, NGOs, or multilateral agencies, I refer to these individuals as *officials* or *employees* rather than using their names. In short, I avoided attributing conversations to particular individuals so that informants felt comfortable in openly discussing their experiences without fear of reprisal, stigma, or economic loss.

All data derived from this research are kept secure and private. I discussed the sensitive nature of these data with research assistants and have been assured that all fieldnotes deriving from this research remain private, shared only between them and myself. As discussed below, when a digital recorder was used, those research assistants employed to transcribe or translate interviews have been asked to delete the audio files following the completion of this work. Research assistants only have access to their fieldnotes; I alone have access to the comprehensive data set.

Reciprocity in research: Compensation and gifting

The provision of compensation and incentives – monetary payments or otherwise – to respondents by researchers has long been criticised. Fine and Sandstrom (1988) argue that gifting leads to the commodification of the relationship between researcher and respondent, and generates a sense of expectation, by which researchers are accepted within a community because of the gifts they provide. Weinreb and colleagues, however, argue that the "researcher-respondent relationship is essentially instrumental" and that, as a result, "researchers need to give more formal attention to the notion of reciprocity as a methodological issue" (1998, 2). Along these lines, researchers need to be aware of the demands they place upon respondents and what respondents deserve in return.

In this research I was cognizant that interviewing people actively working in the poultry trade might distract them from their work, and potentially impact their business and livelihood. With this in mind, we limited interviews during the busy early-morning hours of work in the market when the majority of birds are slaughtered and the majority of customers purchase poultry; during these hours we focused on participant observation, as outlined in Chapter 6. The majority of interviews were held later in the morning and early afternoon when PWP had more time. Nonetheless, we were always mindful when customers approached, and were quick to retreat from conversation to ensure that we did not interrupt business.

As an in-kind contribution to respondents, I often paid for coffees and small snacks. Less frequently I bought informants meals, but this happened only a few times, when we met away from the central market and from other informants. I did not view this as compensation so much as reciprocity; many informants readily, and pre-emptively, bought my assistants and me food and drink in all three of the fieldsites. Cigarettes were offered and shared between my research assistants and respondents; again, this was more bi-directional reciprocity than simple gifting. Although a third party prepared the food and drink, sharing and interacting in this way may present an elevated risk for disease exposure. When I talked about this with Sari and Sammy, they responded that, much like a handshake in some

circumstances, these kinds of interactions were typical and considered polite, even necessary, and thus it may have been perceived as rude to have abstained or not reciprocated.

Some believe that gifting as a material exchange from researcher to respondent initiates a "process of social bonding" (Ahlheim, Börger, and Frör 2013). However, I deemed it inappropriate to provide a financial incentive for informants, in part because our interactions were frequently fluid and informal. For instance, we would often be speaking with a particular informant for a few minutes in the morning, and then be drawn into a different conversation with their neighbour, before engaging in a discussion among several informants in which people would join spontaneously before they returned to work. Determining *who* to pay in these contexts would have proven difficult, and might have artificially attracted informants who would not otherwise have spoken with us, or those who are not PWP. Essentially, I wanted to leave open the space for potential informants to join in as well as opt out from conversation, and did not want to create an expectation of payment for each and every conversation, regardless of its length.

While I never gave any denomination of money to informants, the gesture of gifting or providing monetary incentives to informants came up through the course of fieldwork. Of the few informants who did ask for *uang kecil* – small money – most made the request in a half-embarrassed, joking manner. Although usually coupled with a laugh or a smile, these requests may very well have been an exhibition of genuine need; I do not know. When such requests were made, we responded that we were students and could not pay for interviews. Indeed, on several occasions, other informants would overhear their colleague asking for money and pre-empt our response, telling the enquiring individual that we were students and could not pay to speak with them. I do not believe that our response to such requests ever halted conversation or limited access.

The only time that I gave money to people during fieldwork was when they were begging or performing (mostly singing). The majority of people who begged or sang were elderly. Many were blind or physically challenged, and most were accompanied by a younger male escort, usually a relative, who helped them navigate between stalls, through the tight corridors that interweave the markets. When confronted by requests for money, I followed the lead of PWP, the majority of whom gave small change, usually a few coins, to these people; the amount given ranged between five hundred and a few thousand IDR (less than 20 pence in GBP). I always kept small change with me for this purpose.

Positionality

Throughout fieldwork and during data analysis I have attempted to remain mindful of the ways in which my identity – race, gender, class, nationality, and other personal characteristics – may have affected relationships with respondents and perspectives on data. I have also asked each of my research assistants to reflect on

how their identity affected the research process. Their reflections follow the discussion below on my positionality.

As a relatively tall, white, upper-middle class male, I did not go unnoticed during fieldwork. This visible difference – my obvious foreignness – allowed me to ask questions that might have been considered naïve, should an Indonesian have asked, such as: "what does *halal* mean?". And, "how do you ensure that a bird is killed according to *halal* standards?". Both Sari and Sammy knew the answer to each of these questions, yet I routinely informed them to ask questions about common practices to ensure that there was not divergence of opinion. To ensure that my assistants were not embarrassed to ask these sorts of questions, I told them both to claim that I, as a foreigner, was not knowledgeable and curious about seemingly commonly understood notions or behaviours. In this way, I was able to leverage my foreignness to understand the subtleties of daily practice.

Conversely, at times the fact that I was visibly foreign led some people to try and stage activities for my benefit, such as cockfighting. As discussed in greater detail in the section on photography, when this occurred, I politely attempted to divert effort away from these theatrical acts, stating that I had already seen many cockfights. Such interactions were never hostile and, so far as I could judge, everyone was quick to revert to a state of normal business.

The vast majority of respondents from the poultry trade were men. The fact that I too was a male helped more than hindered access with key informants. This was most evident in Aceh, where a separation of the sexes is more clearly demarcated than in the other provinces. Had I been a woman, I believe it would have been difficult to speak as openly with the majority of informants; I say this having heard from some foreign female researchers that they had difficulty negotiating access in Aceh. Of course, my sex may have also limited my access to particular groups, as both of the women working in the market in Aceh opted not to speak with me, referring Sammy and me instead to their husbands. That being said, we frequently spoke to female customers in Aceh. In the other two fieldsites I do not think that my gender greatly altered my research relationships, as I openly spoke with women in the poultry trade in Lampung, and with female customers in Serang; it is, however, quite possible that these discussions were facilitated primarily because Sari, the assistant who worked with me there, is a woman.

Language afforded an opportunity to observe how respondents perceived my presence. Both *Bahasa Indonesia* and *Bahasa Aceh* utilize personal pronouns that distinguish individuals by age, and as a sign of respect. In *Bahasa Indonesia,* for example, an older man would be referred to as *Pak*, a second person pronoun that also means father. In most of Indonesia a man of near equivalent age or status, or somebody very familiar, would be referred to as *Mas*, a slang equivalent of brother

or young man.[70] In Aceh, the equivalent of *Mas* is *Bang* or *Bung.* During the early stages of fieldwork I would frequently be greeted as *Pak* as a sign of respect, regardless of the fact that many of those speaking with me were clearly older. I too would most frequently utilize the more formal *Pak* to greet respondents, even if they appeared to be younger. Over time, however, most people referred to me as *Mas* or *Bung*, indicating both familiarity and a recognition that I was similar in age to many of the PWP. When this occurred I too would revert to less formal titles.

Every Indonesian citizen, regardless of their adherence or practice, is identified on government-issued documentation as a member of one of five recognized religious communities. These are: Islam, Buddhism, Confucianism, Catholicism, and Protestantism.[71] Atheism is not recognized. While tolerance for religious diversity and expression are enshrined politically, in practice only particular expressions appear to be protected. Religious intolerance in Indonesia is rife and increasing (Human Rights Watch 2013), with frequent violent clashes between groups having divergent beliefs (Sidel 2006). This is the context in which I, an atheist, undertook fieldwork.

As a white foreigner it was assumed that I was a Christian, and in each fieldsite I was routinely asked if I was Protestant or Catholic. Prior to beginning fieldwork, and following discussions with Indonesian colleagues, I decided to respond honestly when asked about my personal religious affiliation, answering *tidak ada agama* – I have no religion – each time I was queried. I asked Sammy and Sari to observe whether my response altered or closed-off discussion; they never concluded that it did, and I never felt as though people were offended by my response. Rather, answering honestly frequently led to further discussion about religion, and in particular, about the existence of Muslims in Canada, my home country. When I affirmed that there were indeed Muslims in Canada people appeared pleasantly surprised.

Along with questions about religious belief, I was routinely asked in a hetero-normative manner about my marital status. When I confirmed that I was married the inevitable follow-up question was whether I had children.[72] To this second question I always answered *belum* – not yet. This answer often spurred a third line of questioning about how long I had been married and, after they found out that I had been married for a few years, *why* I did not have children. I found most people extremely frank about procreation, with both men and women enquiring whether or not my partner and I were actually physically and biologically able to have

[70] *Mas* derives from Javanese but has entered into common usage in *Bahasa Indonesia*. In Aceh, the equivalent of *Mas* is *Bang* or *Bung;* in Bali the equivalent is *Bli.* For a more thorough discussion of the politicized history of these terms see Anderson (1990).
[71] Along with these five recognized religions, across the archipelago, myriad local belief systems known as *agama asli* – literally *original religion* – exist.
[72] In each fieldsite many men suggested in a half-heartedly joking manner that I marry a local woman as well, assuring me that it was permissible to have more than one wife.

children. The fact that I was married frequently opened a larger discussion with respondents about our respective families.

Taken as a whole, I do not feel that my foreignness, in its many manifestations, negatively altered fieldwork. Conversely, in many settings being a male foreigner opened opportunities to explore the subtleties of behaviour and culture among PWP that might be closed for questioning by Indonesians or women. Nonetheless, there may of course have been situations where I could not judge accurately how my presence altered the research environment.

Norman (2009) observes that field assistants are often visible in the research process only to the extent that they are thanked in the acknowledgement section of a dissertation or an article. Following the completion of fieldwork in August 2012 I asked both my research assistants, Sammy and Sari, to reflect on their experiences in doing this research, focusing in particular on how their background and identity may have affected this process. I did not specify a word or page limit, allowing them both to reflect on the process of fieldwork as they saw fit. I have edited their reflections into a collective discussion and attribute direct quotes to each speaker when appropriate: Sammy and Sari have both read and approved what is presented below. By asking them to reflect on how their identities may have shaped the fieldwork process, I aim to *make visible* these essential companions in my doctoral research.

Reflecting on research: Sammy and Sari looking back on fieldwork

One reason why I chose to work with both Sammy and Sari is because they were curious about the practice of qualitative research, and in particular qualitative health research. When I met Sammy, he was in the first year of his undergraduate degree, reading Social Psychology. When Sari and I met, she had recently completed an undergraduate degree in Anthropology. While they were both familiar with ethical considerations relating to qualitative research, prior to beginning this research both Sammy and Sari, at different times, participated in a research-training course I prepared to ensure that safety and ethical considerations remained paramount throughout our work together. Concerted time was spent identifying how personal characteristics or beliefs may affect fieldwork. In particular, we discussed at length how gender, age, ethnic or national identity, religion or personal philosophy, political orientation, and language could affect the research process.[73] These discussions continued through the process of fieldwork, and their reflections below are written with reference to how their identity shaped the research process. Below I summarize and reflect on their afterthoughts, beginning with Sammy, as he and I undertook fieldwork together in Aceh before I started work with Sari in Banten and Lampung.

Sammy discussed primarily how "being Acehnese" facilitated research in Bireuen. He noted that having the ability to speak *Bahasa Aceh* was incredibly important and,

[73] In retrospect I acknowledge that I did not address how sexual identity may also affect fieldwork.

as he wrote, “in my own humble opinion made research more flexible, comfortable, and acceptable” for respondents, allowing us to “access information” that might have been difficult to access if, for example, “I were a Batak from North Sumatra or Javanese”. For Indonesians, Sammy contended, “unless I was an anthropologist that lived in the fieldsite for many years (or spent the rest of my life in the field, or married an indigenous woman)” it would be difficult to be accepted by respondents in Aceh.

Indeed, throughout fieldwork in Bireuen I routinely witnessed Sammy being publicly questioned on his ancestry, his place of birth, and his ability to speak *Bahasa Aceh*. This vetting would often continue for several minutes, as Sammy relayed the district and the village where he grew up, the place where he now lives, and the work that we were undertaking together. These interactions were always cordial and frequently ended with Sammy turning to me and stating: “It’s fine, they just wanted to know where I was from.” In this way, Sammy writes, “being Acehnese” was incredibly important for building “trust” with people in the poultry trade in Bireuen. Establishing credibility, in this way, did not figure as prominently in the other two fieldsites.

Sammy is “from a middle-class family from a rural village in Aceh” and grew up “keeping chicken in the house.” Despite being university educated, Sammy contends: “I am from the same class as the people in the market... [and thus] it wasn’t hard for me to communicate” with them. Although people would ask about Sammy’s education and the fact that he spoke English, he does not believe that his education hampered access. Conversely, he believes people more readily accepted our presence in the market because we said we were students. Moreover, “smoking and drinking coffee in the same place as respondents everyday in the market” worked to dilute any sense that he was of a different class than respondents, and “actually led to greater acceptance, trust, and openness” with people in the poultry trade.

“Being Acehnese” was important, Sammy contends, but so too was being a male. In Aceh, “there is an unwritten rule that in an Acehnese family, the husband has an obligation to provide for the family... [while] an Acehnese wife has an obligation to be a good mother for their children... [and is not obliged] to work outside” of the house. As stated in Chapter 5, men make up the vast majority of people in the poultry trade in Aceh. And, as Sammy states, the fact that he was a male most certainly affected our relationship with people in the market:

> If I were a woman, there would be some secrets or issues that they [male respondents] wouldn’t want to talk about with us... There are some topics [that come up] in conversation that are taboo to talk about between men and women. So, in this context, we would have had trouble gaining access [if I had been a woman].

There were two female sellers in Bireuen. Neither would speak to us beyond basic greetings, and, as stated above, both referred us to their husband, alongside whom

they worked. Although many female customers spoke with us, Sammy believes that the female sellers avoided conversing because we were both men and they were in the presence of their husbands. Ultimately, Sammy's sex and Acehnese identity, among many other personal qualities, facilitated research in Bireuen, Aceh.

Sari grew up in urban Indonesia, first in Yogyakarta and later in Jakarta. She reflects on how she too grew up with birds in the house:

> As a Javanese girl, my dad raised many live birds at home. We had songbirds, *ayam kampung, ayam Bangkok*, and sometimes we had ducks. I remember when I was a child my dad raised many fighting cocks and on Sunday morning many of his friends came into our backyard for matches. I don't know whether my dad gambled money on those matches but I remember my dad was very qualified at raising fighting cocks. He also loved to raise *ayam kampung* because he liked to eat their eggs. Sometimes he would kill one and ask my mom to cook the bird. But only my dad and I ate the chicken; my mom and brother and sister did not eat it because they said "it was hard to eat our pet".

When Sari was growing up she also frequently went to live bird market with her mother to buy poultry for the household. Recalling these experiences many years later, and with knowledge about avian influenza, Sari reflects on her childhood experience around birds and in markets, with what I emphasized about staying safe in the field during research training and throughout fieldwork:

> Sometimes I felt confused about risk and my presence in the market. Sometimes I felt nervous and worried about becoming sick if I touched birds or feathers or faeces. But on the other hand, reflecting on my personal experience, I never had any problems when I lived among many birds at home when I was younger. In this process, I reflected on Indonesian people's perspectives about avian influenza...

I tried to recall my childhood memories: Why was there no *flu burung* when I was a child?... Why did my mom not feel scared or awkward about touching chickens when we went to the traditional market near our house?... The scientific facts that Scott talks about contradict with my values, from my personal experience.... because I feel safe even though I have touched chickens without wearing gloves... My close experience with live birds since I was a child make me think like many chicken sellers who do not believe that avian influenza is a problem.

Sari and I discussed these issues over the course of research, particularly the issue of the relative risk of human infection, and reflected on how PWP do not appear to be disproportionately infected with H5N1, and nor do they routinely show signs of past infection in seroprevalence studies (Toner and Adalja 2012; M. D. Van Kerkhove 2013). These discussions served to reiterate that, while there are a range of factors that may influence the likelihood of human infection, many of which are

outside of our control, such as the particular clade (Toner et al. 2013; Bridges et al. 2002), safety in the field should remain a high priority as the majority of reported human infections are associated with disease exposure from contact with sick or dead poultry, or more passive transmission in contaminated environments (M. D. Van Kerkhove 2013; Patel et al. 2014). Furthermore, for me, Sari's reflections also underscored the normalized nature of human interaction with poultry in Indonesia

Just as Sammy's Acehnese identity was important for gaining access to people in the poultry trade in Aceh, Sari contends that my foreignness afforded us greater access to those working in the poultry trade in both Serang and Bandar Lampung. Indeed, although she was initially concerned that it would be "very hard" to speak with sellers and customers, Sari states that my "status as a *bule* gave us the opportunity to open discussion" with respondents; because of this she came to see me as "the can opener."

The situation of "a female researcher working with a foreign male researcher" in a predominantly male environment posed unique challenges, and led Sari to "sometimes feel uncomfortable" during fieldwork. This was because "many people thought that I had a private and personal relationship with Scott", and despite the fact that "we both always clarified our relationship, sometimes people still do not believe us." In particular, Sari writes: "when we went to cockfighting matches I was the only female" there and because of this

> sometimes they teased me... but I didn't pay much attention to this and just continued my job. Cockfighting in Indonesia has a strong relationship with masculinity – it is a man's game – and maybe that's why they also feel uncomfortable with my presence at the match.

I tried to remain aware of these negative interactions during fieldwork and when respondents would make assumptions about Sari - or our relationship - we would always reflect on these interactions at the end of the day, as I wanted to ensure that these insinuations did not negatively impact her wellbeing. Our discussions together always concluded in laughter, with reference to the absurdity of such commentary.

While Sari recalled how being a woman made some aspects of fieldwork more difficult, I noted throughout research in Lampung that Sari's gender was advantageous, in that it allowed us to speak more openly with the relatively large number of female sellers working in *Pasar Tugu*. Whether or not we would have had the same access, for example, in Lampung if Sari was male I do not know. I do know, however, that Sari's training in anthropology, her self-effacing confidence, and her reflexivity, greatly facilitated research in Lampung and Banten.

Working with interpreters in the field

The markets where the majority of fieldwork took place are not known, well-trodden environments extensively chronicled by researchers focusing on the human-animal interface. On the contrary, I know of no comparable qualitative

studies. The extensive and intensive nature of this research would not have been possible without Sammy and Sari, who assisted to interpret conversations and cultural norms, to negotiate access, and to ensure that guiding research questions were appropriate.

Language has long mediated political authority in the Indonesian archipelago. *Bahasa Indonesia* was not widely used prior to Japanese occupation during the Second World War and only gained prominence as the "language of the state" during the "Revolution of 1945-49 [when] it was the language of resistance to the returning Dutch and the language of hope for the future" (B. Anderson 1990, 139). Since that time *Bahasa Indonesia* has functioned as part of the unification project, institutionalized by bureaucrats in Jakarta and taught across the country to cultivate a national identity. This national project, although largely successful, in that *Bahasa Indonesia* can now be heard across the archipelago, was seen by some as supplanting local linguistic identities and therefore resisted.

While I acquired a working knowledge of *Bahasa Indonesia*, I recognized from my first visit to Bireuen that many informants preferred to speak *Bahasa Aceh,* and therefore wanted to make certain I was working with an Acehnese interlocutor. In the other two fieldsites language was less politicized and respondents primarily spoke *Bahasa Indonesia* during interviews. Nevertheless, employing Sari to translate in Banten and Lampung made possible more in-depth discussion than I alone would have been capable of facilitating.

When appropriate, I asked Sammy and Sari to provide simultaneous translation of the conversations with respondents. This occurred more often during the first round of fieldwork, when I wanted to maintain oversight to make certain that they were not asking leading questions. During the early stages of research my command of *Bahasa Indonesia* was also less developed. Over time, as I became more comfortable in *Bahasa Indonesia* and as Sammy and Sari grew more confident and knowledgeable about the research aims, I did not request simultaneous translation unless I was unclear about the content of the discussion, as I wanted to avoid interrupting the flow of conversation. In such cases, I would actively listen and participate in the discussion, while also taking note of verbal cues and observing the surroundings.

In employing translators there is always the possibility for miscommunication and misrepresentation. Two prominent concerns arise: One, are my assistants representing key research questions adequately and not posing leading questions to informants? And two, are my assistants representing the views of respondents accurately back to me? To avoid the former, I revisited the aims of research and research themes and questions with Sammy and Sari prior to each round of fieldwork. To mitigate both of these concerns, during the first round of fieldwork in Aceh, I used a digital recorder to enable literal translation. This allowed me to see if Sammy was staying on-track and whether he was accurately representing respondents. I did not record interviews in subsequent field visits because I was

confident in the translation I was receiving and also became better able to understand what was being said. Moreover, the fact that we returned to each site three times and spoke with the majority of respondents on multiple occasions diluted the possibility that Sammy and Sari simply *got it wrong* in their translation. In this way, the research design crosschecked what I was told and helped ensure reliability of findings.

Ethical considerations and photography

In the photographic process a camera can become a "tool of power," which has the ability to turn "people into objects that can be symbolically possessed" (Sontag 1977). Writing before the advent of digital cameras, Sontag in *On Photography* (1977) was unable to signal to the wider dispersion of these *tools*. Along with taking images, I was also the subject of many photographs, all captured on camera-phones. It was not uncommon for people in the market – mostly customers – to take my photo, sometimes, but by no means always, after asking my permission. Sometimes I was asked to stand next to their children; sometimes customers would pose with me, handing their phones to a poultry trader to capture our image. Poultry traders also frequently took my picture. In this way, the research process became bi-directional, with key informants readily engaged in capturing part of this fieldwork.

While I was asked to pose both for and with others, the pictures that are presented in this dissertation were not staged. I never asked people to behave in a particular way, stand in particular places, or undertake certain actions. That is not to say that people did not ask me to take a picture when they themselves were posing for the camera, or attempting to create a scene they deemed worthy of capturing. For example, men in all three fieldsites tried to pit two fighting cocks against each other for my supposed benefit. Each time this occurred I tried politely to let them know that this was not necessary and that I did not want it to occur, as I did not want to be responsible for animals fighting or being injured, even if this practice was commonplace.[74] Moreover, the photographic component of my research was guided by the principles of documentary photography, which may be best understood as "a praxis and phronesis for visualising the object of the social sciences; a reflexive process of thoughtful and ethical social interaction whose value combines history, observation and aesthetics in a discourse over time" (R. Brown 2011, 198). Essential to this process is capturing images that are not staged, and do no harm.

More specific ethical issues arose due to the nature of this research. Many of the images presented show people touching dead birds, working or shopping in what are considered to be high-risk environments, or undertaking behaviours that may expose people to disease. I know from showing select photographs both privately and in public venues[75] among people working in public and animal health, including

[74] I have captured hundreds of photos of cocks fighting. These scenes, however, were not staged for my benefit, but were occurring when I arrived. I always asked to take photographs and was always granted permission.

[75] I have presented some form of this qualitative research alongside select photographs to academic audiences at: the History Department, Columbia University (May 2011); The Saw Swee Hock School

those working specifically on avian influenza, that some people recoil from images of animals bleeding and dying, some react to the explicit and visceral presentation of environments considered high-risk, and most have never seen or visited live bird markets. In presenting these images, important practical and ethical implications of including pictures come to light, as showing such pictures in these instances may misrepresent the context in which these photos were originally taken, and may have inadvertently served to stigmatize informants. This experience has led me to consider what it means to take a picture that is representative of *normal behaviour*, and then transport said picture into a context where it can easily be viewed as disgusting, risky, dirty, dangerous, odd, bizarre, exotic, and, perhaps, as rationale for an intervention.

Photography has long portrayed unfamiliar locales and cultures as inherently primitive, dirty, and un-evolved (Solomon-Godeau 1991). In this way, the act of taking photographs has worked to infantilize and exoticize others, effectively presenting them as in need of assistance – a material process that has been used to justify colonial intervention in so-called *pre-modern societies*. As Spencer writes,

> There are many examples of static, stereotyped images of indigenous people... rendered voiceless and devoid of active subject status in the process of representation, passively posed for the eye of the camera. Examples of this imperialist cataloguing are abundant and reflect thinking in the social sciences which still laboured under the sign of the colonial project (2011, 48).

I am aware that the inclusion of certain pictures in this dissertation and subsequent publications may be appropriated to justify and reinforce preconceived stereotypes about particular individuals or communities said to give rise to disease. To make it clear, photographs from this research are not shown with any intention to shock or to either valorise or stigmatize behaviour exhibited. Rather, particular photographs are employed to illustrate the everyday, what I came to see and understand as normal behaviour – what Brown calls the "rhythms of everyday life" (2011). In future exhibitions of this work, I intend to have comprehensive written descriptions accompanying the images, serving to explicate the behaviours captured in the images and make the rationality of certain activities clear. Of the many limitations inherent in still photography, the most glaring is that pictures cannot explain *why* people undertake certain behaviours. By pairing images and words I aim to reduce the exoticizing effect of such photos, and instead represent the reality of the subjects on their own terms.

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of Public Health at the National University of Singapore (April 2012); The Centre for Global Development, Leeds University (September 2012); The Royal Veterinary College, University of London (December 2012).

Ethical considerations for social science studies of emerging infectious diseases at the human-animal interface

There is growing consensus that understanding and effectively responding to emerging infectious diseases hinges upon greater social science engagement at the human-animal interface (Janes et al. 2012). Yet many essential elements of this research remain undefined. Over the course of this fieldwork it became apparent that there are distinct ethical considerations for researchers employing qualitative methods to study emerging infectious diseases. The following discussion aims to add complexity to qualitative, social science approaches to EID, and to contribute to the development of this burgeoning research agenda by illustrating the need for balancing ethical considerations alongside methodological rigor.

While there are inherent risks in all fieldwork, there may be unique risks for researchers employing ethnographically-oriented methods to study EID. The quality of such social science research is largely determined by how far each research team adapts to social and cultural norms and whether respondents accept researchers. Building trusting relationships can take time. Spending extensive time and interacting in particular environments like live bird markets, however, may pose an increased risk of disease exposure to researchers. Although transmission routes for emerging diseases are not always known, some of the most common routes – aerosol, fomites, skin contact - are highly social (Woolhouse, Gowtage-Sequeria, and Evans 2006). Questions about safety during the fieldwork process arise when employing qualitative methodologies and methods. Should an interviewer, for example, try to limit physical contact with some respondents by not shaking hands or sharing food and drink, if such behaviour may be perceived as impolite? Should research teams avoid certain localities identified as particularly risky environments? Balancing the competing demands of collecting data, ensuring the safety of all researchers, and limiting the spread of disease requires careful planning. Each disease poses unique challenges that may test disciplinary conventions, and researchers may have to adjust their methodological approaches. This is particularly important for qualitative studies requiring sustained time in environments associated with transmission and human infections.

In their ethnographic study of outbreaks of Ebola in Gabon, Uganda and the Congo, Hewlett and Hewlett (2008) questioned whether wearing personal protective equipment (PPE), such as a mask, boots, apron, and gloves, during fieldwork protected them sufficiently. They also struggled with the interpersonal implications of employing PPE and biohazard suits to shield them from exposure – a compromise between safety and ethical data collection. Such dilemmas, they assert, occurred daily: "Where to stay, how to protect ourselves from the virus while at the same time trying to develop rapport and trust with families and communities"(2008, 69). Researching a disease, such as Ebola, that is readily transmitted, has a high case fatality rate, and is widely feared by at-risk communities, raises different safety and ethical issues for researchers than a disease that has limited human-to-human transmission, a longer incubation period, and is not widely perceived as a risk. Here, H5N1 is instructive.

Despite high-mortality rates and global concern about an impending influenza pandemic, this study and others (Samaan et al. 2012; Naysmith 2013b) show that communities living and working closely with poultry in H5N1-endemic countries rarely wear masks and gloves. Exploring lay knowledge and risk perceptions, and observing behaviour among these high-risk groups is critical for understanding the social and economic drivers of exposure and transmission (Janes et al. 2012). In such an environment, however, PPE-use or the avoidance of contact with respondents may take on new meaning, as it may appear to presuppose environmental contamination, in turn acting to stigmatize respondents, jeopardize access, and potentially endanger the research agenda.

In this study, safety was paramount, and in laying out the research agenda I addressed these concerns as well as some of the areas of scientific uncertainty surrounding avian influenza, as set out in Chapter 2. Though the relative risks of contracting avian influenza from an animal host in LBMs is low, the high case fatality rate and the impossibility of knowing precisely where, or if, H5N1 virus resided in any particular LBM, meant that there existed real tensions between pursuing practices that were linked to decreasing one's personal risk and those practices that were associated with being accepted, even trusted. One such tension that arose was whether to shake hands with PWP. From an epidemiological perspective, shaking hands with people who slaughter and sell birds may lead to viral exposure. From a cultural perspective, not shaking hands with informants may be viewed as impolite or arrogant. After Sammy and Sari and I had discussed this dual reality together on separate occasions, we made the decision that we would never refuse an informant's hand that was first offered to us, but we would not pre-emptively offer our own hand. In practice this meant that we routinely shook people's hands. At some point after this contact we would attempt to apply hand sanitizer discreetly, away from public gaze.

Reflecting on fieldwork, Sari discussed how my preoccupation with staying safe in the field by avoiding unnecessary contact with people or places in LBMs was difficult to balance against cultural expectations. She stated:

> I tried, as Scott requested, to reduce the possibility to shake hands with people in the markets. But this is not common in Indonesian culture. I mean, maybe it's okay for Scott [to avoid shaking people's hands] because people will understand that he is from another culture, but for me, as an Indonesian, I may be called *sombong* (arrogant). If I think about it, I would probably think that somebody is *sombong* if they avoided shaking my hand.

Sari's comments indicate a concern that goes deeper than fear of being seen to take precautionary measures such as sterilizing one's hands following an interview. For Sari, taking these actions, even if respondents did not witness them, was seen as culturally duplicitous – to a certain degree a betrayal of her experience and what she knows about her culture. On one level, in this research, we engage with respondents

and yearn for acceptability; and then, immediately following these interactions we seek to purify ourselves of this engagement, driven by the fact that the simple act of meeting and greeting informants is a potential risk factor for exposure.

Alongside avoiding personal contact with people in the poultry trade, I instructed Sammy and Sari to eschew touching surfaces that could have come in contact with poultry, or poultry by-products, such as cutting boards, seller's tables, or cages. Yet when working alongside poultry traders in live bird markets one never knows where a bird has been. H5N1 has been found to travel between villages on car tires and footwear (Normile 2007) and thus, upon returning from fieldwork every day, we commenced a daily cleansing that would start by scrubbing our footwear, feet, and hands with soap and water outside of our lodgings. We would then launder all of our clothes and thereafter retire to our respective rooms to shower.

Along with these practical precautionary measures, I routinely met with my assistants to ensure they were feeling healthy and rested. While I remained vigilant about safety throughout fieldwork, the methods that I tried to enforce by no means eliminated all risk. Indeed, like Sari, I continually found myself caught between a desire to be respectful and accepted among respondents and a concern to remain safe in the field.

Remaining safe during qualitative research on EID requires a certain degree of familiarity with biomedical data. It is not enough to know about therapeutic interventions. Knowledge of disease transmission and spread are integral. So too are recognizing behaviours that are associated with exposure and transmission, understanding diagnostic methods, and knowing how and where to seek medical assistance.[76] With increased interest and funding for research on EID, the number of social scientists engaging in this kind of qualitative research will surely grow, contributing valuable disciplinary perspectives to our understanding of the human-animal interface. With these studies come unique ethical and practical considerations that need further attention for each context and for each disease before research begins. These issues are revisited in the conclusion of this thesis.

Conclusion

This chapter has outlined the unique ethical and practical considerations that I considered throughout each stage of this study. In particular, it outlines how I keep informants' identities private and confidential, how my positionality influenced fieldwork, and how the identity of my assistants influenced the research process. Although I recognize that I am unable to eliminate all bias, by acknowledging how my identity - and that of my assistants – influenced the research environment, data collection, and analysis, I aim to relay findings as they are portrayed and experienced by people in the poultry trade in Indonesia. Finally, after discussing the

[76] Throughout research I kept a list of "Avian influenza referral hospitals" in Indonesia. These are available at: http://www.who.or.id/avian/information_advice_avian-referral_hospitals.php Last accessed: August 18, 2012.

unique ethical implications associated with using photography, this chapter concluded with a novel discussion of the ethical and practical considerations of employing qualitative methods in studying the human-animal interface. The next chapter elaborates on the wider context in each field site, and in this way, expands on the description of each LBM in which research was undertaken.

Chapter 8: The research context

Introduction

This chapter provides an overview of the research environment, and describes both the physical space, as well as the dynamic structures and networks underpinning the wider poultry trade in each of the three LBMs in which this research was undertaken. In contextualizing the trade, slaughter, and sale of birds in these LBMs, this chapter illustrates how different forms of risk may be produced and experienced through everyday activities. In part, this chapter underscores that disease risk in poultry and people is not definitive, but variable, and contingent upon a range of factors that can amplify and diminish such risk. The trade in live birds, for example, is identified as a "major pathway for disease spread" in H5N1 endemic countries, and live bird markets can act as hubs for traders to sell their birds (Fournié et al. 2013, 1). When poultry traders transit between communities, farms, and different markets, they can introduce H5N1 viruses in the poultry that they are selling or on their equipment, and this sort of trade has been associated with disease introduction in LBMs (Wan et al. 2011; Indriani et al. 2010), and disease events in poultry (Sims 2007; Fournié et al. 2013) and in people (Soares Magalhães et al. 2012). Environmental contamination in Indonesian LBMs is most common in markets that sell ducks and have slaughtering on-site (Indriani et al. 2010). Although the actual risk that each market in this study poses to poultry and people could not be ascertained, a somewhat partial view of these relative risks in each market can be inferred from observations and existing studies that identify the factors associated with environmental contamination and disease in poultry and in people. In this chapter it becomes clear that the potential for environmental contamination and disease exposure for both poultry and people in each field site are myriad. Yet, as this chapter outlines and concludes, the potential for virus introduction and maintenance is not equal across every market.

Ultimately this chapter situates the research context, providing background for data that are presented and analysed in the remainder of this thesis. Before examining each fieldsite in turn, the first section of this chapter briefly outlines general human health considerations in Indonesia, paying particular attention to communicable and non-communicable diseases. Thereafter, this chapter looks at each research environment, first in Aceh, and then moves to Lampung, and finally concludes with Serang.

General human health considerations in Indonesia

With roughly 249,886,000 people living in the archipelago, Indonesia is the fourth most populated country in the world. The government dedicates approximately 3.1 percent of the country's gross domestic product on health.[77] Although the contemporary decentralized nature of health service provision in Indonesia has

[77] See: http://www.who.int/countries/idn/en/ Accessed May 12, 2015

negatively impacted more marginalized Indonesians (S. Kristiansen and Santoso 2006), there have been marked gains in human health indicators in Indonesia in the past half-century (WFP 2015; Statistics Indonesia 2012). In the 1970's, for example, life expectancy was 43 for adults.[78] Now, life expectancy at birth for men is 69 years; for women it is 73 years (Statistics Indonesia 2012).[79] The number of children considered "fully vaccinated" in Indonesia increased from 59 percent in 2007 to 66 percent in 2012 (Statistics Indonesia 2012), and under-five mortality continues to drop.[80] Despite such gains, however, significant human health complications and considerations persist.

After years of steady decline, the maternal mortality rate has increased in the past decade (Statistics Indonesia 2012). Communicable diseases remain prevalent in some parts of the country, in particular lymphatic filariasis, malaria, dengue, tuberculosis, typhoid, diphtheria, and rabies (Kandun 2006). Poliomyelitis was reintroduced in 2005. Roughly 640,000 Indonesian adults aged 15 and up are living with HIV; approximately 34,000 people die from AIDS each year.[81] With estimates suggesting 680,000 people are infected with tuberculosis, Indonesia is considered a high TB burden country by the World Health Organization (WHO 2009).[82] Alongside communicable diseases, over half of Indonesians do not meet their daily caloric needs - roughly 37 percent of children are stunted (WFP 2015). Food insecurity and malnutrition persist across the archipelago (FAO 2012; WFP 2015). Non-communicable diseases in Indonesia are increasing, as are obesity rates. Diabetes and cardiovascular diseases too are on the rise, and account for most adult deaths.[83] Moreover, the majority of Indonesian men smoke: cardiovascular diseases and cancers are likely to increase.[84] As one of Forster's respondents states in reference to avian influenza in Indonesia, H5N1 is "just a little rattle in the deep Indonesian machine" (2012, 25). In other words, H5N1 may not be among the most pressing health concerns amidst the myriad other human health considerations afflicting Indonesians. Having outlined in brief the general context of human health in Indonesia, the remainder of this chapter looks at each of the three field sites in context.

Pasar Bireuen, Bireuen, Aceh

Aceh is a province on the northern tip of Sumatra - the western-most part of the Indonesian archipelago – and is governed as a *daerah istimewa,* or special territory, with significant autonomy from the central government in Jakarta. This political

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[78] See: http://www.worldbank.org/en/country/indonesia/brief/world-bank-and-health-in-indonesia Accessed May 22, 2015.
[79] See: http://www.who.int/countries/idn/en/ Accessed May 22, 2015.
[80] See: http://www.who.int/gho/countries/idn.pdf?ua=1 Accessed June 13, 2015.
[81] See: http://www.unaids.org/en/regionscountries/countries/indonesia Accessed May 22, 2015
[82] See: https://extranet.who.int/sree/Reports?op=Replet&name=%2FWHO_HQ_Reports%2FG2%2FPROD%2FEXT%2FTBCountryProfile&ISO2=ID&LAN=EN&outtype=html Accessed June 12, 2015.
[83] See: http://www.who.int/gho/countries/idn.pdf?ua=1 Accessed June 13, 2015.
[84] See: See: http://www.who.int/gho/countries/idn.pdf?ua=1 Accessed June 13, 2015.

distinction came following decades of civil conflict between the Free Aceh Movement – *Gerakan Aceh Merdeka* (GAM) – and the national government, and was written into the Helsinki Memorandum of Understanding, the peace accord signed on 15 August 2005 to bring an end to the conflict.[85]

The epicentre of the 26 December 2004 Indian Ocean earthquake was off the coast of Aceh and the resulting tsunami killed roughly 180,000 Acehnese. Following this, the international community descended on the province to provide short-term humanitarian assistance, as well as longer term aid in the form of a five-year multi-donor development programme.[86] I went to Aceh for the first time in October 2009.

In Banda Aceh I was hosted at the *Aceh Research Training Institute* (ARTI) at *Syiah Kuala University*.[87] Here, I was often asked by other international scholars: "Is there *actually* bird flu in Aceh?". In 2005 H5N1 was confirmed in domestic poultry in Aceh, and there has been one suspected human case of H5N1 in the province.[88] The live bird market in which I focused research in Aceh was located in Bireuen, a district located roughly 100 miles south of the provincial capital Banda Aceh (Map 2). *Kota Bireuen* – Bireuen city - is the economic and political center of the district Bireuen.[89] The Trans Sumatran Highway is the island's commercial artery and it runs from Aceh to Lampung along the eastern coast of Sumatra. This highway bisects Bireuen, and each day thousands of broiler chickens travel north, roughly 175 miles from Medan into Bireuen via this route. Road density and highway systems like this have been found associated with disease in poultry and in people in Indonesia (Yupiana et al. 2010; Loth et al. 2011). And while disease in poultry and humans in Aceh is comparatively limited in relation to the other two fieldsites, the trade in poultry on the Trans Sumatran Highway offers a potentially rapid route for disease spread between provinces and districts. Located less than one mile from this highway, *Pasar Bireuen* is the largest market in the district and open daily, and the area in this market where poultry are sold and slaughtered was my primary field site in Aceh.

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[85] For more on the conflict in Aceh see: (Drexler 2008; Aspinall 2009).
[86] These funds were primarily directed at rebuilding public infrastructure and private housing, facilitating governance structures in a post-conflict, post-disaster environment, providing health programming for traumatized communities, and supporting livelihoods across the province. See: (Grayman 2013).
[87] ARTI provided a research base for a number of international doctoral scholars from Australia, Germany, UK, Netherlands, and the USA. The vast majority of these scholars were in Aceh to examine one of three broad topics: 1) post-conflict reconstruction; 2) post-disaster reconstruction; and 3) Islam. I alone was there to research a disease that was not widely discussed in the province, and certainly not a priority for research.
[88] See: http://www.flutrackers.com/forum/showthread.php?t=170867 Accessed: 21 August 2013.
[89] Bireuen and neighbouring districts were particularly affected by conflict during Aceh's civil insurrection (Aspinall 2009), and I was warned by other researchers to remain vigilant throughout fieldwork. Nonetheless, during fieldwork Sammy and I did not have any problems.

Map 2: Map of Bireuen, Aceh, and Banda Aceh and Medan

Data courtesy of the U.S. Geological Survey

Pasar Bireuen

Pasar Bireuen occupies many city blocks in the center of Bireuen. On one side of the market there are multi-story buildings with formalized shops spilling into the streets and selling household goods, ornamental birds, bulk rice, agricultural supplies, and clothing (Image 2). These buildings give way to single-story structures where noodles are made, spices are ground, and vegetables, eggs, and other goods are sold. Two-lane streets turn to alleyways where different kinds of sellers are interspersed. The ground goes from concrete to dirt and back again. By walking down these smaller lanes, away from the multi-story buildings, one reaches a central square where fish, red meat, and poultry are sold. This area is the central location of interest for research in Aceh. Although relatively isolated, the poultry slaughter and selling area is surrounded by other shops and restaurants, and people shopping and working elsewhere in the market may come and go through the section of the market where poultry are located. While the primary pathway of human exposure is contact with infected poultry, disease exposure may also occur passively in contaminated environments (M. Van Kerkhove 2013). Environmental contamination in LBMs in Indonesia and elsewhere can be extensive, posing a potential risk for human and animal health (Indriani et al. 2010).

Where do birds at Pasar Bireuen come from?

Pasar Bireuen is the largest market in the district, drawing the majority of traders and a variety of birds to meet demand. Most of the birds slaughtered and sold here are broiler chickens – *ayam potong* - brought into Bireuen from Medan as day-old chicks or more mature birds nearly ready for slaughter. The movement of birds between Medan and Bireuen is constant - a continual line of trade connecting multiple communities in Aceh with commercial farms in North Sumatra. One PWP

who buys these commercial poultry to finish and sell at *Pasar Bireuen* explains that he receives birds from Medan twice a week: "on Tuesday there will be 1200 chicks and 600 chicks come on Friday."[90] This PWP also sells birds to other people in his community, and to contacts in neighbouring districts, and he sometimes sends birds over district boundaries by public transport. When asked how many people trade commercial poultry in a similar manner in the area another PWP states bluntly: "there are so many."[91]

Local government officials confirm that birds arrive in Bireuen from Medan a few times each week.[92] One of the drivers of the trucks that transport birds between these locations confirms he makes the trip twice a week, each time bringing around 1900 birds to one particular collector yard.[93] The owner of one of these yards says that chickens stay at the farm for up to three days, but all end up being sold to between five and fifteen local traders. He explains that transporting birds into Aceh has become easier since the end of the conflict.[94] He now buys from one supplier with whom he has worked for five years, and hires upwards of twelve local men to assist in unloading, caging, and caring for these birds.[95] When the birds arrive they are offloaded promptly and either housed in large, wooden buildings to await the next move, or immediately re-caged in local poultry traders' containers (Image 3). Although the actual risk of disease spread in these activities was not determined in the current study, transporting birds between farms and communities and markets has been associated with disease dissemination, with both the birds and poultry traders' equipment identified as potential vectors (Fournié et al. 2013).

Poultry traders who buy *ayam potong* from this collector yard are based in Bireuen and surrounding districts and they buy anywhere between a few dozen to several hundred chickens a couple of times a week; some drive motorbikes with a side-cart stacked with cages (Image 4). From these collector yards, chickens are taken to backyard cages on farms in various villages until they are 30-35 days old – a timeframe where profits still outweigh input costs like feed. At that time most are brought to LBMs to be slaughtered and sold. The profit on each commercial chicken can be as low as 1000 IDR and PWP who care for these birds before they are sold monitor the potential for profits carefully.[96] Brought back to farms, these chickens may be caged with birds from other stocks, as long as they are around the same size. At one farm in Aceh, I observed small wild birds inside these cages drinking from watering cans used for the chickens; this inter-species interaction has the potential for disease transmission (Prosser et al. 2013), as does mixing chickens from different stocks (Bouma et al. 2009). The actual risk for disease transmission in

[90] Interview in Aceh, 30 October 2010.
[91] Interview in Aceh, 10 February 2010.
[92] Interview in Aceh, 5 February 2010.
[93] Interview in Aceh, 6 February 2010.
[94] Interview in Aceh, 6 February 2010.
[95] Interview in Aceh, 6 February 2010.
[96] Interview in Aceh, 30 October 2010.

poultry in these two examples, however, hinges on a range of temporal and biological factors not accounted for in this study.

Image 2: Ornamental birds and pigeons sold at Pasar Bieruen, Aceh

Image 3: Sorting and caging poultry at trading yard in Aceh

Hundreds of broilers arrive at *Pasar Bireuen* each day, and here they may come in contact with people, as well as village chickens, ducks, and geese brought to the market by *mugees*[97], poultry traders who use motorbikes to buy these birds from rural communities and bring them to central urban markets (Image 4, 5, and 6). Outlined in Chapter 2, ducks infected with H5N1 are often asymptomatic yet can shed relatively high levels of virus for extended periods of time. Although the exact mechanisms of transmission are not always known, ducks are associated with disease events in poultry and people in Indonesia and elsewhere (Henning et al. 2010; Gilbert and Pfeiffer 2012; J. K. Kim et al. 2009; Yupiana et al. 2010; Loth et al. 2011), and the presence of ducks in Indonesian LBMs has been associated with environmental contamination (Indriani et al. 2010). Whereas ducks and village chickens are brought daily by *mugees*, geese are more commonly available during holidays such as Ramadan.

One *mugee* who has worked for over twenty years says that there are around fifteen *mugees* who sell birds at *Pasar Bireuen.* This older *mugee* collects village chickens and ducks from five villages in Bireuen each afternoon, taking the birds he buys to his house each night, and then to *Pasar Bireuen* the following morning; the profit on each bird he buys is roughly 2000 IDR.[98] Others drive to neighbouring districts and beyond to buy birds.[99] All *mugees* confirm that they keep the birds they buy from multiple sources in cages at their home. Housing different species and stocks of birds together in this way for extended periods can facilitate disease transmission between animals (Paul et al. 2011), and increase the likelihood of environmental contamination (Indriani et al. 2010).

While most *mugees* focus on selling at *Pasar Bireuen,* some come to the market to buy birds from other *mugees,* to then sell across the province, and in districts where the price of poultry is higher than in Bireuen.[100] *Mugees* rely on personal contacts, connecting with them by mobile phones to determine the value of birds in other areas. One *mugee* says that if a bigger bird, such as a goose, sells for 140,000 IDR in Bireuen, he will be able to fetch 150,000 IDR in Meulaboh, a city located on the western coast of Sumatra, across the Gayo mountain range.[101] Individuals seeking incremental profits connect this extensive trade network. While such trade has been associated with disseminating H5N1 in poultry between geographically distant

[97] *Mugee* is an Acehnese term reserved strictly for people who buy and sell products that they collect from local communities, as one PWP describes: "There are so many *mugee:* There are *mugee eungkot* (fish), there are *mugee peutek* [papaya], and there are *mugee mamplam* [mango)]. There are so many kind of *mugee"* (Interview in Aceh, 1 April 2012). When I refer to *mugee,* I am referring to those who buy and sell birds. As discussed below, *mugees* in Aceh are a rough equivalent of *agen* in Banten and Lampung.
[98] Interview in Aceh, 5 February 2010.
[99] Interview in Aceh, 30 March 2012.
[100] Interview in Aceh, 6 February 2010.
[101] Interview in Aceh, 28 March 2012.

locations (Sims 2007), assessing the relative risks for transmission in this sort of trade in Aceh are beyond the scope of this study.

Image 4: A poultry trader travels by motorbike to pick up chickens in Aceh

Image 5: A *mugee* arrives at the market with a few birds to sell in Aceh

Image 6: A *mugee* in Aceh leaves the market at the end of the day

Image 7: A village chicken tied to the top of a cage with different bird species housed below

Mugees congregate in *Pasar Bireuen* close to where birds are slaughtered and defeathered, on a main customer thoroughfare for the wider market. Most wait with their birds, engaging potential customers. While some customers take the birds that they buy from *mugees* home alive, most pay to have them slaughtered at the market. One or two birds are often tied to the tops of cages as an advertisement (Image 7); some *mugees* hold birds in their hands, or place them on the ground. These birds were often observed excreting faeces, a physiological process with the potential to amplify environmental contamination in LBMs (Kurmi et al. 2013).

The slaughter and sale of poultry at Pasar Bireuen

In the course of the fieldwork in Bireuen, *Pasar Bireuen* underwent restructuring. During the first round of fieldwork in *Pasar Bireuen* in February 2010 the poultry slaughtering area abutted fish sellers on one side, and red-meat sellers on the other side; the PWP who sell birds and their by-products – as distinct from the slaughterers - were separated from the slaughter area by the fish sellers. The slaughtering area occupied roughly one-third of the rectangular footprint, and the market's water source was a well located in this area. Throughout each day, multiple individuals, both those working with poultry and other market workers, drew water from this well, and in this process, walked through piles of feathers, faeces, and pools of blood. H5N1 viruses can persist in feathers (Yamamoto et al. 2008) and other bird by-products (Nazir et al. 2011), and water (J. D. Brown et al. 2007) for extended periods, and thus the shared water source located in the centre of the slaughtering area may have posed a risk for wider disease dissemination.

When Sammy and I returned to *Pasar Bireuen* for the second round of fieldwork in October 2010 this slaughtering and selling area had been closed, and an elevated rectangular area was being built to house the fish sellers. During this construction, chicken sellers had relocated to the thoroughfare next to the old building. Here, they sold in a row, covered under blue tarpaulins and atop compacted dirt ground that turned to mud when it rained (Image 8); H5N1 viruses can persist in mud and soil (Horm, Gutiérrez, Sorn, et al. 2012; Horm et al. 2013; Nazir et al. 2011). All poultry-slaughtering activities had moved to the opposite side of the new building for fish sellers, between 15 and 20 yards away from the PWP who sold the slaughtered birds. There were then two distinct shop-fronts where birds are slaughtered at *Pasar Bireuen.* This is where the slaughterers and fish sellers remained. The public well was covered and the market's water source had been situated between the two slaughtering areas, in the form of a publically accessible open-air tank that market workers and customers used jointly. Indeed, I frequently observed PWP collecting water by dipping buckets that they used during slaughter into this public water source, and also often saw customers rinse their hands in this tank. As discussed in Chapter 2 and above, H5N1 viruses can persist in water (J. D. Brown et al. 2007), yet whether or not the conditions allowed for contamination in this public water source in Aceh is not known.

After the fish sellers' building was completed, a comparable building was built for the chicken sellers on the footprint of the first market described. This new structure

includes space for vegetable sellers, who occupy roughly one-quarter of this new structure, and red-meat sellers, who occupy about one-eighth of the space. The majority of this new building is taken up by poultry sellers (Image 9). Slaughtering activities remain on the far side of the fish market, thus ensuring a steady flow of processed poultry from the slaughter area to the sellers (Image 10). The diffuse nature of this workflow may facilitate wider environmental contamination, as slaughtered, prepared birds are routinely carried across a main thoroughfare to seller's tables. Moreover, the workflow in the slaughtering and selling area in Aceh, as here described, is unique. The majority of PWP in the other two fieldsites slaughter and defeather the birds that they sell in roughly the same location. In Aceh, however, there are areas dedicated to slaughtering and cleaning poultry; slaughterers here receive live birds and send prepared, defeathered carcasses to people who strictly sell birds and by-products to customers in a different area of the market. At the risk of oversimplifying the dynamism and complexity of poultry marketing in *Pasar Bireuen*, it is worth illustrating the slaughter and sale process in a linear fashion.

Image 8: A PWP in Aceh sells in the temporary market during reconstruction

Image 9: A PWP in the new market, located close to vegetable sellers

Each morning PWP with broiler chickens and *mugees* with some variety of village chickens, ducks, and geese arrive at *Pasar Bireuen* around sunrise. While *mugees* keep their birds live, those who sell commercial chickens unload most of their animals with slaughterers who are in turn paid around 700 IDR for each commercial bird, and up to 3000 IDR per village chicken, duck, or goose that they kill and defeather.[102] Village chickens, ducks, and geese are killed on-demand. Between seven and ten slaughterers work in the market, each earning around 45,000 and 50,000 IDR per day after expenses. These slaughterers kill birds in batches in the morning and then on-demand thereafter. Hundreds of animals are killed most mornings, and even more during religious holidays. All birds are killed in a *halal* manner. After their throats are slit, the birds are thrown into oil drums to bleed-out (Image 11). From here they are taken by hand and placed in pots of boiling water to loosen their feathers (Image 12). Thereafter these birds are placed in mechanical metal drums with pieces of rubber hose attached to the inner sidewalls (Image 13). Turned on, this petrol-powered machine quickly spins the birds, so that they bang against the inner walls of the drum in a process that removes most of their feathers. During this, slaughterers add water and use their hands to facilitate de-feathering; this can result in water and effluent spraying outwards. Although there are a few of these machines in both Serang and Lampung, I never saw them in use. As a collective, the slaughterers in Aceh who use these machines pay 5000 IDR a day to a

[102] Interview in Aceh, 28 March 2012.

third-party owner and are responsible for fuel used, as well as cleaning the machines at the end of each day.

As the morning progresses feathers and other by-products of the slaughtering process spill out onto the public thoroughfare. At the end of each day these by-products are piled together and removed by market cleaners. Before they are removed, however, most days a young man searches through them for duck and geese feathers that he resells to people in Java; this behaviour has the potential for disease exposure, as H5N1 viruses can persist in bird feathers for days (Yamamoto et al. 2008), as well as the potential for disease spread during the shipment of feathers to Java.

Image 10: A slaughterer carries carcasses to selling tables in Aceh

Image 11: A PWP waits for a bird to die before defeathering

Image 12: Chickens quickly boiled to loosen their feathers

Image 13: Defeathering chickens in Aceh

Image 14: Slaughtered birds ready to be sold, carried by wheelbarrow

Image 15: Customers looking at chickens for sale in Aceh

When birds are slaughtered and cleaned, their carcasses - innards intact - are returned by hand, bucket, or wheelbarrow, to the PWP who brought these birds to the market, or their affiliates who are responsible for selling to customers (Image 14). If an infected bird has been slaughtered, this process has the potential to facilitate environmental contamination. Most PWP who bring broiler chickens to the market work in a partnership with another individual who then sells the meat and by-products to customers; there are multiple groups of siblings working together in Aceh, and while these individuals and groups may rely on slaughterers to prepare their birds, they work largely independently to market their birds and are responsible for paying daily market taxes for cleaning and water, which can equate to nearly 5000 IDR, and for any birds that do not sell.

These sellers present birds to customers in a row, on tiled countertops (Image 15). There are approximately twenty different stations where sellers market prepared birds in *Pasar Bireuen*, and nearly all of them sell *ayam potong*. Those who sell *ayam merah* – layer chickens – commonly char the skin of these red-feathered birds because, as one customer explains, they have smaller feathers than *ayam potong* that can only be fully removed with a light burning[103]; PWP in Lampung and Serang do not char *ayam merah* like this. Under each seller's table there is an area where PWP store equipment like cutting boards, knives, and aprons. In LBMs in other parts of Indonesia, H5N1 viruses have been isolated from the equipment used to prepare

[103] Interview in Aceh, 31 March 2012.

and market poultry, suggesting that H5N1 can persist on this kind of equipment and potentially pose a risk for poultry and people (Indriani et al. 2010).

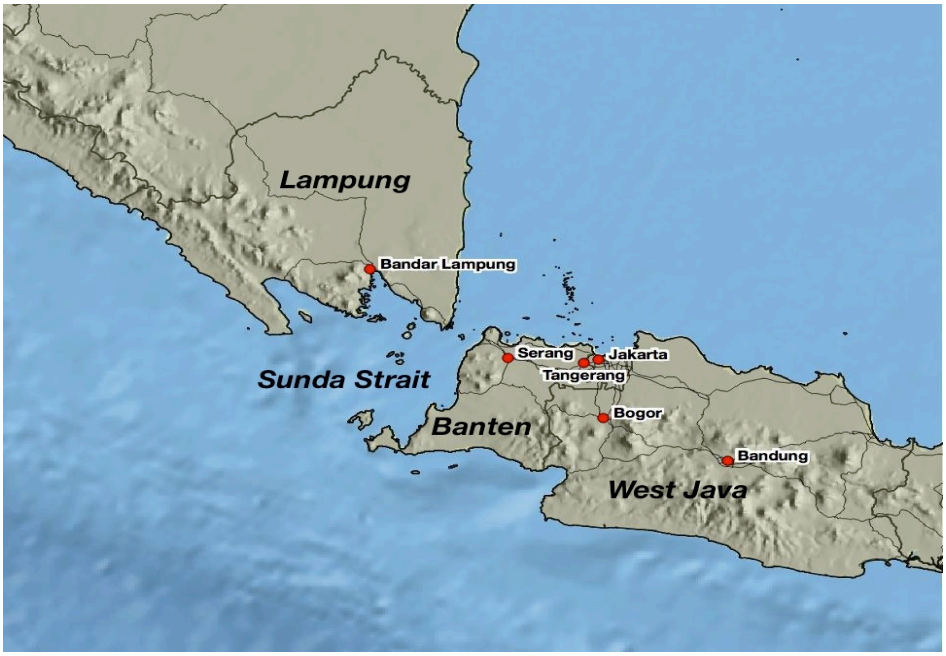
At the end of each day unsold birds are often put on ice and stored in locked chests and left at the market overnight, to be presented for sale again the following morning. If an infected bird is stored in this way, this practice may lead to further environmental contamination, as H5N1 viruses can persist in the meat of slaughtered birds (Mase et al. 2005; Nazir et al. 2011). These sellers use water throughout the day to keep a veneer of moisture on birds, and to rinse clear their workspace. Puddles emerge and can linger for days, posing a potential threat if virus is present, as H5N1 can persist for extended periods in water, depending on temperature and salinity (J. D. Brown et al. 2007). The market begins to empty around mid-day, and soon thereafter market cleaners begin to clean the area where poultry are slaughtered and sold.

Taken together with the discussion in Chapter 2, this rough description provides a more complete picture of the fieldsite in Aceh, and illustrates that in the daily routine in *Pasar Bireuen*, there may be myriad opportunities for disease exposure and environmental contamination should infected birds, or traders with contaminated equipment, enter this marketing system. The next section focuses on the research context in Lampung.

Pasar Tugu, Bandar Lampung, Lampung

Bandar Lampung in the provincial capital of Lampung, the southernmost province in Sumatra, and the city where *Pasar Tugu* is located (Map 3). The population of Bandar Lampung is roughly 880,000 (Badan Pusat Statistik 2010). Close to western Java, Lampung has long received Javanese migrants, many of whom were relocated from Java during Suharto's *transmigrasi* programme, a central government initiative that sought to disperse Java's growing populations across Sumatra and other Indonesian islands (Hardjono 1988). Lampung is also the point of entry for goods from Java, and the point of departure for goods from across Sumatra that are sent to Java - a busy trade route on which many poultry travel between the two islands. The Trans Sumatran Highway starts on the southern tip of Lampung and heads north, through Bandar Lampung as far north as Banda Aceh. As discussed above, this kind of road way has been associated with disease events in poultry in Indonesia and elsewhere (Loth et al. 2011; Gilbert and Pfeiffer 2012)

Map 3: Bandar Lampung, Lampung



Data courtesy of the U.S. Geological Survey

Lampung has experienced sporadic outbreaks of H5N1 in poultry and in humans. While Lampung has had minor success in controlling the spread of the virus because the governor actively engaged with policies and lent his weight to their enforcement (Forster 2009), it is ultimately very difficult to control the movement of birds here, as the province is a transit point for birds going north in Sumatra, and east to Java. This trade has the potential to facilitate viral reintroduction in poultry. As one government official charged with avian influenza control in Lampung explains rhetorically: "Bandar Lampung is still at risk of bird flu. Why do I say so? Because Bandar Lampung is the gateway to Sumatra, it becomes the filter, the area that is closest to the [avian influenza-] prone area [in Java] right?[104]

Pasar Tugu

The main building at *Pasar Tugu* is set back around 20 yards from the main road and rises four stories high. Thoroughfares run down either side of this building, with a variety of sellers established on both sides of these alleyways. Those not covered by the formalized market sell under tarpaulins. The centre of the market is occupied mostly by clothing and electronics sellers. Fresh-produce sellers, PWP, dry-goods dealers, and small restaurants are setup along the lanes that border the market. Both these lanes thin towards the back of *Pasar Tugu*, and lead to an area predominantly occupied by fishmongers and red-meat sellers. While some of the larger poultry sellers work from established storefronts, PWP sell carcasses and by-products throughout the ground floor, interspersed between people selling clothes, produce, and other goods (Image 16). If any birds are infected, or PWP's equipment

[104] Interview in Lampung, 27 August 2012.

contaminated, this sort of intimacy can provide an opportunity for disease exposure and environmental contamination. Unlike *Pasar Rau* in Serang and *Pasar Bireuen* in Bireuen, *Pasar Tugu* in Bandar Lampung is not the largest LBM in the city. The market is, however, consistently busy throughout the morning, and only begins to slow by the early afternoon. As in *Pasar Rau* in Serang, the vast majority of business in *Pasar Tugu* is relegated to the ground floor of the market, despite ample space in the upper floors of the main building.

The top floor of the market is occupied by a colony of bats. A thin layer of guano and rainwater covers much of the ground. The ceiling rises to roughly 30 feet in the larger rooms. On the day Sari and went to this floor, and as indicated in Image 17, thousands of bats flew above us and the rooms were filled with smoke emanating from oil drums burning a mixture of rubber and wood – fires lit by the local government in an attempt to persuade the bats to "relocate".[105] Bats harbour various zoonotic diseases including, rabies, coronaviruses like SARS, henipaviruses like Hendra and Nipah (Calisher et al. 2006), as well as influenza viruses (Tong et al. 2012). Although there is little opportunity for poultry and people to come in direct contact with bats at *Pasar Tugu,* environmental contamination can be particularly high where bats nest and feed (Newman et al. 2011). In short these bats may pose an additional risk facilitating environmental contamination at *Pasar Tugu.*

Where do birds and their by-products at Pasar Tugu come from?

As in the other two sites, the majority of birds at *Pasar Tugu* are commercial broiler chickens – *ayam potong*. There is only one PWP who permanently sells slaughtered and live *ayam kampung,* and a few others who occasionally sell live village chickens; ducks and geese were not observed in *Pasar Tugu*. With few ducks entering the market the potential for disease introduction and environmental contamination is likely far lower in *Pasar Tugu* than in the other two sites (Indriani et al. 2010). The *ayam potong* sold in the market are bought from commercial poultry companies collector yards located around Bandar Lampung. One large commercial poultry producer occupies a property not far from *Pasar Tugu*, and this collection yard provides the majority of the birds sold in the market, although there are some other, smaller suppliers.[106] Everyday up to a few thousand *ayam potong* are sent to this particular collector yard from one of 52 "ranches" contracted to raise the birds, the closest of which is approximately 45 minutes drive away. If this company lacks sufficient supply they import birds from Java, or from Palembang, farther north in Sumatra.[107]

When birds arrive at this collection yard they are promptly offloaded from the truck and placed on the ground to be sorted (Image 18). Sometimes birds die during transport; these dead birds are placed to one side and discarded (Image 19), while live birds are briefly examined and shuffled between cages (Image 20), or housed in

[105] Interview in Lampung, 9 April 2012.
[106] Interview in Lampung, 25 July 2012.
[107] Interview in Lampung, 27 July 2012.

one of two larger holding pens. Faeces that build up under the orange-colour crates are washed away with water, an action that has the opportunity to lead to environmental contamination, as H5N1 can persist in both faeces and water for extended periods (Kurmi et al. 2013; J. D. Brown et al. 2007). From around midday onwards PWP arrive to buy chickens. PWP select the birds, which are promptly weighed and paid for; there is no credit, and one kilogram costs between 21,500-22,500 IDR, depending on supply and the time of year.[108] Many PWP travel by motorbike without cages, binding birds by their feet to attach them to their motorbikes (Image 21). This sort of trade – small-scale traders moving birds between urban and rural communities, and farms and markets - has been associated with H5N1 maintenance and dissemination in poultry (Fournié et al. 2013), and may connect pathways for disease transmission in Lampung; establishing the actual risk for transmission in poultry and people posed by this kind of trade in each site, however, was beyond the scope of the current study.

Image 16: A PWP sells poultry across from a clothing seller in Lampung

[108] Interview in Lampung, 27 July 2012.

Image 17: Bats fly in the top story of Pasar Tugu, in Lampung

Image 18: Commercial chickens arrive at a trading yard to be sorted

Image 19: Birds that die during transit are set aside

Image 20: Chickens sorted at a poultry yard in Lampung to be resold

Image 21: A PWP ties chickens he bought from a poultry yard to his motorbike

Not all birds from this collection yard go to LBMs. For example, a retired policeman from Java who buys 10-50 chickens a week takes them to his village outside of Bandar Lampung to resell to local restaurants.[109] Moreover, not all PWP who buy birds from this receiving bay hand-select the birds. Many of the smaller sellers at *Pasar Tugu* obtain chickens from an intermediary agent, or "broker", who buys birds and then passes them to those who cannot afford the initial financial outlay; this system was unique to Lampung. As an incentive to the broker a marginal increase is attached to the price of each bird. PWP buy birds through this route because it offers them an opportunity to sell birds without having the necessary funds to purchase them live. When asked about his business, Pak Mustafa – the most prominent broker in *Pasar Tugu* - replies that the commercial companies "implement a cash and carry system", where chickens must be paid for up front, "so I buy those chickens and then they [PWP in the market] pay me according to how many chickens they sell."[110] Two older female PWP explained their relationship with Pak Mustafa:

> Sari: So, are there a lot of brokers like Pak Mustafa in this market?
>
> Ibu Lena: No, but there are some others. But most [sellers who borrow money] take the chickens from Pak Mustafa because he's kind, he's pleasant... yesterday I lacked 30,000 IDR for payment [and he said] 'it can

[109] Interview in Lampung, 28 July 2012.
[110] Interview in Lampung, 25 July 2012.

> be paid tomorrow, no problem'. [And then] that time I lacked 12,000 IDR he let it go, he said 'keep it for the children's pocket money'.
>
> Ibu Ning: Yesterday I should have paid 350,000 IDR but I gave Pak Mustafa 300,000 IDR [and he said] I can give 50,000 IDR later.
>
> Ibu Lena: ...Thankfully there is Pak Mustafa. Here [in Pasar Tugu] almost 80 percent of small chicken sellers take chickens from Pak Mustafa.[111]

Over the course of research in Lampung I only heard of one negative experience between a PWP and a broker.[112] Essentially, this system illustrates that not all PWP in Lampung have the financial capital to purchase poultry up-front, with most relying on intermediary brokers to facilitate the purchase of poultry, and the sale of birds to repay loans. Additionally, it illustrates that the majority of PWP in *Pasar Tugu*, although reliant on external financial assistance, work independently to sell their birds. Unfortunately, I did not ask Pak Mustafa how much profit he makes on each bird, as I considered it inappropriate to enquire in the presence of sellers. The larger sellers in *Pasar Tugu* buy birds that are close in age to be slaughtered directly from commercial poultry companies; only one seller in this market raises day-old chicks until they are ready for slaughter.

There is one seller who sells *ayam kampung* every day in *Pasar Tugu*, an older woman who brings both a few carcasses and live village chickens to the market. She sources the birds she sells from an *agen* who brings birds to her house that he collects from villages surrounding Bandar Lampung.[113] There are other sellers who bring live *ayam kampung* to the market, but they do not sell at *Pasar Tugu* everyday.[114] There is an increase in PWP selling *ayam kampung* during Ramadan, when the demand and cost for these birds rises. Throughout three rounds of fieldwork I did not see any ducks or geese in *Pasar Tugu;* these birds are, however, in other LBMs in Bandar Lampung, and thus these markets may have a higher likelihood of contamination with H5N1 (Kurmi et al. 2013; J. K. Kim et al. 2009). The vast majority of poultry sold in *Pasar Tugu* are *ayam potong* that are slaughtered outside of the market.

The slaughter and sale of poultry at Pasar Tugu

Slaughtering birds that are infected can lead to environmental contamination, and such practices have been associated with disease presence in LBMs in Indonesia (Indriani et al. 2010). Only a minority of PWP slaughter birds in *Pasar Tugu*. Those that slaughter on site are established in permanent storefronts that they rent or own (Image 22). One PWP explained that he continued to slaughter at the market even though officials from *Dinas Peternekan* – the local animal health department –

[111] Interview in Lampung, 28 August 2012.
[112] Interview in Lampung, 10 April 2012.
[113] Interview in Lampung, 26 July 2012.
[114] Interview in Lampung, 9 April 2012.

instituted a ban on slaughtering in *Pasar Tugu* in 2010.[115] Throughout fieldwork I did not observe officials enforcing this ban, and no other PWP confirmed that slaughtering was not allowed on-site, or that animal health officials had implemented such a ban. Indeed, throughout fieldwork I did not observe any public veterinary or public health officials interacting with PWP in Lampung. The only government workers I observed in the market were those collecting daily taxes.

The majority of PWP in *Pasar Tugu* slaughter the birds they sell at their house each morning, and many with the help of their family.[116] These PWP carry the birds they sell with them to the market each morning in buckets or bags. Some rent out more established space with a small wooden table; others move daily and fit where possible between other sellers to market their birds (Image 23). The space to market poultry in *Pasar Tugu* is further squeezed during Ramadan. The demand for all poultry increases during Islamic holidays, with a concomitant rise in both the cost of birds, and in the number of seasonal PWP who market poultry. The cost of other key commodities, like garlic, onions, and chillies, also increases around Ramadan (Osman 2013). While more PWP vie for customers, permanent sellers in all three fieldsites report that they sell more birds and make more money over Islamic holidays: they sell more birds because more people buy them, and make more money, in a relative sense, because they are able to charge more for poultry during this time. A representative from a commercial poultry company says that during Ramadan 2012 the price of their birds rose from 21,500 IDR to 22,500 IDR, an increase attributed to shortages of

Image 22: A PWP prepares chickens to sell in Lampung

[115] Interview in Lampung, 10 April 2012.
[116] Interview in Lampung, 25 July 2012.

Image 23: A PWP sells chickens in the middle of the market in Lampung

Image 24: Birds kept at the market in Lampung

Image 25: Birds kept at the market in Lampung

stock.[117] On top of any increase that commercial producers charge, PWP add more. One respondent in *Pasar Tugu* confirms that during Ramadan the cost of poultry cn rise up to 20 percent.[118]; the day after Ramadan the price of poultry is said to drop across each LBM studied. Other commodities fluctuate in a similar manner. Such price fluctuations are not necessarily due to a shortage of stock, however, but can reflect opportunism among sellers (Osman 2013).

While some of the larger sellers in *Pasar Tugu* slaughter on-site, and have storage space for equipment, live birds, and unsold carcasses and by-products (Image 24 and 25), the majority of PWP here take equipment and unsold poultry home each day. These birds and by-products are brought back the following morning and sold at a lower price. If H5N1 persists in some parts of the market, or at the house of a PWP, this daily transportation – between home and market - may act as a mechanism for disease transmission and exposure to the wider public, as many PWP rely on public transit. Although not the largest market in Bandar Lampung, hundreds, if not thousands of chickens enter and leave *Pasar Tugu* each day, and in this way, this LBM is comparable to those in both Aceh and Banten, the latter of which is discussed next.

Pasar Rau, Serang, Banten

Serang is the capital city of Banten, the westernmost province on the island of Java, located roughly 50 miles from the national capital Jakarta (Map 4). The population

[117] Interview in Lampung, 27 July 2012.
[118] Interview in Lampung, 26 July 2012.

of Serang is just above 575,000 (Badan Pusat Statistik 2010). As Jakarta grows outwards, increasingly encroaching westward into Banten, populations in cities like Serang become further incorporated into the *Ibu Kota,* or Mother City. This amalgamation will continue should the proposed Sunda Strait Bridge connecting Sumatra and Java move forward.

Java is the centre of poultry production in Indonesia (USAID 2013), and the majority of outbreaks of H5N1 in poultry and disease events in people are reported from the island. Banten has recorded the second highest number of infections in humans after the neighbouring province of West Java. Here, disease events in people have been significantly associated with outbreaks in poultry (Yupiana et al. 2010). Most human infections in Banten have been near Tangerang, a commercial distribution centre of the Javanese poultry industry located on the west side of Jakarta. There have also been repeated outbreaks in poultry across districts in Banten from 2003, with sellers reporting disease events in poultry through to August 2012, when this research concluded. In short, Banten is relatively the worst affected of the three field sites, with more cases of H5N1 reported in poultry and in people.

Map 4: Serang, Banten

Data courtesy of the U.S. Geological Survey

Pasar Rau

Pasar Rau is the commercial centre of Serang and open, in some capacity, every hour of every day. The streets surrounding the central market bustle with traders and vehicles. *Angkots* – mini-buses – crawl through pedestrian traffic and *becaks* – pedal-driven rickshaws – stand idle on the side of the road as drivers vie for passengers. A mass of fresh produce for sale narrows the road leading to the market to a single

lane, and small-scale produce sellers, mostly women, sit closest to the road, exposed to the elements. The position of these sellers is not guaranteed – each day they set-up wherever space is available. Behind these sellers runs a row of more established produce stalls, most covered by blue or orange tarpaulins held down by ties to bricks or incorporated into the wooden structures. Walking towards the back of *Pasar Rau*, the stands of produce become interspersed with dry-goods sellers and small restaurants. Continuing in this direction, the first indications of live poultry become apparent in the presence of rectangular metal cages. Towards the south-east corner of the market, poultry sellers begin to outnumber produce vendors. This is the area where the majority of fieldwork in Serang took place.

"There are so many", responded one government official asked about the number of people who buy and sell poultry in Serang.[119] *Pasar Rau* is the largest market in Serang, attracting the majority of traders and customers. Drawing in the majority of traders, and thus live birds, *Pasar Rau* may be at an increased risk for repeated reintroduction of virus, either through infected birds or a trader's equipment. Although hinging on a range of factors, such repeated contamination can lead markets to act as viral reservoirs (Fournié et al. 2013; Fournié et al. 2012), and, as traders frequently move between different farms, villages, and markets, potentially a source for infection across the wider poultry sector.

Where do birds at Pasar Rau come from?

Of the three markets, *Pasar Rau* hosts the largest number of birds and PWP. The majority of PWP sell broiler chickens. There are also PWP who specialize in village chickens, ducks, and geese; fighting cocks are also occasionally for sale at the market. Taken together, there are hundreds, and sometimes thousands, of birds brought daily to *Pasar Rau*. Indonesian markets with a mix of bird species – and especially ducks - are associated with greater environmental contamination than markets selling fewer species (Indriani et al. 2010).

While broiler chickens are bred and sold across the archipelago, the centre of this industry is in West Java (USAID 2013), the province neighbouring Banten. Most of the broilers sold at *Pasar Rau* come from other areas in Java.[120] As one PWP explains:

> ...The central production [of these birds] is in Tasikmalaya. So, from Tasikmalaya birds are sent to Bogor, and then to Tangerang, and from Tangerang the chickens will be spread all around the city of Serang.[121]

Commercial poultry production, and the transportation of these birds across Indonesia's road networks, are associated with disease events in animals (Loth et al. 2011; Yupiana et al. 2010). When broiler chickens arrive in Serang these birds are either sent to PWP who raise the birds until they are ready to be sold to consumers

[119] Interview in Banten, 19 March 2012.
[120] Interview in Banten, 4 May 2011.
[121] Interview in Banten, 4 May 2011.

or, if the birds are considered adequately sized and ready for sale, delivered directly to PWP at LBMs (Image 26). When broiler chickens arrive at *Pasar Rau* they often come in orange-coloured cages on the back of trucks. Many PWP have on-site storage for birds, and broilers are placed into bamboo stalls or metal enclosures. Sometimes broilers are placed with other bird stocks and species. Faeces often remain on the back of poultry delivery truck, and these are frequently removed with water prior to the truck leaving the market after delivering the birds (Image 27). These kind of actions can contribute to environmental contamination, as H5N1 can persist in faeces (Kurmi et al. 2013), water (J. D. Brown et al. 2007), and mud and dirt (Nazir et al. 2011; Horm, Gutiérrez, Sorn, et al. 2012) for days.

Birds brought to *Pasar Rau* that are not killed immediately may remain caged alongside birds from other stocks or species for a few days. Keeping different stocks and species of birds on-site in LBMs for repeated days can increase the potential for environmental contamination and disease transmission in poultry should a susceptible bird be stored alongside an infected bird or in an already contaminated environment (Samaan et al. 2011; Indriani et al. 2010; Fournié et al. 2012). Compared with the other two sites, the caging facilities at *Pasar Rau* are relatively unique, in that the majority of birds are kept on-site until they are sold or slaughtered.

Image 26: Delivering broiler chickens to Pasar Rau, in Banten

Image 27: Chicken faeces washed from the back of the truck after delivery

Village chickens, ducks, and geese are brought to *Pasar Rau* by *agen,* or poultry traders*,* and small-hold farmers. There are more than a dozen *agen* who work independently and sell in *Pasar Rau*, all of whom use motorbikes to transport poultry. This sort of trade network is associated with disease introduction in farms and markets (Sims 2007; M. Van Kerkhove et al. 2009; Kung et al. 2007; Magalhães, Pfeiffer, and Otte 2010; FAO 2011; Roche et al. 2014; Santhia et al. 2009). When asked how many *agen* he buys from, one seller at *Pasar Rau* responds there are five traders who bring him birds daily.[122] *Agen* and PWP in the market speak daily about prices and availability via mobile phones. When customer demand for poultry rises, sellers make contact with *agen* to secure more stock. While *agen* and PWP are nominally independent, their business transactions take place within longstanding relationships built on trust and mutual benefit. Sellers do not necessarily pay entirely up front for all of the birds they take from *agen*, as one seller claims: "...we don't pay right away when they deliver the birds but maybe the next day when he's back to deliver some more."[123]

Like *mugees* in Aceh, *agen* buy only village chickens, ducks, and geese. As one *agen* explains:

[122] Interview in Banten, 7 May 2011.
[123] Interview in Banten, 7 May 2011.

> There's no farm for *ayam kampung* [village chickens] I just go looking at houses where people care for *ayam kampung*. I take one if they have any available. Sometimes I don't get any.[124]

Through this trade, these PWP can connect physically disparate communities. *Agen* often source birds in districts and provinces away from their home base of business, and while most of the birds are bought in rural communities and sold in urban LBMs, these markets are not necessarily the end point for these birds. Some PWP buy village chickens, ducks, geese, and fighting cocks in Serang to sell in other parts of Java where the price is higher. An *agen* states how cost dictates where he procures poultry:

> ...the price is definitely cheaper if you get [birds] right from the village. But you have to count the cost of petrol and the time and energy. So, I thought it's easier to just go to the market. Pick, buy, and resell [laughing].[125]

The majority of *agen* in *Pasar Rau* buy birds at *Pasar Kelodoran,* a large, urban poultry-only market roughly fifteen kilometres outside Serang. To better understand the source of birds brought to *Pasar Rau*, my assistant Sari and I undertook repeated visits to *Pasar Kelodoran.*

Every day about a dozen *agen* connect a trade network between sellers and small-hold farmers at *Pasar Kelodoran* and PWP at *Pasar Rau*, and by extension, customers. *Pasar Kelodoran*, as one seller describes, has existed "from the time of our ancestors. The market is already here before Banten [the province]. It's been a long time."[126] The market occupies much of both sides of a busy two-lane road and there are between 70 and 100 sellers marketing birds here. The beaks of some sellers' birds, which are bound and laid flat on the tarmac, stretch into the road (Image 28). *Ayam kampung* are tied together and ducks sit at sellers' feet where, on display, they are routinely prodded and moved (Image 29 and 30). Small pitch-black "antique" chickens, with dark eyes and purple-black legs sell for 200,000 IDR each. Pointing at one dark chicken their owner says: "it's all black: black meat, black bones", and then goes on to relay that customers buy the dark birds to drink their blood, as it alleviates asthma and other (unstated) illnesses.[127] Consuming uncooked birds and their by-products in this way may be a risk factor for human H5N1 transmission (M. Van Kerkhove et al. 2011). A likely higher risk for disease in poultry, and by extension in people, is the high number of ducks that are marketed at *Pasar Kelodoran*. As largely silent carriers of H5N1, infected ducks can shed high concentrations of virus for extended periods and have been associated with disease events in poultry (Gilbert and Pfeiffer 2012). On any given day, there are hundreds of ducks brought to this rural market

[124] Interview in Banten, 16 March 2012.
[125] Interview in Banten, 6 May 2011.
[126] Interview in Banten, 30 July 2012.
[127] Interview in Banten, 31 July 2012.

Pasar Kelodoran is also a central hub for fighting cocks - *ayam jago* or *ayam Bangkok* - attracting sellers from across Banten and farther afield. Some birds are said to come from as far away as Thailand, although most are from across Java.[128] There is an area of the market where most of these cocks are sold and here Sari and I watched multiple, simultaneous bouts in which men pitted their birds against one another to show-off their value, set up future matches, and sell birds (Image 31 and 32). Here, men massaged and washed their birds in preparation for bouts, and some plunged their birds' throats with a damp feather to promote breathing; this feather was shared between multiple birds. While dependent upon a range of factors, H5N1 infected chickens in Indonesia may shed high concentrations of virus orally (Wibawa et al. 2013), and thus such behaviours have the potential to facilitate disease spread between birds, and potentially expose people. Indeed, a high density of fighting cocks has been associated with disease events in birds in Thailand (Tiensin et al. 2009), and some fighting cock owners in Indonesia have been the focus of disease control initiatives (Lowe 2010).[129] In the current study, respondents who raise and fight cocks in each site recalled losing birds in the past, however, no respondent reported these disease events, and nobody claimed involvement in official disease control initiatives.

Pasar Kelodoran is a receiving bay and transition point for myriad birds. When a bird arrives here it is difficult to determine where it hatched. One duck and goose seller describes how he sources birds from across Banten as well as across the Sunda Straight in Lampung because of the marginal economic gains that come from buying birds where they are cheapest: "the price is more competitive... That's my secret [laughing], buying in Lampung." When asked why he travels by motorbike, he states:

> I prefer going by motorbike because it's more efficient. By car the process is not short; we must fulfil the quota. It means two days may not be enough [to fill the cars]. It means we have to feed the geese – it's another cost. Using a motorbike is fast... the weight cost in the harbour is cheaper, we only pay the ticket. With a car there's a 'weight-cost', not to mention gasoline cost.[130]

This same seller discussed the process of buying geese from rural communities in Banten:

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[128] Interview in Banten, 7 May 2011.

[129] Cockfighting is a male pursuit in each site. PWP who engage in cockfighting take particularly intimate care of their birds, and pride in showing them off and in pitting them against one another, even if only in practice. Indeed, cockfighting in Indonesia is "far from simply cruel and brutal". The tradition, in all aspects, "exhibits an intimate relationship between men and their birds", with the life of fighting cocks straddling "luxury and brutality" (Naysmith 2011).

[130] Interview in Banten, 2 August 2012.

> There are entok sellers in every RT [*rukun tetangga* – the smallest unit of community]... I usually wait at the markets in [different] districts; then they will come to me. Sometimes it can be done by phone. 'Sir, there's this amount of geese.' I can visit their house to get geese.[131]

Many sellers confirm that "big" buyers come from the Jakarta area – "from Subang and Cikampek"[132] – and bring multiple vehicles at a time to fill with poultry before returning east. "Customers in *Pasar Kelodoran* are from markets in Marunda, Klender, Jatinegara – they all buy birds from here!"[133], one PWP explains. These three latter locations are neighborhoods in Jakarta; Subang and Cikampek are cities east of Jakarta, in West Java.

While some PWP raise all the ducks that they sell, others purchase ducks from different communities. One such seller with 35 years experience says that to "maintain the ducks" at home, is too expensive. Rather he collects ducks "one by one" from different villages, and then travels to *Pasar Kelodoran* each day with a few dozen ducks that he keeps bound in rice-sacks with holes cut in them for the ducks' heads. As we spoke, this particular seller prepared to leave the market by mini-bus. The first three drivers refused the seller, saying their vehicles were too full to carry him and his ducks. Finally, a mini-bus transporting school-children picked him up (Image 35). This interaction illustrates the diffuse nature of the poultry trade in Indonesia, and in turn underscores that if a bird is infected and shedding virus, there may be ample opportunities for environmental contamination resulting in the potential for poultry and human exposure.

Along with *agen,* village chickens, ducks, and geese are brought to *Pasar Rau* by individuals, or small groups of men attempting to sell a few birds from multiple stocks. Some of these PWP are frequently at the market; others sell birds only intermittently, bringing one or two animals at a time. On our first day in *Pasar Rau* in May 2011 Sari and I spoke with an older trader who had four *ayam kampung* bound on the ground at his feet (Image 34); we spoke with him each time we visited Serang. He began selling birds at *Pasar Rau* in 1980. As we spoke he rubbed his birds' throats and chests, and trailed his hand down their backs, closing his grip on their tail feathers before repeating the stroke. He has only ever sold *ayam kampung*, and collects birds from neighbours, who often give him village chickens on credit that he repays when the birds sell: "They trust me," he states. When he cannot procure birds from neighbours, he is given birds from other sellers - "friends" in the market – using a similar credit scheme. While he usually sells around 10 to 15 birds each day, when we spoke this first time, he had only four birds because he did not have "enough money to increase [his] capital to raise [his] business."[134]

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[131] Interview in Banten, 2 August 2012.
[132] Interview in Banten, 2 August 2012.
[133] Interview in Banten, 2 August 2012.
[134] Interview in Banten, 4 May 2011.

Although this older seller relies on credit and the goodwill of others, the majority of people trading and selling village chickens, in and around Serang work independently. Indeed, "There are so many", responded one government official asked about the number of people who buy and sell poultry in Serang.[135] Such extensive and intensive trade networks have been associated with disease spread and outbreaks among poultry in different countries (Fournié, de Glanville, and Pfeiffer 2012), and this kind of trade may be largely responsible for disease spread and maintenance in poultry in parts of Indonesia (Santhia et al. 2009; Loth et al. 2011; Yupiana et al. 2010).

Pasar Rau is the largest market in Serang, attracting the majority of traders and customers, and thus live birds. While the majority of birds sold at the market are broiler chickens, there are a variety of species brought daily to the market. These birds can come from numerous stocks in different areas, including from other provinces in Java, as is the case with most broiler chickens, communities around Banten, and from further afield, including a boat ride away in Lampung. By the time these birds arrive at *Pasar Rau* they may have come in contact with multiple people as well as different species of birds, from multiple stocks, for varying lengths of time. As the central market, *Pasar Rau* may be at an increased risk for repeated reintroduction of virus, either through infected birds or traders' equipment. Indeed, although hinging on a range of factors, such as the presence of ducks and other species (Indriani et al. 2010), a constant flow of traders and birds can facilitate markets to become viral reservoirs (Fournié et al. 2013; Fournié et al. 2012) and, as traders frequently move between different farms and markets, markets like *Pasar Rau* may act as a constant source for infection across the wider poultry sector.

Image 28: Birds presented for sale at Pasar Kelodoran, outside Serang

[135] Interview in Banten, 19 March 2012.

Image 29: Ducks for sale at Pasar Kelodoran

Image 30: Customers look to buy ducks at Pasar Kelodoran

Image 31: Fighting cocks for sale at Pasar Kelodoran

Image 32: Two fighting cocks pitted against each other at Pasar Kelodoran

Image 33: A duck seller returns home with unsold ducks via public transit

Image 34: A PWP sells a few village chickens at Pasar Rau

Image 35: Birds are quickly boiled in Pasar Rau

The slaughter and sale of poultry at Pasar Rau

While there is a separation between slaughterers and sellers in Aceh, in Serang and Lampung the vast majority of PWP who sell birds, also slaughter them. However, unlike *Pasar Tugu* in Lampung, where most birds are slaughtered at sellers' houses each morning, in *Pasar Rau* birds are slaughtered onsite each day. Most PWP at *Pasar Rau* occupy storefronts that were made after "one hundred shops were burnt"[136] in a fire that destroyed the market in 2001.[137] Most poultry sellers at *Pasar Rau* built these structures in the years following the blaze and have since slaughtered and sold birds from within them. In each area where birds are slaughtered there is a barrel – an aluminium pot or oil drum cut in half – of water on a slow boil, heated by either wood or gas. This water serves to loosen the feathers of slaughtered poultry killed in a *halal* manner; limp birds are stirred in this water for about 30 seconds before they are pulled out and hand- plucked (Image 35). Water is continually added to these ever-depleting boiling pots, and at the end of the day what remains is often poured onto the main thoroughfare, a dirt road, resulting in pockets of mud surrounding poultry slaughter areas. If an infected bird is processed in this way wider environmental contamination can result, as H5N1 viruses can persist in water and mud for extended periods (J. D. Brown et al. 2007; Nazir et al. 2011).

[136] Interview in Banten, 18 March 2012.

[137] While sellers spoke about this fire, only one respondent was certain what year it had occurred, with most sellers simply responding "*sudah lama"* – roughly translated as, 'already a long time ago'.

Cleaned carcasses rest beside live birds awaiting slaughter. A bucket of tepid water is used to rinse these birds before they are presented for sale. Piles of red, white, brown, and black feathers accumulate incrementally, along with faeces stripped from intestines, and brown and orange nodule-ridden duck and geese bills. Cages are located close to where birds are slaughtered and elevated off the ground to allow faeces from live birds to pass through. These cages are often covered by blue tarpaulins to protect birds from theft and weather (Image 37). The tops of some of these cages double as a table where slaughtered birds are laid out, cut-up, and bagged for customers. The cutting surface on top of these tables is not always sealed, allowing small amounts of water and blood to drip on the live birds caged below; as virus can persist in such runoff (Indriani et al. 2010), this process may lead to environmental contamination. Some of the larger sellers in Serang also rent small, enclosed buildings where they store poultry (Image 36). When PWP slaughter in batches, these poultry holding-rooms can be depleted. Birds kept at the market are fed rice husks in small trays, and drink water from containers that hold about 10 litres and have self-refilling base trays; birds share these watering trays, an activity that may lead to disease transmission in birds if an infected animal efficiently sheds virus into the water (Forrest, Kim, and Webster 2010).

Though the number of people selling poultry in *Pasar Rau* fluctuates according to the season, the time of year, or an individual's ability to raise capital, conservative estimates from interviews and observations suggest that there are more than 60 individuals involved full-time in some aspect of the poultry trade in *Pasar Rau.* Many of these workers slaughter and prepare birds for sale, receiving between 40,000-50,000 IDR per day, depending on sales. Each month PWP responsible for each independent outfit pay between 330,000-350,000 IDR in rent; this covers electricity, security, and general cleaning. Water is delivered by hand to each seller for 1000 IDR per jerry-can, with most sellers using 15-20 jerry-cans a day. Broiler and layer chickens are bought from contract farmers and commercial producers for about 20,000 IDR each, and are sold to consumers at the market for about 22,000-24,000 IDR.[138] The price of other species fluctuates depending on their size and age: *ayam kampung* sell for between 40,000-50,000 IDR; ducks that are not producing eggs sell for around 30,000-40,000, while the price for adult ducks and geese start between 60,000-70,000 IDR each.[139] In all three fieldsites the price of poultry rises during holidays when demand increases. While these prices are comparable, or slightly cheaper than the cost of poultry and taxes in Aceh and in Lampung, what is important here is recognizing that after taxes and expenses are paid, PWP in each of the three sites make only a marginal profit from each bird sold.

[138] Interview in Banten, 18 March 2012.
[139] Interview in Banten, 4 May 2011.

Image 36: Chickens kept overnight at Pasar Rau

Image 37: Chickens kept overnight in cages at Pasar Rau

Conclusion

This chapter discusses the general context in each fieldsite to situate this research and underscore the dynamic, extensive, and often diffuse nature of the poultry trade in Indonesia. While it is not possible to determine the actual risk posed to poultry or people in any of the three field sites, through observations and the use of existing studies it is possible to generally outline the relative risk that exists in each location.

Factors associated with disease in poultry include the presence of ducks, the density of road networks and transport links, and the presence and proximity to water (Gilbert and Pfeiffer 2012). In Indonesia, other factors, such as commercial poultry and trade in and out of communities are also associated with disease events in birds (Loth et al. 2011; Yupiana et al. 2010; Santhia et al. 2009). Moreover, Indonesian LBMs associated with environmental contamination are those that market ducks and those with on-site slaughtering and processing facilities (Indriani et al. 2010). These criteria – broadly understood – are not similarly present in each of the field sites where this research was undertaken. For example, although ducks are routinely sold and slaughtered in the markets in Banten and Aceh, they are not commonly sold in the market in Lampung. Similarly, slaughtering on-site is routine in the markets in Aceh and Banten, whereas most birds sold in Lampung are slaughtered off-site. Additionally, water is not as ubiquitous in Lampung as it is in the other two sites, where pooled water and mud are frequently observed around the slaughter and sale areas. Each of the three sites, however, are located near major road networks on which birds are routinely transported, and each LBM in question is made-up of different PWP buying and selling birds from different stocks. This form of dynamic trade is associated with disease introduction and maintenance in LBMs (Fournié et al. 2013). Establishing the potential – and degree – of environmental contamination in these three markets, however, was beyond the scope of this study. That said, observations and available information suggest that Serang, the largest of the three markets, attracts the most traders and birds, including ducks, from across Java and beyond, and thus *Pasar Rau* may be the market most likely to act as a reservoir of infection.

In describing the market environment in each field site, this chapter broadly outlines the myriad ways in which H5N1 may persist within a live bird market environment, should an infected bird be introduced, or PWP introduce virus via their equipment. Risk factors associated with H5N1 in humans include contact with sick poultry or fomites, or indirect transmission in contaminated environments such as LBMs (M. Van Kerkhove 2013; Patel et al. 2014). Human contact with poultry and potential fomites in each of the three sites are numerous, illustrating that while there may be countless opportunities for disease exposure in the right circumstances, such contact does not necessarily result in disease transmission. Ultimately, this chapter situates the current study, providing a sense of the relative risks in each location, and context for the data presented in the remaining chapters.

Chapter 9: Constructions of risk about avian influenza among PWP

Introduction

This chapter explores the way that PWP construct the risks about H5N1 for animals and humans, respectively. In the case of the former, data suggest that constructions of risk about avian influenza for animals are largely premised on whether they believe that avian influenza, as a new or a familiar disease, is species-specific, or whether it can infect other birds or humans. As the majority of PWP subscribe to the notion that avian influenza can only infect poultry, the risks associated with H5N1 for humans are considered to be implausible. As a result, the most familiar and salient risk associated with H5N1 is that derived from the potential of economic loss as a result of either disease outbreaks or disease interventions. As will be shown, these assessments are formed in response to PWP's long histories of working with poultry, illustrating how constructions of risk are founded on PWP's experiential risk rationalities.

To introduce the themes that arise in the body of this chapter, the first section situates the research with reference to one particular seller, Pak Tusni, who works on the fringe of *Pasar Rau* in Serang. The aim of this introduction is to confer a degree of normality upon the key themes that arise throughout this chapter and to illustrate that disease or death among birds is not seen or responded to as an abnormal event. Thereafter, this chapter is organized around 5 questions stemming from the conceptual commitments set out in Chapter 5. These are: How do PWP conceptualize the risks from avian influenza associated with humans? How are the risks of H5N1 for animals constructed? How are the risks other than those presented by H5N1 to human health or animal health constructed? What factors are involved in shaping PWP's assessments of risks? To what extent can attention to the familiarity, salience or timing of particular risks provide insights into PWP's constructions of these risks?

Pak Tusni

Pak Tusni has sold birds for decades and is one of the older poultry traders at the market. His stall is located on the opposite side of *Pasar Rau,* and is well separated from those of other PWP at the market. He keeps ducks, geese, and village chickens, and is the sole seller who markets only live birds, finding it too much trouble to slaughter birds and sell their carcasses and by-products. Commercial broilers and layers, among other species, are slaughtered and sold on the other side of the market.[140] *Ayam kampung* and ducks are kept in one of six stacked cages, while geese are corralled in an open pen enclosed by a bamboo fence. A concrete wall at the back of the pen has a bench where Pak Tusni often sits and smokes. Pieces of coconut pulp are scattered across the cage floors and small water trays in each cage are refilled from a larger bucket under the bench.

[140] There are independent sellers that sell only live birds in *Pasar Rau* but, unlike Pak Tusni, they have no fixed location at the market.

The roughly 15-20 birds a day that Pak Tusni sells come from surrounding villages and markets, and are delivered to this corner of *Pasar Rau* by four or five independent *agen*, with whom he communicates daily via mobile phone to secure poultry and prices. Sometimes an individual arrives at Pak Tusni's stall with one or two birds in hand. Once bought, these birds are promptly caged with the other animals: in this environment identifying the exact origin of any one bird is difficult. The price of a younger *ayam kampung* can be as low as 25,000 IDR; while larger village chickens can command up to 60,000 IDR. Duck and geese are more expensive, with large birds selling for 70,000-100,000 IDR.

At the end of each day, Pak Tusni returns home with the unsold birds and cages the animals close to his *ayam jago* – fighting cocks. He has raised fighting cocks for a long time. Two years ago, after following his normal daily routine, he was shocked to find all his chickens dead in the morning. A similar incident also occurred one month prior to our first conversation in 2011. He has never reported birds dying to officials, and has received no information about poultry disease, let alone poultry raising or marketing, from any government officials. When birds die he throws their carcasses into the river near his house.

Poultry in Serang have a long history of infection with disease. What people now call *flu burung*, Pak Tusni says, is actually an older chicken affliction known commonly as *lelentuk*; ducks and geese have stronger immune systems and are not at risk for infection. Although the disease is old, the number of chickens dying has dramatically increased since 2001, with die-offs occurring during the transition between *musim hujan* - the rainy season - and *musim panas* – the hot season. When Pak Tusni lost all his chickens two years earlier, he feared he would not be able to recoup the loss, and consulted with other poultry traders. Rather than sympathy, however, the other traders recalled similar experiences to Pak Tusni's, saying: "Yeah same, my birds also got sick. They're dead [laughing]."[141]

Pak Tusni continually looks for sickness in his chickens, the diagnostic symptoms being a red anus and a lack of appetite, especially around the rainy season. The way to keep birds safe, he says, is to feed them before they sleep. If birds are sick, they are fed finely crushed red onions. And, when possible, he gives sick birds a common human *obat flu dan batuk* – flu and cough medicine – called *Mixagrip,* which is widely advertised on television.[142] If a chicken is not recovering he slaughters the bird before it dies. If a bird dies naturally it is not eaten, as this would be *haram.* Although Pak Tusni recalls how the media have discussed *flu burung* infection in humans, he challenges the notion that sick birds can infect humans, stating: "I have

[141] Interview in Banten, 7 May 2011.

[142] *Mixagrip* is advertised widely on television in Indonesia. For example, see an advertisement for this flu and cough medicine here: http://vimeo.com/6456707 (Accessed June 12, 2013).

always been around chickens and I don't get the disease. It's safe [laughing]. It's just the news".[143]

Pak Tusni's comments illustrate a number of salient themes for this chapter. In speaking about his long history of involvement in the market and his extensive experience dealing with poultry diseases, Pak Tusni demonstrates how his construction of the risk around poultry disease is derived from his own established basis of knowledge - from observations and experience - rather than from external sources of information. As such, he views avian influenza as a species-specific disease, posing a threat to chickens but not ducks or geese. When faced with a large die-off of his poultry, he did not seek assistance, information, or other resources from government officials, preferring to deal with the problem, as he conceived of it, by disposing of the dead birds in the river. He challenges the notion, widely reported on television, that humans are at risk of infection, citing his own inductively-derived conclusions, suggesting that his experiential risk rationality is a far more plausible source of understanding. The remainder of this chapter examines key issues raised by Pak Tusni in more detail.

Constructions of risk for animals

In general, the risks associated with H5N1 for animals are considered to be familiar risks, though as will be discussed below, PWP are quick to draw distinctions between affected species and those that are less susceptible. Data show that across the three sites poultry diseases, as a general topic, are not novel phenomena. Every respondent acknowledged that they had heard of *flu burung.* When *flu burung* is discussed it is most often represented as a new name for older afflictions that have long affected chickens. Only a minority of PWP think that *flu burung* is a novel disease. The greatest variation in responses came from Aceh. In Bireuen there is less certainty than in Serang or Bandar Lampung about whether or not the disease is novel or familiar, or whether, although a real disease, it exists only outside of Aceh.

In Serang most respondents confirmed that *flu burung* is a new name for older diseases. When questioned directly, two sellers in *Pasar Rau* explained this as follows:

> Sari: What are the diseases that infect your birds?
>
> Seller 1: People around here usually call it *lelentuk*.
>
> Seller 2: Yes, the [infected] chicken will look sleepy all the time and their heads are bowed. But the familiar name is *flu burung*.
>
> Sari: So lelentuk is the same as *flu burung*?

[143] Interview in Banten, 7 May 2011.

Seller 2: Yeah, they are the same.[144]

Another seller at *Pasar Rau* echoes these two respondents while suggesting another name for the affliction:

> Pak Atang: Well, I can say there is a disease similar to it. It's called *tetelo* in Sundanese [the local dialect]. *Tetelo* is caused by weather... It's hard to cure but you can still eat the meat. It used to be called *tetelo* but now *flu burung*.
>
> Sari: So they are the same disease?
>
> Pak Atang: Yes, the same. Old disease, same story, only different names.[145]

A minority of sellers – mostly older men with decades of experience - also spoke about disease names that were commonly used in the past but are no longer in fashion, and not used by younger sellers; these include: *muyung*[146]*, dedeluk*[147]*,* and *beluk*[148]*. Lelentuk* and *tetelo* were the most common local names that people employed for what is now being called *flu burung* in Serang*. Flu burung* is also used interchangeably to refer to a number of poultry diseases in Bandar Lampung and in Aceh.

In Lampung, among those who do not see avian influenza as a distinct disease, *flu burung* is often seen as a new name for *tetelo*, an older affliction. A minority of sellers at *Pasar Tugu* say that older generations spoke of a disease called *koli*[149], though this name is no longer in use; and a few distinguish between *flu burung, ngorok,* and *ND,* or Newcastle Disease.

Flu burung in Aceh is widely seen as another name for an affliction called *ta'oen*. For most "*ta'oen* in Aceh is [considered] the same as avian influenza in the world."[150] When compared with the other two sites, however, PWP in Aceh more often convey a degree of uncertainty in distinguishing between diseases. As one seller remarked: "I do not know if they are the same... *ta'oen* has been for a long time... but whether it is bird flu is not known..."[151].

These insights suggest that there is a long history of knowledge about poultry diseases, with new names supplanting those employed by previous generations. As

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[144] Interview in Banten, 6 May 2011.
[145] Interview in Banten, 16 May 2012.
[146] Interview in Banten, 6 May 2011.
[147] Interview in Banten, 31 July 2012.
[148] Interview in Banten, 4 May 2011.
[149] Interview in Lampung, 9 April 2012.
[150] Interview in Aceh, 3 February 2010.
[151] Interview in Aceh, 2 February 2010.

noted in Chapter 2, it would be difficult to conclusively distinguish cases of bird flu from other diseases affecting poultry without laboratory diagnostics. In practice, PWP generally distinguish between types of poultry diseases as species-specific afflictions; diseases that affect ducks are not seen to affect chickens. "There are different diseases between ducks and chickens"[152], one *mugee* asserts in Bireuen. Asked if avian influenza could infect ducks or chickens, a seller in Serang states, "No, ducks have their own kind of diseases. Duck disease is called *Celeng*. It's called *Celeng* because the neck is twisted and the duck walks as if it is drunk"[153]. Similarly, another seller in Serang explains, "Geese don't suffer from avian influenza", and offered the following as further proof: "When there was bird flu, the price of geese went up because people prefer eating geese to chicken".[154]

PWP generally attribute the increased susceptibility of chickens to *flu burung* to their weak constitution, with some pointing to *ayam potong*, broiler chickens, and *ayam kampung*. "It's just broilers", says one slaughterer in Aceh, "It only lives for 30 days, so it's weak"[155]. Pak Sutoyo, a seller of fighting cocks in Lampung, also differentiates between different types of chickens when explaining susceptibility to infection. *Ayam kampung* are most vulnerable to avian influenza because they "don't eat properly in the wild"[156]. As birds that are considered particularly vulnerable to infection, *ayam kampung,* in his opinion, can act as disease sentinels. The general consensus among PWP respondents about chickens, rather than ducks or geese, being susceptible to avian influenza, means that for the remainder of this thesis, unless stated otherwise, discussion of "poultry" or "birds" refers to commercially-raised or backyard chickens.

The observations and distinctions described above roughly map onto research studies, discussed in more detail in Chapter 2, demonstrating that H5N1 infection in chickens is particularly severe, resulting in high morbidity and mortality (Perkins and Swayne 2001). Although some ducks can die suddenly from disease without obvious clinical symptoms (Theary et al. 2012), in general ducks are more often asymptomatic reservoirs for infection that can disseminate live virus (Hulse-Post et al. 2005).

Table 4 catalogues select disease names discussed among respondents. Within species, there is significant crossover in nomenclature for disease, and most PWP discuss these diseases as though different names are synonymous.

[152] Interview in Aceh, 28 March 2012.
[153] Interview in Serang, 6 May 2011.
[154] Interview in Serang, 2 August 2012.
[155] Interview in Aceh, 31 October 2010.
[156] Interview in Lampung, 25 August 2012.

Table 4: Select diseases discussed in Banten, Lampung, and Aceh

Place	Disease name	Affected species	Distinguishing feature
Serang, Banten			
	Gempor[157]	Duck	Does not infect chickens
	Celeng[158]	Duck	Does not infect chickens
	Lelentuk[159]	Chicken	Most commonly used interchangeably with *flu burung*, but translated as Newcastle Disease (ND)
	Tetelo[160]	Chicken	Used interchangeably with *flu burung*
	Muyung[161]	Chicken	Older generations' name for chicken disease
	Dedeluk[162]	Chicken	Older generations' name for chicken disease
	Beluk[163]	Chicken	Older generations' name for chicken disease
Bandar Lampung, Lampung			
	Koli[164]	Chicken	Older generations' name for chicken disease
	Tetelo[165]	Chicken	Most commonly used interchangeably with *flu burung*
	Ngorok[166]	Chicken	Some see as old name for disease; some see as distinct disease
	ND (Newcastle disease)[167]	Chicken	Distinct disease
Bireuen, Aceh			
	Ngorok[168]	Chicken	Some see as old name for disease; some see as distinct disease
	ND (Newcastle disease)[169]	Chicken	Some see as old name for disease; some see as distinct disease
	Ta'oen[170]	Chicken	Most commonly used interchangeably with *flu burung*

A minority of PWP from across the three sites distinguish between the concept of *flu burung* and other poultry diseases. When respondents differentiate between avian

[157] Interview in Banten, 31 July 2012.
[158] Interview in Banten, 6 May 2011.
[159] Interview in Banten, 16 March 2012.
[160] Interview in Banten, 16 March 2012.
[161] Interview in Banten, 6 May 2011.
[162] Interview in Banten, 31 July 2012.
[163] Interview in Banten, 4 May 2011.
[164] Interview in Lampung, 9 April 2012.
[165] Interview in Lampung, 8 April 2012.
[166] Interview in Lampung, 25 August 2012.
[167] Interview in Lampung, 27 July 2012.
[168] Interview in Aceh, 30 March 2012.
[169] Interview in Aceh, 30 October 2010.
[170] Interview in Aceh, 3 February 2010.

influenza and other diseases, they most often cite as the distinguishing feature of avian influenza infection the speed with which *flu burung* kills chickens. These observations are supported by scientific literature suggesting that poultry infected with avian influenza usually die within 3 or 4 days (Bouma et al. 2009). One older man who raises *ayam kampung* and brings a few to *Pasar Rau* in Serang each day to sell live, identifies *flu burung* as a fast-moving disease that kills birds quickly and was never "found before the year 2000."[171] A respondent in Lampung confirms that "if there's a bird infected [with *flu burung*] it moves fast."[172] A *mugee* in Aceh states that avian influenza kills birds quickly and is "definitely different" than *ta'oen*; "if [a bird has] '*ta'oen* it will not die at once".[173]

Bireuen, Aceh was the site where the smallest number of respondents identified *flu burung* as a new poultry disease infecting chickens in their district and in their province. In April 2012, however, one poultry trader there furnished evidence in defence of the notion that *flu burung* was distinct. It was nearing the end of the selling day and Sammy and I remained at the market to speak with *mugees*, who often remain at the market later than those who strictly slaughter chickens or sell their meat. Our conversation turned to poultry diseases and Sammy asked if *flu burung* was a new or an old disease: "It's a new disease, since two years ago" the *mugee* replied.[174] Suddenly, as if reminded of a relevant point, the *mugee* turned and walked towards his motorbike, gesturing at us to follow. There, he untied a white plastic sac from the frame of the motorbike and opened up the bag to reveal two dead chickens. He pushed aside the top bird to select the dead chicken at the bottom of the sack, which he claimed died from *flu burung* – avian influenza - earlier that day. This *mugee* stated confidently that the other dead chicken in the bag had not died from *flu burung,* but was more likely crushed by other birds while contained in one of the three cages attached to his motorbike. The breast of the diseased bird that he held was dark red in colour – a clear sign, according to him, of infection. He replaced the bird in the bag and reattached it to his motorbike, and then turned to shake hands with both of us before departing. This interaction suggests that constructions of risk about H5N1 for poultry are in part premised upon the normalcy that is conferred upon poultry deaths. Although I was not able to confirm the cause of death in the bird, this interaction had the potential for disease exposure.

The respondents in Aceh who distinguish *flu burung* as novel had a somewhat standardized way to describe symptoms of avian influenza in chickens. During three separate interviews[175] – each on different dates – these respondents stated that when a chicken is infected with avian influenza they die suddenly, falling to the ground from a tree branch. As one respondent stated, it is possible to discern

[171] Interview in Banten, 4 May 2011.
[172] Interview in Aceh, 25 August 2012.
[173] Interview in Aceh, 5 February 2010.
[174] Interview in Aceh, 1 April 2012.
[175] Interviews in Aceh, 5 February 2010, 6 February 2010, 1 April 2012.

whether a chicken has *flu burung* because the bird will be "sitting on the branch of a tree [and then it] will suddenly fall down and die."[176] This specific phraseology was notably echoed by three separate respondents. While this "falling from the tree" anecdote was not brought up by respondents at the other two sites, a NGO official in Serang did echo these Acehnese respondents when he stated that with *flu burung*, "sometimes birds are falling from the trees."[177] The similarity in these responses is unlikely to be mere coincidence, but may have originated in a past public health message that resonated with a minority of PWP in Bireuen.

Others in Aceh think that *flu burung* is a new poultry disease, but one that does not exist in their province. This opinion was expressed by a minority of the slaughterers and sellers who work at *Pasar Bireuen*, although it was endorsed by only one *mugee*. As discussed in greater detail in the section below, this minority of respondents point to other parts of Indonesia – namely Medan and Java – as the locations that are most affected by avian influenza.

In short, most respondents generally consider *flu burung* "just the same" [178] as other poultry diseases that people have encountered and dealt with throughout their time raising and marketing chickens; it is only the name that is considered to be novel. As one slaughterer in Serang said, *flu burung* was simply what "scholars call it [laughing] – a term from the government."[179]

Lay aetiology of avian influenza

Having outlined PWP's beliefs about the terminology used to refer to poultry diseases, the following section examines the lay aetiology of avian influenza among people who raise and sell birds as a way of investigating how PWP construct the risks of H5N1 to specific animals. Individuals who believe that avian influenza comes from animals are liable to behave differently than individuals who do not believe this is the case. This distinction becomes important in Chapter 10, which focuses on how constructions of risk inform behaviour at the human-animal interface.

Data presented in this section show that the majority of PWP represent poultry diseases as seasonal afflictions that have long infected their chicken flocks. Although very few PWP claim to know how to prevent disease from infecting their birds, there are multiple curative treatments for birds once they are infected, with most involving the boosting of birds' immunity to sustain them through the time when disease is prevalent.

Across the three sites, it is notable that there are very few respondents who believe *flu burung* to be a disease transmitted between birds, though this is not to suggest that birds are not susceptible to disease. Only in Aceh do a minority of respondents

[176] Interview in Aceh, 6 February 2010.
[177] Interview in Banten, 5 May 2011.
[178] Interview in Banten, 6 May 2011.
[179] Interview in Banten, 6 May 2011.

discuss *flu burung* as a novel disease transmitted between pigs and birds. The majority of respondents do not think that birds can transmit disease, but suggest a theory of species-specific infection that is endorsed across the three sites. This theory, which holds in part that inter-species transmission of disease is not possible, is further elaborated on and reinforced in the remainder of this thesis.

Regardless of whether respondents think *flu burung* is the relabeling of an old disease, or rather a new disease, when asked "where does avian influenza come from?" they reply near unanimously that poultry diseases generally accompany meteorological change. Indeed, some version of "The problem is the weather" paraphrases a common refrain among respondents when they speak about disease in their birds. This generalized story of the natural origin of poultry disease is echoed, in some form, across each of the three sites.

Thus, when asked, "Where does avian influenza come from?" a small group of *mugees* in Bireuen confirm that the disease comes with the wind:

> Informant 1: We don't know about that, it comes by itself.
> Informant 2: It comes from the wind.
> Informant 1: Yes, the wind.
> ...
> Sammy: What wind is that?
> Informant 2: The wind comes by itself.
> Informant 1: It certainly doesn't come from any other place.[180]

Another Acehnese informant remarks that disease events occur mostly in chickens and usually during *pancaroba*, the changing of seasons.[181] This understanding is corroborated by a seller in Serang: "When there's a transition in weather, like from hot to rain, or the other way around, chickens will surely get sick."[182] A seller at *Pasar Tugu* in Lampung agrees: "when the weather becomes windy, it's definitely easy to get sick chickens"; he goes on to state, "surely there's something natural [about these diseases]. My chickens have been sick many times."[183] These observations align in part with technical data on disease in poultry and in people, which find disease events more common during winter months and lower temperatures (Mathur et al. 2014; Durand et al. 2015).

In anticipation of disease events, one of the larger sellers in Lampung claims that she has stopped raising birds prior to the changing of the seasons because past losses during these times were too great; she prefers to buy from others who take on the attendant risks of rearing poultry during weather-pattern variations. Animal-health officials agree that the incidence of *flu burung* and other diseases in poultry

[180] Interview in Aceh, 5 February 2010.
[181] Interview in Aceh, 28 March 2012.
[182] Interview in Banten, 16 March 2012.
[183] Interview in Lampung, 25 July 2012.

rises during the rainy season.[184] Forster (2010) and Padmawati and Nichter (2008) report similar findings from research in other parts of Indonesia. That PWP make arrangements to procure poultry in anticipation of *pancaroba* underscores the common association of poultry-disease events with changes of seasons.

Disparate communities from across Indonesia also associate weather and seasonal patterns - and particularly "wind" and the rainy season - with other communicable and non-communicable diseases. Utarini and colleagues (2003) find some respondents in Central Java attribute malaria to seasonal change. In southeast Sulawesi, people attribute the disease *panas dalam* – literally, "hot inside" – to wind and temperature fluctuations (Nolan 2013). On Java, cardiovascular disease (heart disease) is recognized by some as "sitting-wind sickness" or "exposed to wind sickness" (Dewi, Weinehall, and Ohman 2010). In discussing chronic illness, elderly Indonesians in North Sulawesi are found to "develop a specific aetiology for every illness episode such as "wind intrusion" (*masuk angin*) (Van Eeuwijk 2003, 335). *Masuk angin* is also associated with disease symptoms such as fever around Yogyakarta (Ferzacca 1996), as well as among Sasak communities on Lombok (Hay 2001). Additionally, *masuk angin* is remarked on by the expatriate community in Indonesia[185], Indonesian scholars[186] and companies that market medicine for *masuk angin* nationally.[187] In short, wind and seasonal change are common lay explanations for many diseases in Indonesia.

For most PWP a sense of inevitability lingers over discussions about the incidence of poultry diseases, since these are widely perceived as natural phenomena outside the realm of individual agency. While the majority of PWP can diagnose a sick chicken, they do not profess an ability to prevent infection in the first place. Most do, however, employ techniques to mitigate the impact of disease on their birds around seasonal transitions, although these actions are more curative than preventative, aimed at boosting their stock's immunity before anticipated disease events and controlling infection when it arrives. For these PWP, poultry diseases can be managed but not prevented outright.

Asked if there are any ways to prevent disease from infecting his flock, an older seller in *Pasar Rau* states: "I do nothing because when the disease comes, it will also go away again. I don't know the way to prevent disease" in poultry.[188] PWP in Lampung[189] and in Aceh[190] also state that they do not know how to prevent birds from becoming infected by disease. Very few respondents talk about administering vaccines to protect poultry from infection; references to vaccination are made more

[184] Interview in Aceh, 5 February 2010.
[185] See: http://www.expat.or.id/info/culturalhabits-idiosyncrasies.html Accessed: 13 June 2013.
[186] See: http://www.theindoproject.org/site/featured/how-to-expel-wind-when-you-have-masuk-angin Accessed: 15 July 2013.
[187] See: http://obatmasukangin.org/ Accessed: 15 July 2013.
[188] Interview in Banten, 4 May 2011.
[189] Interview in Lampung, 9 April 2012.
[190] Interview in Aceh, 6 February 2010.

often by those who raise birds for extended periods, such as those raising fighting cocks.[191] That so few respondents speak about preventative measures, such as vaccines, may reflect the fact that the majority of respondents are not responsible for raising birds for extended periods, as would be the case with backyard and commercial poultry producers.

Although PWP do not feel capable of preventing infection in their flocks, many do try to boost their birds' immunity so as to stave off infection more effectively in anticipation of seasonal change; common interventions include feeding birds red onions, turmeric, ginger,[192] and brown sugar.[193] Some respondents give birds vitamins – such as *Vita Chicks* or *Koleridin* (Images 38 and 39) - diluted in water to boost growth and immunity.[194] When poultry present as infected a minority of PWP administer widely available human medicine.[195] Others claim that the "way to treat" an infected bird is simply to slaughter it.[196]

Despite these mixed opinions and methods, one seller in Bandar Lampung encompasses the majority opinion when questioned on the origins of poultry diseases: "I'm not sure if I know but I think it comes from nature... from the air, like people say." When Sari asked this seller if he employed any preventative tools to protect his chickens, the seller stated bluntly: "I have no ideas for that, it is just fate" if chickens become infected.[197] This statement reflects a wider construction of risk around animal disease as largely outside of one's control, and thus confers a sense of normalcy upon poultry diseases. To a degree, this comment also indicates this population's pious world-view; respondents across the three sites often and openly identify themselves as devout Muslims. This seller's statement goes beyond fatalism or piety, however, suggesting a more complex theory of the risks of transmission that will be taken up below with reference to data from across each fieldsite.

[191] Interview in Aceh, 28 March 2012.
[192] Interview in Banten, 7 May 2011.
[193] Interview in Lampung, 25 August 2012.
[194] Interview in Aceh, 3 February 2010.
[195] Interview in Banten, 7 May 2011.
[196] Interview in Aceh, 6 February 2010.
[197] Interview in Lampung, 25 July 2012.

Image 38: Vitamins and antibiotics for chickens administered by diluting with water

Image 39: Medicine for chickens administered by diluting with water

Animals as disease vectors

As highlighted above, most PWP implicate seasonal weather patterns in disease outbreaks: the weather, rather than a contagious agent, is believed to trigger disease emergence in poultry. In this way, poultry are rarely identified as vectors for disease transmission. In each of the three fieldsites, however, there are a very few respondents who do identify poultry as carrying and spreading contagion between birds. In Serang, one older seller identifies birds as vectors for disease transmission, stating that when 25 birds of his died from *flu burung* he threw them in the river, because he did not want to infect other people's poultry.[198] When asked how birds become infected with *ta'oen,* an Acehnese respondent replies:

> The [spread] of *ta'oen* can be explained as follows: We take any live chicken from the market then put it together with some other ones [chickens] at home; tomorrow we see the other ones [chickens] are sick, including our neighbours' [chickens].[199]

That this respondent implies that "any live chicken" could spread disease, further suggests that infection in poultry is normalized, even expected. Pak Sutoyo, a fruit seller who keeps fighting cocks on the edge of *Pasar Tugu* in Lampung, also confirms that infected poultry can spread disease.

Pak Sutoyo has a small storefront on one of the busy side streets connecting *Pasar Tugu* to the main thoroughfares where Sari and I disembarked and caught *angkots* – mini-buses - each day. Out of the front he and his wife sell papaya and pineapple; just inside he keeps a few fighting cocks caged and separated, with each cage housed in an empty, large, live-fish holding pen. Sari and I noticed the birds during the first round of fieldwork in Bandar Lampung and returned to speak with Pak Sutoyo during each subsequent visit. A few years earlier, over a period of 3-4 days, Pak Sutoyo lost roughly 60 fighting cocks to *flu burung* even though he bought and administered vaccine from a poultry specialty shop, at the suggestion of friends who also raise fighting cocks. "Only one or two were [still] alive, the rest were dead", he explains.[200] He considers *flu burung* a new, "fast moving" disease that has affected "almost everyone" in Lampung, "not only me."

When asked to account for the origin of avian influenza, Pak Sutoyo points to commercially farmed birds:

> Pak Sutoyo: Avian influenza comes from [commercial] chicken farms [in rural areas]. *Ayam Bangkok* and *ayam kampung* have no dust.[201] If you see *ayam kampung* or *ayam Bangkok* flap their wings, there's no dust.

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[198] Interview in Banten, 4 May 2011.
[199] Interview in Aceh, 6 February 2010.
[200] Interview in Lampung, 25 August 2012.
[201] Regrettably, Sari and I failed to ask Pak Sutoyo to clarify what he meant when he stated that "dust" spreads avian influenza. We were unable to follow up with Pak Sutoyo about this issue, as this interview took place during the last round of fieldwork in Lampung

> Sari: So why is there avian influenza in the city?
>
> Pak Sutoyo: Because in the distribution process, when live chickens are sent from the farm to the city, the dust on the chickens spreads the avian influenza.

For Pak Sutoyo, *flu burung* does not originate from *ayam kampung,* but these birds are considered particularly vulnerable to infection, and disease sentinels; they are also vectors for transmission between different bird species. As Pak Sutoyo explains, last June he moved his fighting cocks from his home outside of the city to his current location near *Pasar Tugu* "because no one has *ayam kampung* [here]." He continues: "Because [*flu burung*] infects very quickly, if *ayam kampung* have died it's a sign."[202] These two respondents are exceptional. Although birds are known to become sick and die, the majority of respondents do not identify the body of a diseased or dead bird as a contagious threat to other poultry.

A minority of PWP in Bireuen, however, claim that avian influenza is a real and novel disease, yet not present in Aceh because there are no domesticated pigs in the province. According to these respondents, avian influenza is prevalent in Medan, Jakarta, and Java more generally because in these places "the henhouse is close to the pig stall."[203] Indeed, the belief that avian influenza infection in chickens is associated with proximity to pigs was recalled more than once by sellers and slaughterers in Bireuen.[204] One *mugee* there also confirmed that,

> There is no [avian influenza] here because there are no pigs here. There is lots of avian influenza in Java, and in Medan also. The disease is there because there are pigs there – when there's birds and when there's pigs [there is avian influenza].[205]

Whether or not these respondents also believe that birds transmit disease to pigs was not made clear. Their opinions do, however, suggest a more nuanced understanding of virology; this may indicate that public health messaging did reach at-risk populations during the 2009 H1N1 pandemic. Regardless, the fact that these PWP view the occurrence of avian influenza as contingent on the presence or absence of pigs highlights how those who do not keep pigs absolve themselves of concern. In this there is an element of othering and stigmatization - embedded within these Acehnese respondents' opinions; a disassociation with avian influenza that does not exist in Serang or Bandar Lampung.

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[202] Interview in Lampung, 25 August 2012.
[203] Interview in Aceh, 31 October 2010.
[204] Interviews in Aceh, 6 February 2010, 31 March 2012, 31 October 2010.
[205] Interview in Aceh, 28 March 2012.

Alternative interpretations of the origin of flu burung

Notably absent within discussions of lay etiology of poultry diseases – and *flu burung* specifically - are understandings of a more malevolent, or conspiratorial nature. No respondents blame foreign countries for either devising or knowingly spreading *flu burung* in Indonesia. Even when asked specifically about whether avian influenza comes from the United States, a few slaughterers in Aceh were hesitant to speculate on what they did not know: "Maybe there is avian influenza in America but we have no information about this."[206] Respondents may very well have been hesitant to voice such beliefs in the presence of a foreigner. However, the fact that there was never any suggestion that a foreign government or country plotted to spread this disease reinforces the idea that poultry disease events are normalized and *flu burung* is treated as a new label for older afflictions.

The fact that PWP do not openly associate foreign plots with *flu burung* contrasts with the opinion of a few local and national officials. In Banten, one official casually posited a "missing link" about the origin and spread of avian influenza in Indonesia. While lacking in specificity, he said that not long after Indonesian authorities started exterminating infected chickens to prevent the spread of disease, there were "a lot of chickens imported from America [laughing]."[207] This official did not elaborate further and other government officials present during this interview did not confirm or debunk this particular official's rhetorical "missing link".

Positing foreign government interest in *flu burung* in Indonesia was popular with Siti Fadilah Supari, the former Minister of Health and vocal Indonesian government spokesperson on all issues relating to avian influenza from 2004 to 2009. In her book Supari hypothesizes that the United States government was using viral samples to develop biological weapons (2008, 19).[208] That political elites with higher levels of formal education are more likely to endorse these conspiratorial explanations for avian influenza than PWP aligns with some other studies of conspiratorial and alternative beliefs. In Steinberg's study of alternative explanations for HIV in rural South Africa, he contrasts the conspiratorial views of a government official with those of the villagers under his jurisdiction (2008, 153). Indeed, individuals with political power have been at the forefront of numerous conspiratorial accusations about disease. Kenyan Nobel Prize winner Wangari Maathai publically declared that HIV was created by "evil minded scientists" (The Economist 2004). President Yahya Jammeh of the Gambia has made bold claims of possessing a cure for HIV (Cassidy and Leach 2009). Barack Obama's former pastor, Reverend Jeremiah Wright, infamously delivered a sermon accusing the US government of deliberately spreading HIV among marginalized groups (Wright 2003). And in South Africa, former president Thabo Mbeki and his health minister Manto Tshabalala-Msimang publically obfuscated the link between HIV and AIDS and the efficacy of ARVs for years (Nattrass 2007).

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[206] Interview in Aceh, 31 October 2010.
[207] Interview in Banten, 19 March 2012.
[208] See (Elbe 2010a) for further discussion on Indonesian former Health Minister Siti Fadilah Supari.

Ultimately, of particular interest in this study is the fact that when PWP voice counter-explanations for the origin or spread of *flu burung* in Indonesia, they are more likely to point the finger at Indonesian official meddling rather than conspiratorial accounts involving external governments or foreigners. The absence of widespread conspiratorial beliefs about avian influenza in this population suggests that respondents are not, in general, casting about for alternative explanations for this phenomenon. They are instead relatively secure in their knowledge about how disease originates – and how it does not. These beliefs are discussed in more detail below.

Factors influencing constructions of risk

Having established that the majority of PWP believe avian influenza to be a seasonal affliction, largely outside of one's control, discussion will now turn to various factors influencing PWP's constructions of risk towards animals. These largely align with the availability heuristic, in that they demonstrate the importance of familiarity, salience and timing with regards to shaping the way that the risk avian influenza poses to animals is conceived.

People who believe that avian influenza exists and is a disease present in their communities – most of whom see *flu burung* as simply a new name for an older affliction - can be broadly separated into two categories. The first comprises PWP who tend to play a role in the poultry trade entailing an extended interface with poultry and a degree of care for live birds. The second is composed of individuals who recall relatively recent and large-scale disease events that affected their poultry and their business. These categories are, of course, not mutually exclusive, and illustrate the relevance of the availability heuristic – referring to the familiarity, salience and timing of experiences with risk – in shaping respondents' understanding of disease and constructions of risk.

Those who said that avian influenza was a novel poultry disease that affected Acehnese birds were primarily *mugees* and not people who strictly slaughter birds or sell their carcasses to customers. As discussed in Chapter 8, at *Pasar Bireuen* birds are not kept overnight in cages and thus people there who are largely responsible for slaughtering and selling are not necessarily responsible for caring for birds before they are killed and sold. *Mugees*, on the other hand, buy birds from multiple sources and house and care for them - sometimes for extended periods - before taking them to the market. Not all birds are sold every day; *mugees* care for birds as they await sale, and a healthy bird brings a better price. While many slaughterers and sellers in Bireuen raise birds and claim an ability to identify a diseased bird, on the whole, *mugees* in Aceh have more experience in tending to poultry for extended periods and are likely to witness more death in poultry than people who strictly slaughter birds and sell meat.

In Serang, by contrast, all unsold live birds are kept caged overnight; a chicken in *Pasar Rau* may remain caged with other animals for multiple days awaiting a buyer.

Because of this, respondents who work strictly in the market in Serang tend to care for animals for extended periods and are responsible for feeding them, providing water, and ensuring that their cage is sheltered from the elements when closing at the end of each day. PWP here spend more time with birds than slaughterers and sellers in Aceh and are thus better able to discriminate between healthy and sick chickens. This became clear when Sari and I witnessed one PWP in *Pasar Rau* assess the value of twelve chickens brought by an *agen* from *Pasar Kelodoran.* During this assessment he singled out one particular *ayam kampung*, placing it to one side of the remaining eleven village chickens; Sari inquired about this specifically:

> Sari: What's wrong with that one, why is it separated?
>
> PWP: It's sick.
>
> Sari: Sick?
>
> PWP: Yes, it's likely to die tomorrow morning, if not this afternoon.
>
> Sari: How do you know?
>
> PWP: Because the face is red, and it's very quiet - so inactive.
>
> Sari: Oh is that so? What else?
>
> PWP: The leg of this one is cold; I see chickens often enough to know if anything strange is going on.[209]

What role a person plays in LBMs - and whether they buy chickens knowing that they need to sustain them for multiple days – influences whether or not respondents think avian influenza affects their poultry. In this way, respondents' familiarity with disease is an important factor shaping their constructions of risk about H5N1. In Bandar Lampung, in contrast, birds are only rarely kept overnight at *Pasar Tugu* and there are very few *agens* bringing village chickens and other birds to the market each day. What then explains why nearly all respondents in Lampung identify *flu burung* as a disease present in poultry in their market?

Respondents in Lampung readily discuss disease events labelled as outbreaks of *flu burung.* One respondent there confirmed that in the past few years, "Yes, my chickens got that *flu* [*burung*] too. Most of them are dead" because of avian influenza.[210] In this way, the salience and timing of personal and collective experiences with disease matters: those who have lost birds or business because of a disease event are more willing to discuss these events. In environments where disease events are rare, the amount of interface PWP have with birds helps

[209] Interview in Banten, 6 May 2011.
[210] Interview in Lampung, 25 July 2012.

determine whether they think avian influenza exists in their location. And thus, poultry agents - broadly understood to include *mugees*, *agens,* and other individuals who source and buy birds from surrounding communities and bring them to markets – may serve as valuable conduits for information about poultry health and disease events in rural communities.

So far, this chapter has outlined PWP's constructions of risk for animals related to poultry diseases in general and avian influenza specifically. Although PWP lack consensus with regards to some aspects of aetiology and pathogenesis, by and large, they construct avian influenza as a disease that primarily affects chickens rather than ducks or geese. The novelty of *flu burung* is more the name than the condition, the symptoms, or its effects. Those who have greater knowledge of poultry disease are often those who have more sustained contact with birds – usually those who are responsible for their care over several days. Most respondents agree that avian influenza comes with seasonal fluctuations rather than from a contagious pathogen. This has implications for the majority of respondents' aetiological conceptualizations – infected birds are not seen to pose a risk to non-infected birds, even when kept in close proximity.

Having highlighted how PWP construct the risks associated with H5N1 for animals, specifically distinguishing between the risk of morbidity and mortality among different species of birds, and leading to an emphasis on chickens as the poultry species most susceptible to avian influenza, discussion will now turn to how PWP assess the risk posed by H5N1 to humans.

The construction of risks for humans

Whether or not people perceive a risk to themselves from an infectious disease may contribute to their willingness to participate in health programming aimed at controlling the disease in question (Nichter 2008). Discussing influenza-control programmes, Leppin and Aro state:

> The effectiveness of such control measures depends fundamentally on the public's willingness to cooperate, which again is likely to be associated with the level of personal risk people perceive (2009, 7).

As discussed in Chapter 2, people who work at the human-animal interface may be at an elevated risk for H5N1 exposure and infection (Bridges et al. 2002; J. H. Kim et al. 2011), and there have been recurrent interventions in different markets across Indonesia focused on informing these populations of the attendant risks associated with their work (Samaan et al. 2012). For example, in the two years prior to this research, the American Red Cross and the Indonesian Red Cross worked in all three of the primary fieldsites where this research was undertaken, implementing a communications campaign to inform PWP and the general public of the risks associated with being in close contact with poultry.

As outlined in the sections above, most respondents construct the risk from disease as species-specific, meaning that the majority of PWP do not think H5N1 can affect ducks or geese, to say nothing of seeing themselves as having elevated risk for avian influenza infection. Human diseases are seen to pose a risk to humans alone. Poultry diseases infect poultry, with only a minority of Acehnese respondents suggesting the possibility of interspecies transmission with pigs. For those who believe *flu burung* exists, it is a disease that infects only chickens, not ducks or geese. Likewise, *tetelo* and *ta'oen* were also diseases that only infect chickens; ducks and geese have different diseases. In this way, the majority of respondents articulate a firmly embedded construction of the risks associated with different diseases: human diseases are uniquely human and the possibility of zoonotic transmission does not figure in conversation. Underlying hints of a pious fatalism are also embedded within this theory of species-specific infection.

"No it is impossible" for humans to become infected with poultry diseases, reports an older seller with a few *ayam kampung* at his feet: "[There are] different diseases for humans and animals. I don't know exactly, but from my experience selling chicken I've never [been] infected by diseases. *Insha' Allah*."[211] It is notable that this seller was one of the few who believed that chicken carry disease in their bodies and are vectors for transmission to other chicken. When asked if any poultry diseases could infect humans, a seller in Lampung confirms that there are "different" diseases for birds and humans.[212] As one small-hold farmer who sells birds at *Pasar Bireuen* crudely states, somewhat jokingly: "[laughing] There is avian influenza for the animals and AIDS to the people."[213]

Even among those who say avian influenza is a novel disease present in their province, the likelihood of a poultry disease infecting humans seems farfetched, a perception of risk cultivated by media or the government; PWP in all three sites drew similar conclusions. Thus a respondent in Serang cites the empirical basis for his beliefs, explaining that he has always been "around chickens and he doesn't get the disease [avian influenza]. It's safe [laughing]. It's just the news."[214] Asked if avian influenza also poses a risk to humans, a seller in Lampung replies: "No it doesn't. [But] the media has talked about this for a long time, [and] it made customers worry."[215] Another PWP in Serang responds that he has sold chickens for much of his life and "has never been attacked by these diseases. I am healthy, just like now [laughing]. No it's impossible [to become infected with poultry diseases]. Even sick chickens we usually eat."[216] Most respondents agree that *flu burung* "is not contagious to humans. It's just the media that says so."[217]

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[211] Interview in Banten, 4 May 2011.
[212] Interview in Lampung, 8 April 2012.
[213] Interview in Aceh, 3 February 2010.
[214] Interview in Banten, 7 May 2011.
[215] Interview in Lampung, 26 July 2012.
[216] Interview in Banten, 4 May 2011.
[217] Interview in Banten, 17 May 2012.

Sellers note that customers were afraid when avian influenza was widely discussed in the press - broadly around the years 2006-2009 - and therefore they avoided buying birds.[218] Asked to account for why customers were concerned about avian influenza when people working in the markets were not, a PWP in Lampung responds: "I guess the power of word of mouth is so strong... People were afraid because of the mass of information on the television."[219] Of course, what was reported in the press was the incidence of human cases, meaning that as customers were faced with regular reminders of current human cases, they modified their constructions of risk and associated behaviours, albeit on a temporary basis. This highlights the availability heuristic in effect, as perceptions of the risk as familiar (being reported widely), salient (being dramatic) and timely (being recent) informed constructions of risk among customers. Yet for PWP, these media reports were insufficient to convince them that humans were at risk for infection, suggesting that both familiarity and salience are highly subjective criteria, leading to heterogeneous assessments and conclusions.

While most confirm that humans are not at risk, there are a few respondents who are uncertain about human susceptibility to H5N1 infection. Asked if *flu burung* can infect humans, a duck seller at *Pasar Kelodoran,* the market just outside Serang replies: "I don't really know about it."[220] A seller in Lampung also conveys uncertainty:

> I'm not sure, the news on TV was never good. I can't say whether it is infecting humans or not because I'm not infected. Well, I hope I will not be infected... Bottom line, if we are honest, God will protect us, and we have to thank God for what we have.[221]

This seller expresses pious fatalism coupled with uncertainty about human susceptibility to disease. Indeed, a common refrain among the minority who echoed some concern about the risks of human avian-influenza infection was that this issue was ultimately not in their control, and *insha' Allah* - God willing – they will not be infected.

Along with those who remain unsure, there were also a notable few respondents who felt that humans could be infected with *flu burung*. A fishmonger working across the aisle from the area where most poultry is sold in Aceh says: "I am very worried" about avian influenza because "our health is everything for us." When asked whether all people in the market are equally at risk of becoming infected, the fish seller confirms that people who slaughter and sell poultry are more at risk because,

[218] Interview in Lampung, 10 April 2012.
[219] Interview in Lampung, 26 July 2012.
[220] Interview in Banten, 31 July 2012.
[221] Interview in Lampung, 9 April 2012.

> they tend to make contact with the birds while we [other people in the market] just breathe the air... We are not prone to be infected from the disease. We never make contact with the birds. We just breathe the air every day.[222]

It is important to note that when interviewed, this seller was marketing fish no more than a few yards from someone selling chicken carcasses. Wheelbarrows were passing by stacked with dead birds, and blood and feathers littered the ground. For this seller, direct contact with birds was risky, and he wanted people who slaughter and sell birds to be relocated - isolated from the other sellers at the market. He also thought it best to establish limits on when birds could be slaughtered. When we asked this fish seller if anybody had ever suggested to PWP that poultry should be slaughtered and sold in a separate space, he indicated clearly that any such suggestion would be inappropriate: "We cannot say that in front of them [the poultry sellers]. We can only talk like this when they are not around. This is the way it is."[223]

In Lampung, a former policeman from Java who retired to Bandar Lampung and now sells a few dozen chickens a week to restaurants for *uang kecil* – small money – said, "When people were talking about avian influenza it was scary." Addressing Sari directly, he stated: "That [avian] influenza is contagious, Miss." Asked specifically whether or not *flu burung* is dangerous for humans, this respondent confirms that it is, and suggests more nuanced technical knowledge on virulence: "Of course it is, especially if [infected] people go late to the hospital."[224] Indeed, one reason for higher-than-average mortality rates among H5N1-infected Indonesians is that infected individuals across the country delay their arrival at health care facilities (Adisasmito et al. 2013). That this policeman alone reflects these data is likely due to his proximity to past channels of official messaging rather than penetration of public health messaging, as there are no other PWP who share his opinion.

While concern about human infection with avian influenza among PWP in Serang is largely absent, there was a notable exception when one individual – a man who raises a few birds at home - concluded that *flu burung* can infect humans. This story, however, was not heard directly from the person in question, but delivered second-hand by a NGO official based in the city. In their words, this man

> ...went to his wife's parents' house and was told that their neighbour's chickens were suddenly dying. He thought, and told me, 'This could be bird flu'. He cut [killed] the chickens...[then] cooked and ate them. Then, he immediately became sick. 'Really sick', he said, 'this is the only time I've ever felt a fever like this – it must mean that bird flu is real', he thought. I asked him why he did not report this outbreak or tell his

[222] Interview in Aceh, 7 February 2010.
[223] Interview in Aceh, 7 February 2010.
[224] Interview in Lampung, 28 July 2012.

> doctors. 'I'm afraid I'd be yelled at' he said. So he did not report. He went to the clinic but did not say he ate a sick chicken. He just wanted to prove if bird flu is true or not... No, he didn't die... He was trying hard to prove and show people [that bird flu is real]. It was a thrilling story.[225]

Although relayed by a third party, this story illustrates how respondents claim to gather evidence to interpret government claims about *flu burung,* as well as how these accounts are relayed (and possibly embellished or otherwise altered) by NGO workers. That properly cooked chicken is unlikely to transmit H5N1 (Thomas and Swayne 2007) is not addressed. According to this narrative, official assertions alone were neither trusted nor convincing enough to alter this man's constructions of risk – he had to live it to believe it. While this story is unique, the inductive method that he employed is characteristic of the tendency for most PWP to gather knowledge through first-hand experience and observation. Moreover, that this individual was worried about being "yelled at" by medical professionals suggests an underlying sense of intimidation surrounding authority figures. Disease-control programming for avian influenza is more effective when people thought to be infected with the virus seek assistance promptly (Adisasmito et al. 2013). This individual self-diagnosed his H5N1 infection; the fact that he thought he was infected with avian influenza and still did not tell animal- or human-health care professionals that birds were dying and that he had eaten a sick bird suggests a hesitancy to engage with official institutions, with significant implications for the mechanisms on which avian influenza surveillance hinges.

On the opposite end of the spectrum to those who think that avian influenza can infect humans, there is a small minority who voice more aggressive opposition to the idea that poultry transmit disease to humans. In Banten two sellers openly question the idea that humans are susceptible to avian influenza. One, an older seller at *Pasar Kelodoran,* says that he would confront officials who claim that *flu burung* can infect humans, stating: "Here, I will drink chicken blood from a bird that is sick" to show that there is no risk.[226] The other, a younger seller at *Pasar Rau*, said that "if there's a chicken diagnosed with bird flu, 'here let me eat it.' I keep on eating chickens and I'm still healthy [laughing].[227] Like the story recounted by the NGO official above, these sellers draw on experiential proof, using their consumption habits as evidence that humans are not susceptible to H5N1. In Lampung a PWP also professed a willingness to test whether avian influenza can infect humans when Sari inquired if he was worried: "No, I don't care about those issues. It [poultry diseases] naturally happens. If someone bets me to eat a chicken that is suspected [to be infected with] avian influenza I will eat it." From here, Sari followed up, asking if any people that work in the market are worried about *flu burung*:

[225] Interview in Banten, 5 May 2011.
[226] Interview in Banten, 31 July 2012.
[227] Interview in Banten, 16 March 2012.

> Pak Muji: I've been a long time working in this site, if there is any worry from someone [about avian influenza] that means that person is stupid.
>
> Sari: Stupid?
>
> Pak Muji: Yeah, they forget that we will die. Who takes care of all of this? God...[228]

Once again, this respondent raises the idea that constructions of risk about avian influenza for animals and humans are partly considered to be issues that remain beyond human control - a sense of fatalism intertwined and articulated within professed religiosity. Such fatalism is also reported in relation to other diseases in Indonesia, and notably those identified as able to infect humans (Hay 2001). Though in the current study, these more-overt deviations from constructions of risk represented by scientific authorities were unique, it is nonetheless important to consider their implications for policy and programming. In citing their consumption of chicken as proof that H5N1 does not infect humans, PWP indicate the importance of experiential evidence in their assessments of the potential risks posed by avian influenza. Public messaging about H5N1 prevention already highlights the importance of cooking chicken thoroughly (UNICEF 2007), but it may be important to communicate a more explicit message explaining human susceptibility to address the type of beliefs illustrated above.

Sources of information or authority about avian influenza

As the previous sections illustrate, PWP routinely draw on their own observations and long histories of involvement with the poultry industry to arrive at their understandings of the risk posed to animals and humans from bird flu. This section outlines why other sources of information or authority presenting a different construction of risk about H5N1 are considered secondary to experience and observation. Across all three sites, though television is near unanimously identified as the source that first introduced the idea of *flu burung*, as a label and an affliction, this does not suggest that people first learned about poultry diseases from television. As has been shown, poultry diseases are not considered novel phenomena – yet the concept of *flu* was first introduced to respondents across Indonesia via official television messaging.[229]

Across the three sites very few respondents report that government officials, public health workers, or veterinary authorities provided them with information about *flu burung*, despite the fact that there was relatively active programming by the American Red Cross and PMI promoting avian influenza awareness in each of these

[228] Interview in Lampung, 7 April 2012.

[229] This observation draws on a long tradition in HIV research suggesting that the reputation of the original source for information about disease becomes invariably intermingled with the disease itself (Steinberg 2008; McNeill 2009). With avian influenza, official television messaging associated with the government renders the disease "a government name" and little else.

sites at least as late as 2009. In Aceh two sellers recall how the Indonesian Red Cross came to *Pasar Bireuen* once around 2006 to distribute soap to PWP – about "one [bar of] soap for five people". But, as these respondents recall, "They didn't bring a big amount of soap" and "they didn't tell us anything... They came by themselves [while] we were busy with our own work" and have not since returned.[230] For most PWP, interfacing with officials is rare. "So far, the government never gave [us] any news" about avian influenza, concludes one respondent in Lampung.[231] This stands in contrast with statements by officials, who say that they had actively disseminated information to PWP in live bird markets about the risk of human infection with avian influenza.[232] Along with interventions in LBMs, officials state that they used both radio messaging and *Ustads* – people who teach about Islam - to disseminate news about the risk to human health posed by H5N1.[233]

Despite these programs, television messaging is by far the most remembered medium for information about *flu burung* among PWP. Some form of these official messages likely linger with a minority of those working at the human-animal interface, as is suggested above with reference to the "falling from the tree" anecdote. Nonetheless, receiving official messaging that avian influenza is a new disease that poses a significant risk to poultry and human health does not influence respondents' opinion about the novelty of the disease or their constructions of the risk associated with H5N1 for humans, largely because these messages are not corroborated to any degree by their experience. On the strength of their history of involvement in the market and working with birds, PWP suggest that they have all the information that they need. Whether they would be receptive to new information if their circumstances changed – for example, if they observed the occurrence of widespread human-to-human transmission – is open for debate and future study.

PWP are not self-conscious or anxious about their levels of knowledge; indeed, PWP are not actively searching for more information about *flu burung.* Rather, most PWP profess sufficient expertise about poultry diseases, among which *flu burung* is included. Nonetheless, these data identify certain gaps between lay knowledge and biomedical understandings about avian influenza. PWP's basis of knowledge, derived through extensive experience of working at the human-animal interface can, at times, lead them to overlook important aspects of avian influenza pathogenesis that are not readily observable. An example of this is the belief that avian influenza does not affect ducks but is solely a disease for chickens. As discussed in Chapter 2, ducks are often asymptomatic reservoirs for infection with avian influenza, and as such, are capable of transmitting the virus to chicken populations without appearing sick themselves (Wibawa et al. 2013). Thus, it is easy to perceive that ducks are not affected by avian influenza. In this way, PWP may be able to claim expertise in

[230] Interview in Aceh, 10 February 2010.
[231] Interview in Lampung, 27 July 2012.
[232] Interview in Aceh, 4 February 2010.
[233] Interview in Aceh, 5 February 2010.

recognizing a sick chicken, but they are less capable of recognizing the more complex population dynamics of avian influenza. Similarly, PWP may have a tendency to conflate diseases among poultry that have similar or identical clinical presentations; avian influenza infection in chickens appears in much the same manner as infection with Newcastle Disease (Gardner and Alders 2014; Alders and Bagnol 2007). This would lead PWP to potentially overestimate the prevalence of either avian influenza or Newcastle Disease in chickens. Most importantly, as illustrated throughout this chapter, inductively-derived constructions of risk also lead PWP to erroneously conclude that humans are not susceptible to avian influenza, because human infections are rare (Patel et al. 2014).

That most PWP do not think that poultry diseases can infect humans, and that they dismiss constructions of risk that deviate from these assessments, is acknowledged by officials responsible for controlling avian influenza in the sites where this research was conducted. To make people aware of the risk that H5N1 poses to humans, one official responsible for animal health recognized the importance of having recent, vivid encounters with the disease to furnish proof of these claims, saying that in the future, he "hoped there was an example [of people] dying because of avian influenza (laughing)."[234] While stated in a seemingly perverse, yet joking manner, this official's statement confirms that in the absence of an epidemic, very few people at the human-animal interface in Indonesia feel that the risk of becoming infected with H5N1 is familiar or salient. As a result, as will be discussed in the following chapter, they are unlikely to modify their behaviours in significant ways in order to contribute to the attainment of the global public good of preventing and containing the spread of avian influenza in humans.

Here, it is important to reiterate that these data derive from research in LBMs during times when there were not exceptional disease events in humans or in poultry. If human morbidity and mortality from H5N1 began to increase, along with mass die-offs in the poultry population, and decreasing economic opportunities, risk perceptions among PWP might drastically alter.

Economic and political risks presented by avian influenza

In contrast to the current lack of anxiety around the threat posed by avian influenza for humans discussed above, anxiety *is* apparent in PWP's remarks in relation to the economic losses sustained from both public perceptions about disease outbreaks in poultry, and from interventions designed to contain the spread and impact of disease. PMI officials in Banten recall how PWP resist PMI's awareness and education activities associated with *flu burung* in LBMs, including in *Pasar Rau* in Serang. As one PMI official describes: "In schools, the response was great, and also in social situations [in communities]. But in the markets, we usually tell them [PWP] the information [about avian influenza], but they take it as if we are trying to frighten them… yeah, people [who work in LBMs] tend to get angry" when we speak

[234] Interview in Aceh, 5 February 2010.

with them. Another PMI official adds, "Yeah, they think that because of this [PMI's presence], their chickens won't sell."[235]

Some respondents suggest that more cynical motives may underpin the practice of calling attention to what are perceived to be long established older diseases by giving it this new name. [236] Pak Haji, an older live-bird trader at *Pasar Kelodoran* implicated domestic political and economic aims, stating:

> Bird flu is just an issue to create anxiety. There has always been different names [for poultry disease] from long time ago... yes, this issue [of bird flu] was made to lower the business of small sellers... As usual, Indonesia has political games in it.[237]

Pak Haji did not go into further detail and, unfortunately, we did not follow up his comment to better determine the nature of the "political games" that he alludes to. While other PWP in Serang did not voice Pak Haji's opinion, his words resemble those of three sellers in Bandar Lampung, a family made up of three men – a father and two sons – who work at *Pasar Tugu*. This family echoed the belief that relabeling *flu burung* was motivated by cynical interests, as the following conversation with the father and his younger son suggests:

> Pak Muji: The disease that everybody is talking about is avian influenza, but it doesn't exist... Chicken diseases have existed since a long time ago. It is seasonal, because after hot weather it changes to cold and chickens become sick.
>
> Sari: So there is no avian influenza?
>
> Pak Muji: No, there is no avian influenza. It's just the work of smart people.
>
> Sari: If avian influenza is only a rumour, who made this rumour?
>
> Pak Muji: Yes, it's made by smart people – the more smart people that exist the more rumours exist.
>
> Mas Siswoyo: Yeah, it's doctor's work.
>
> Sari: What do you mean?
>
> Mas Siswoyo: It's doctors business... there will inevitably be new medicine. If [they are] correct and avian influenza exists, the one who will

[235] Interview in Banten, 5 May 2011.
[236] Interview in Lampung, 7 April 2012.
[237] Interview in Banten, 31 July 2012.

> be the most easily infected must be the sellers. But why then are there no sellers infected by the disease?

Although these opinions are not widely held in Lampung or elsewhere, it is notable how these respondents draw attention to both the financial incentives that might motivate some to claim avian influenza as a novel affliction, and the implications these claims have for PWP's own livelihoods. They further illustrate how the observed lack of mortality among sellers is used to furnish proof that H5N1 does not exist.

Another instance where the economic risks of being associated with *flu burung* seems to outweigh any other concern is raised by an Acehnese government official who works in animal health. He confirms that some PWP are concerned about being officially labelled as *flu burung*-affected, and targeted by interventions such as depopulation programmes. He explains:

> Usually the compensation [for culling] is very cheap, I mean under the usual price. If one chicken costs 20,000 IDR then the compensation is only 4000 IDR, and that is also problematic. [For example], *ayam jago* [fighting cocks] cost almost one million IDR… [If] we kill their chickens and provide only 5000 IDR for compensation, they will attack us.[238]

Thus, whether bird flu is seen to be a real affliction or just a renamed risk, PWP view avian influenza primarily as a threat to the revenues of people who sell in markets. As such, these economic losses constitute a far more familiar and salient risk to PWP than any risk to themselves from disease.

Conclusion

The findings outlined in this chapter suggest that PWP's constructions of the risks posed by avian influenza to animals and to humans are primarily mediated by personal experience and observation. Through these inductive processes, PWP conclude that poultry diseases are seasonal, thus largely outside of human control, and operate in a species-specific manner, which obviates the perception of threat for humans. The majority of respondents draw this conclusion from experience: they have long worked in close contact with poultry and remain healthy. It should be noted that PWP's constructions of risk, while not precisely reflective of the established scientific data, are loosely aligned with such consensus. As Chapter 2 outlined, the actual risk of transmission between poultry and humans is quite low, as is the absolute number of human cases of H5N1 infection. Thus, PWP's constructions of risk about avian influenza, particularly in contexts where outbreaks among humans have not been prevalent, are not unreasonable.

A more salient risk for PWP is the potential for public perceptions of disease to drive customers away from LBMs, thus threatening their livelihoods. An additional threat

[238] Interview in Aceh, 9 February 2010.

is posed by government-led disease interventions, which can resort to depopulation programmes without adequate compensation, with deleterious consequences for PWP's sources of income. Thus, governmental involvement in LBMs is seen primarily through the lens of threat rather than as a resource to provide information or assistance to control disease.

The findings reported in this chapter suggest that, as each risk is evaluated and assessed in its own right, based on available evidence, the relationship between these different dimensions of risk do not correspond to a hierarchical model. PWP's constructions of the risks posed by H5N1 to themselves are unlikely to change even if the economic risks posed by disease outbreaks were alleviated. Put another way, perceptions of risks to humans are not "waiting in the wings", but rather are established by inductive processes of reasoning and will likely shift only when and if a different set of empirical observations become available.

Such was the case, according to PWP, when earlier public health campaigns were seen to cause customers to become concerned about avian influenza, leading them to avoid the markets. The fact that no significant outbreak materialized, however, led customers to return to their habitual practices. Thus, these respondents allude to how risk perceptions evolve over time and with new information. These findings echo other studies showing waning concern about avian influenza infection in humans over time, in the absence of wide-scale human morbidity and mortality, in Yogyakarta, Indonesia (Padmawati and Nichter 2008), and among the general population in Viet Nam (Figuie and Fournier 2008), and Hong Kong (Q. Liao et al. 2011). As will be discussed further in the conclusion of this thesis, future interventions would be well advised to consider that constructions of risk are not static or immutable.

Having highlighted in detail the varied constructions of risk among PWP, discussion will now turn to examine how these risk constructions are invoked in their behaviours in LBMs.

Chapter 10: Understanding behaviours of PWP at the human-animal interface

Introduction

Humans are infected with H5N1 through some degree of exposure to live virus in a contaminated environment, on a fomite, or from an infected host. Human behaviour is intrinsically linked to such exposure. As Janes and colleagues contend, "the probability of the emergence of a pandemic strain [of avian influenza] is greatly enhanced by social and demographic factors..." such as human behaviour (2012, 2). Nonetheless, they continue:

> In the causal chain of emergence, substantial gaps or uncertainties exist, which are often related to insufficient social and behavioural data for epidemiologically significant aspects of the human-animal interface (2012, 2–3).

Epidemiological studies in Indonesia find that most diagnosed cases of H5N1 in people are associated with direct or indirect exposure from infected poultry (Aditama et al. 2012; Adisasmito et al. 2013). People who work in and around LBMs engage in frequent daily acts identified as having the potential for exposure to disease: behaviours that go beyond simply touching birds, an action that is an essential part of their job description. Despite this, there are no known qualitative studies documenting and interrogating the rationale for behaviours of PWP in LBMs – behaviours that may amplify environmental contamination with H5N1, or the potential for disease in poultry and people.

As discussed in Chapter 5, most studies looking at behaviour employ quantitative methods, with data derived from self-reporting (deZwart et al. 2007; Fielding, Lam, Ho, Lam, Heley, et al. 2005; I. Kristiansen, Halvorsen, and Gyrd-Hansen 2007; Lau et al. 2007; Peltz, Avisar-Shotat, and Bar-Dayan 2007; SteelFisher et al. 2012; Tam, Lee, and Lee 2007; Santhia et al. 2009). This method of data collection is vulnerable to social-desirability bias. As SteelFisher and colleagues acknowledge in their study of H1N1-related health behaviours, "people could have overestimated behaviours perceived as socially desirable". Nonetheless, they argue that self-reporting is necessary to get at these data because "observing many of the behaviours asked about in the poll would have been difficult" (2012, 849). While getting at these data through qualitative methods takes time, it is not impossible. In an attempt to overcome the limitations inherent in self-reporting, the data presented in this chapter derive from observations and semi-structured interviews undertaken over the course of multiple visits to each site.

Studies that employ qualitative methods to look at behaviour are often part of interventions aimed at behaviour change (Samaan et al. 2012; Kosen et al. 2009), or derive from short-term fieldwork (Lohiniva et al. 2012), and do not focus

exclusively on PWP in LBMs (Padmawati and Nichter 2008; Forster 2012). Only Samaan and colleagues (2012) look at behaviours of PWP in Indonesian LBMs; yet they do not aim to understand the rationale for PWPs' behaviour, but rather identify that certain behaviours are present in order to alter them, so that ultimately PWP will adopt "hygienic practices" (2012, 297), as laid out in the WHO (2006) guidelines. While noting the prevalence of such behaviours is important, research needs to go beyond simple documentation. As Liao and Fielding contend, "an important aim of behavioural research in epidemics is to reveal the underlying determinants of individual and population behavioural responses" (2013, 567).

Behaviours that are seen to amplify the risk of infection or transmission are usually presented as resulting from a lack of information about disease and a limited understanding of the dynamics of transmission (FAO 2011; WHO/FAO/UNICEF 2006; Fielding and Lam 2007). This chapter sees behaviour as shaped by more than the presence or absence of a deficit of knowledge, and explores the extent to which the different constructions of risk outlined in the previous chapter – relating to animal and human health, economic impacts to livelihoods, and political involvement – animate PWP's behaviours. While much of the focus is on *what* respondents do, this chapter also highlights *what people do not do*, asking, for example: why do respondents at the human-animal interface not wash their hands with soap and water after touching birds? Why do they not wear personal protective equipment such as gloves or a facemask?

This chapter organizes its discussion of behaviours in relation to the biosecurity strategies advocated in the World Health Organization's *Measures to reduce transmission of avian influenza in wet markets in developing countries* (WHO 2006).[239] Though these WHO guidelines are intended to reduce the risks of transmission between poultry, they are largely aligned with a disease narrative representing the primary risk posed by H5N1 to be in relation to human health. It outlines ten measures to mitigate environmental contamination and disease exposure, including washing hands, using PPE, and ensuring there is adequate drainage in the markets. These measures, however, do not all relate to the behaviour of PWP; the issue of drainage, for example, is a wider structural concern and more an issue for officials than PWP. Thus, I address the WHO's recommendations focusing on individual behaviours of PWP, first examining washing behaviour, and particularly, hand-washing and the cleaning of surfaces and equipment used to slaughter and sell poultry, followed by personal protective equipment, examining the rationale for why the majority of respondents do not wear PPE. Next, behaviours associated with sourcing and caging poultry – including noticeably sick birds – are discussed and analysed, followed by behaviours associated with the sale and disposal of poultry and their by-products.

[239] Measures to reduce transmission of avian influenza in wet markets in developing countries is published as Annex 3 in the WHO's A guide to healthy food markets (2006).

At the outset, it is important to note that the majority of behaviours discussed in this chapter are normalized and openly observable in each of the three sites. As has been made clear, respondents' behaviour is not mediated by concern for human vulnerability to avian influenza, and as such, PWP do not actively seek to mitigate against the potential for exposure to disease. Data from interviews and observations show that the concerns to maximize profits and minimize losses are primary influences on PWP's behaviour. Ultimately, this chapter shows that the behaviours of PWP - taken together – reinforce the constructions of risk highlighted in Chapter 9.

As noted above, the findings of this chapter are juxtaposed with the WHO guidelines. These guidelines are informed by available technical data on how to prevent the spread of avian influenza, and as such, reflect "objective (non personal) inputs rather than subjective (experiential) information" (Plough and Krimsky 1987, 8). It is, of course, not their function to reflect the beliefs, preferences, or rationales of those who work at the human-animal interface. Nonetheless, if the biosecurity measures contained within the WHO's *Healthy Market* guidelines are to find traction in the diverse environments that are currently the focus of avian influenza control initiatives, it is crucial to interrogate them in relation to the normalized, everyday practices of PWP. As discussed below, in some instances, the guidelines are significantly out of touch with these daily realities and would be hard to implement without significant adjustments. In other cases, implementation of the guidelines might actually increase the risk of disease transmission. In both instances, comparing the directives of the WHO guidelines with the behaviours of PWP serves to underscore the limitations of disease control initiatives that are not appropriately attuned to the experiential risk rationalities of target populations.

Washing in the markets

The *Healthy Market* guidelines state that "Hand-washing, when done correctly" – with "soap, potable water, disposable towels and correct procedure" – is an effective way to "reduce the likelihood of [avian-influenza] transmission between hands and face, and therefore it is a high priority measure" which should be prioritized in programs designed to control avian influenza. For PWP, "hand-washing should occur straight after handling the birds to prevent transmission to the person and surfaces as well as equipment that might be handled". A complementary measure promoted in these guidelines is ensuring that all surfaces that come in contact with poultry during slaughter and sale are "cleaned adequately", meaning "washed with hot soapy water, rinsed with potable water and sanitized with a disinfectant" (WHO 2006, 34–35).

Prior to discussing data, however, it is important to note that personal hygiene is paramount for followers of Islam, and washing oneself is intrinsically bound to the cultural context where this research took place. In each site the vast majority of PWP are Muslim. In Indonesia, *wudhu* is the term borrowed from Arabic to refer to washing one's body in preparation for formal prayers, an ablution performed five

times daily. Outside of LBMs I frequently witnessed PWP undertake this ritual purification when they returned home, or before going to mosque. Indeed, in Indonesia, "cleanliness of body and spirit is integral to individual and group identity" (K. van Dijk and Taylor 2011, xii). While some PWP finish work early on Fridays to go to the mosque, I did not witness PWP openly praying at the market, and thus conclude that they do not habitually perform ablution throughout the day when working with poultry. To be clear, in the discussion that follows, I do not contend that PWP in general do not wash in a manner concomitant with disease control, as set out by the WHO (2006). Rather, data collected at LBMs suggest that PWP do not wash in this way when working.

Additionally, I acknowledge a long and problematic history in identifying others as dirty and unclean, and in need of *proper* washing. Such labelling often followed colonial encounters in Africa and Asia (W. Anderson 2006; K. van Dijk and Taylor 2011). Dijk comments that Javanese people, for example, were recognized by Dutch and British colonial officials to bathe "more times a day than a Westerner would do. All this [however] was inessential. It did not count. By the end of the nineteenth century the belief in the dirty native…" in places like Indonesia was widespread (K. van Dijk 2011, 16). In these encounters, bathing in itself was not enough – whether or not people used soap was an essential marker of being civilized (K. van Dijk 2011). In this, I recognize that the WHO's concept of "cleaning adequately" (2006) is a relative term, and I do not seek to reinforce colonial, racial stereotypes about hygiene, nor do I seek to reinforce labelling of PWP as dirty or diseased. Indeed, as highlighted in Chapter 2, given the uncertainty surrounding the relative risk of H5N1 virus present in LBMs, this research can not definitively determine whether people's behaviour places them at increased risk for infection but, rather, interrogates the extent to which PWP's constructions of risk about H5N1 is an influence on their behaviours. The remainder of this section examines washing behaviours at the human-animal interface, beginning with a look at water usage.

The way that PWP obtain the water they use during their workday differs in each fieldsite. In Lampung only the bigger sellers with storefronts have private access to water, with the majority of PWP reliant on water they bring from home or buy at the market. Sellers who bring their own water to work do not slaughter on site and thus do not require the same amount of water as PWP who store, kill, and prepare in *Pasar Tugu*. These smaller sellers primarily use water to keep birds looking fresh, to wash work surfaces and equipment, and to rinse their hands. These sellers dump what water remains before leaving the market at the end of work to ease the burden of returning home. The bigger poultry traders in Lampung use more water, not because they have access to it, but because they require more water for the slaughtering, defeathering, and processing of birds.

In Banten, both large and small poultry traders buy water from private sellers who constantly carry and cart jerry-cans of water around the marketplace. Each jerry-can holds approximately 10 litres of water and costs 1000 IDR. The amount of water used by people in *Pasar Rau* is largely determined by how many birds they slaughter

and sell. One PWP who claims to kill around 200 birds a day uses between 15 and 20 jerry-cans of water every day.[240] When this seller was asked if he changed the water in which he boils birds before defeathering, he answered promptly: "Well of course, how can I not [change the water]? The water is always used everyday, so I have to buy some more" at the beginning of each day. Water is used constantly throughout the slaughter and sale of poultry. Only a minority of PWP in *Pasar Rau* store more than a day's worth of water on site; those that do use large, blue plastic containers with lids. Most PWP here use what they acquire daily, and purchase more the next day.

Image 40: Water being drawn from well located in the poultry slaughter area

[240] Interview in Banten, 6 May 2011.

Image 41: Well being used during slaughter of poultry (note, the well is green)

During the course of this research *Pasar Bireuen* in Aceh underwent a renovation that altered the source of the market's water. During roughly the first half of this study, the central water source for people selling fish, poultry, and red meat was an open well sunk in the middle of the poultry sale-and-slaughter area (Images 40 and 41). Every day hundreds of birds were slaughtered and cleaned within yards of this well. At the end of each day PWP repeatedly threw buckets of water across the ground to clear faeces, blood, and other remnants of the slaughtering process; inevitably, as the slaughtering area surrounded the well, some of this runoff spilt back into the main water source. This water was also used by people selling fish, meat, and vegetables, as well as PWP, to wash away effluence that built up on their equipment and bodies. As discussed in Chapter 2, in the right conditions, H5N1 can persist in water for days (Brown et al. 2007). If disease is present, these behaviours may facilitate environmental contamination and the potential for disease exposure in markets.

When the market was rebuilt in 2010-2011 the central water source was moved roughly 20 yards away and relocated between a storefront where birds are slaughtered on one side, opposite an ice seller and coffee shop on the other. This new water source is not a bucket-drawn well, but an above-ground concrete basin where water is stored, drawn from, and refilled by a pump and tap. This open tub of water is utilized by people who sell poultry, fish, and meat, as well as vegetable sellers, market cleaners, and other market vendors. *Mugees* draw water to wash their motorbikes and their cages. After touching poultry, some customers rinse their hands in this water. Slaughterers and sellers frequently submerge their buckets in this tub to draw water. These buckets are used throughout the slaughter and selling processes and thus routinely in contact with poultry and their by-products. Although water is freely and consistently available in Aceh, it is important to

consider how external interventions promoting hand-washing in markets with a shared water source may have the unintended consequence of increasing pathogen exposure and spreading disease, if disease is present in the market.

The amount of water used by PWP is determined largely by whether slaughtering occurs on site, and to a lesser degree, whether the water is publicly available. Aceh, for example, has open access to water but PWP here do not noticeably use more water than PWP in *Pasar Rau*, in Serang, the other market where slaughtering on site is common practice, despite the fact that sellers in this latter market pay for all the water they use. Comparatively, sellers in Lampung use the least amount of water, largely because most PWP here do not slaughter at the market. Yet, regardless of ease of access to water or cost, PWP across the three sites use water to wash in a similar manner. This suggests, ultimately, that structural and economic barriers to obtaining water are not the dominant influence on washing behaviours. There are, however, other economic and cultural factors that help shape PWP's washing behaviour.

PWP constantly wash away blood, feathers, and other by-products that continually build-up throughout the day, and keep separate what is sold from what is thrown away. At the end of each day people who boil barrels of water to blanch birds dump this water into the streets and gutters of markets, regardless of whether they brought the water from their homes, bought it, or sourced it freely on site. The slaughter and cleaning processes quickly turn translucent water murky, and water that is discoloured with blood and feathers is disposed of daily in each site because it is dirty. There are clear economic incentives for PWP to keep their selling area visibly free of poultry by-products, such as blood and pools of water that accumulate under carcasses on display. PWP in LBMs pay a daily tax, part of which goes to rubbish removal, which usually occurs in the afternoon, after the rush of the morning slaughter and sales, and mostly consists of the removal of feathers and other parts not highly valued. As a seller at *Pasar Rau* remarks, while part of the daily taxes go to market-cleaner fees, it is still "our own responsibility to clean the inside of our area. If our area is dirty the customers won't come."[241]. To this end, PWP routinely rinse and sweep away undesirable by-products in the area where they interact with the public, and often increase the frequency of this practice when customers approach their selling tables.

Hand-washing with soap and potable water is promoted as a cheap and technically effective way to help prevent human exposure with avian influenza viruses in LBMs (WHO 2006). Officials stated that a primary aim of a recent intervention promoted in each site was to teach people who raise birds, as well as those in LBMs, "the right way to wash [their] hands."[242] Individual bars of soap were distributed, and, as one official confirmed, "people are now getting more concerned about washing hands than before." This same official went on to remark on the difficulty of changing

[241] Interview in Banten, 4 May 2011.
[242] Interview in Banten, 5 May 2011.

people's behaviour: "You need to remember that any counselling programmes take a while to get the desired results. It has a process. It's not instant. It takes time until they realize."[243] For this official, information and time are required before people use what the *Healthy Market* guidelines term "correct procedure" to wash their hands, including soap, potable water, and disposable towels (WHO 2006).

A few respondents in Aceh[244] and Lampung[245] spoke about avian influenza and hand-washing in relation to information they received during these interventions. A respondent in Aceh recalls being given "one [bar of] soap for 5 people, [because] they didn't bring a big amount of soap", and confirmed he and others used the soap until it was finished.[246] A seller in Lampung also recalled being told to wash her hands "often", but did not discuss receiving soap.[247] In all sites PWP rinse their hands throughout their workday but do not follow a pattern of washing with soap after each interaction with poultry. That is not to deny that respondents wash with soap when they return home from LBMs, or before prayer, for example, but to highlight that soap is not used by PWP during the workday at LBMs; this may be because of structural factors.

Implicit in the official's perspective on hand-washing behaviour, cited above, is neglect of structural considerations that may make it difficult for people to use "correct procedure" to wash their hands. While water is ubiquitous and necessary for work in each market, soap and disposable paper towels cost money, and are not considered necessary for slaughtering or selling poultry. As discussed in Chapter 8, most PWP work with small margins and are diligent about maximizing profit and minimizing loss. Perhaps more people would use soap in LBMs if it was freely and routinely available. It is also important, however, to consider whether providing soap and promoting hand-washing in contexts like Aceh, where customers and other traders share a common water source with PWP, may actually increase the likelihood of human exposure to pathogens like H5N1.

Though soap is not used to wash with during the workday, PWP in each site routinely rinse their hands of visible signs of their line of work - a process influenced by cultural norms and economic incentives. This was made clear through the juxtaposition of two distinct experiences during fieldwork. The first occurred in Serang. Here, while I was observing the slaughtering process, one of my legs was splattered by chicken faeces and blood. Seeing this, the slaughterer took a small bucket of water, approached me and - in a sincere yet joking manner - rinsed the bird by-products from my leg with his bare hands. It was not unusual for PWP to assist somebody - PWP often provide water and hand-towels to customers when they come in contact with blood or by-products. It was, however, rare that this

[243] Interview in Banten, 5 May 2011.
[244] Interview in Aceh, 10 February 2010.
[245] Interview in Lampung, 25 August 2012.
[246] Interview in Aceh, 10 February 2010.
[247] Interview in Lampung, 25 August 2012.

respondent physically, and personally, washed my leg for me. To me, while this gesture confirmed a mutual familiarity. It also underscored that such by-products are considered dirty and undesirable, but not potential sources of disease.

The second experience occurred in Aceh in April 2012, and is discussed in detail in Chapter 9. To reiterate: during an interview, a *mugee* stated that one of his birds had died earlier in the day from *flu burung*. He ushered Sammy and me towards his bike, hand-selected the dead bird from a bag attached to his motorbike, and then displayed the limp carcass in his hands. Thereafter, he retied the bag, shook our hands, and then left the market for home. In the first episode, the PWP went out of his way to remove what he saw as undesirable dirt from my body. In the second, the *mugee* was untroubled by the act of touching Sammy and me after handling a bird he suspected had died from *flu burung*. As stated earlier, the majority of human cases of H5N1 are associated with contact with infected poultry (M. Van Kerkhove et al. 2011), and thus, this *mugee's* actions, and his interaction with us, may have exposed himself as well as us to live virus. To mitigate this risk, soon after this interaction we discretely applied hand sanitizer, as we did throughout the course of fieldwork. While these two examples are disparate, and derive from different fieldsites, taken together they suggest that PWP are mindful of removing obvious dirt from themselves and their worksite, but do not avoid birds or their by-products because of concerns about disease. These instances further support the notion that PWP's constructions of risk about avian influenza do not indicate a risk to humans.

These observations were reinforced by PWPs' handshaking behaviours across the three markets. During the course of fieldwork I routinely shook hands with PWP, though only when PWP initiated the handshake, so as to reduce the possibility of exposing myself to disease. I soon noticed that PWP who slaughter and sell routinely avoid fully embracing handshakes with others when at work, recognizing that their hands may be covered with poultry parts and fluids. As one Acehnese respondent states: "Chicken excrement is not dangerous, it's just dirty, especially when it gets on my hand [that] I use to eat.... [But] it's not dangerous. I have never heard [about] people dying because their hands accidentally touch chicken excrement."[248] When PWP are in the middle of work – and consider their hands dirty - the common embrace in greeting does not include an interlocking, reciprocal grip, but rather consists of briefly touching the palm of the right hand with fingers extended, and then gesturing towards the heart. That PWP do not engage in a fully clasped handshake when their hands are in contact with poultry by-products shows that they acknowledge their work to be a dirty job, while also expressing concern about being perceived as impolite. Yet this does not imply that they also view their work as dangerous. Indeed, although bloody and wet hands are considered dirty and somewhat socially and culturally undesirable, they are not also considered by respondents to be a potential vector for disease transmission.

[248] Interview in Aceh, 6 February 2010.

PWP are primarily responsible for maintaining the visual cleanliness of the area where they slaughter and sell poultry to entice customers. Some PWP have an additional cost associated with acquiring the water they need to work each day. Regardless of cost or access to water, however, PWP do not wash in a way that aligns with WHO recommendations. Even in Aceh, where water is free, PWP wash in a similar fashion to those PWP in Serang who purchase water. Structural factors such as cost may limit the use of soap and disposable towels, as recommended by the WHO (2006). This is not to suggest that PWP do not routinely wash. Throughout work PWP rinse their hands and behave in a manner illustrative of a desire to avoid touching others with blood or other by-products that build up on their hands during work (Image 42). In short, across all three sites PWP routinely clean their workspace of visible refuse with water and rinse their hands - not out of a presumed fear of contagion but to attract customers and observe cultural norms. These data further confirm that PWP do not construct the risks of H5N1 as dangerous for humans, and in this way reinforce the theory of species-specific infection that was outlined in Chapter 9. The next section looks at behaviours related to personal protective equipment.

Personal protective equipment

The WHO recommends that personal protective equipment, or PPE, such as gloves, masks, plastic aprons, boots, and eyewear, be worn by people working with poultry, and especially those undertaking activities with an elevated risk for disease exposure, including: transporting birds; assessing flocks; slaughtering, defeathering, or cleaning birds; processing carcasses and by-products; cleaning the selling area; and disposing of feathers, faeces and dead birds (WHO 2006, 33). These activities are commonly observed daily routines for most PWP in LBMs. Yet, during three rounds of fieldwork in each site, there was not a single PWP wearing the WHO-recommended combination of protective equipment. Although the use of PPE is widely promoted as part of behaviour-change programmes in Indonesia, few people working at the human-animal interface wear PPE, even after receiving information about how PPE protects humans from exposure to disease (Samaan et al. 2012; Kosen et al. 2009). In Bali, people who raise and sell fighting cocks chose not to wear masks that were provided freely, even after their birds were diagnosed as infected with H5N1 – an event where all of their birds were stamped out by local officials and followed by an intervention aimed at altering their behaviour by promoting and providing PPE (Naysmith 2013b).

Image 42: Washing at the end of work with water used during the day to slaughter and clean poultry

Image 43: A PWP wears an apron before defeathering chickens

The vast majority of PWP in Aceh, Banten, and Lampung do not wear PPE.
If PPE is used, the two pieces most commonly worn are aprons and boots; masks or gloves are extremely rare. With so few PWP wearing PPE in these markets, the aim of this section is not to document PPE use, but rather examine the underlying

motivations for why the majority of PWP do not wear PPE. As with the practice of washing, the question arises: are particular constructions of risk underpinning PPE use? As detailed below, PPE use is limited not solely because these garments and equipment are expensive or difficult to access. Rather, PWP do not use PPE because they impede work and are uncomfortable, potentially thought of as a deterrent to would-be purchasers of their birds and, ultimately, because they are not seen as necessary. These data reinforce the distinction held by most PWP that the market is a dirty environment, but not one that poses a risk for disease transmission.

Asked whether people working in live bird markets in Serang wear *alat pelindung diri* – literally "tools to keep oneself safe" but understood as personal protective equipment - representatives from NGOs responsible for health programming confirm, "Yes, they wear aprons, masks, and gloves."[249] Other officials state that people working in the markets rarely wear PPE[250] despite the fact that it is widely promoted.[251] Observations over repeated visits confirm that PWP do not wear most of the recommended PPE. Boots are expensive and worn by roughly one-quarter of the sellers in *Pasar Rau*, and only a few sellers at *Pasar Kelodoran*. Of the minority that wear boots, most spend the majority of their time slaughtering; it is rare for *mugees* or other *agens* to wear boots. Only a few PWP at the larger selling tables in Lampung wear boots; this may be because there is limited slaughtering on site at *Pasar Tugu*. In Aceh around half of the PWP slaughtering and selling wear boots, with sandals also worn by some PWP.

If people who raise and sell poultry wear aprons they are made from fibrous material, like cotton, not from disposable plastic, as promoted by past interventions in Indonesia (Samaan et al. 2012) and by the WHO (2006). These aprons often show extensive wear and discolouration, especially among people who slaughter and prepare poultry, as Image 43 illustrates.

Those who wear aprons use them routinely. When PWP have a permanent location at the market, they often lock their apron with other equipment on site; those without a dedicated location at the market for storing belongings commute with their apron and other equipment, a process with the potential to expose others to disease if it is present in the market. That not all PWP can store their aprons or other equipment on site suggests that there may be barriers leading to behaviour with the potential for disease spread, as these respondents were required to take their equipment home with them daily – equipment and materials on which H5N1 may persist (Indriani et al. 2010). The finding by Samaan and colleagues that PWP in live bird markets are more likely to wear aprons if they are provided (2012) suggests that there may be economic barriers to wider adoption of aprons. However, that these respondents refused masks and gloves at the same time as wearing an apron suggests that PWP are more concerned about soiling their clothes

[249] Interview in Banten, 5 May 2011.
[250] Interview in Aceh, 5 February 2010.
[251] Interview in Banten, 5 May 2011.

and being comfortable than preventing disease exposure. Such behaviour also indicates that there are factors beyond structural and economic barriers that limit the wider adoption of PPE among PWP.

While aprons and boots appear to be utilized when provided, masks and gloves remain unused even when they are provided free to PWP. It is not necessarily that people do not have access to masks and gloves, but rather that they see no reason to wear them, or see them as an impediment to work (Image 44). One slaughterer in Aceh explains that even after he and others each received gloves and a mask for free from their boss, "nobody used them". When asked why, this respondent, in an unconcerned manner, says that he "forgets to wear it".[252] Another PWP in Aceh says that he does not wear a mask because when he wears one he "cannot breathe", and goes on to say that,

> It is fine for me not to use a mask because the chicken that I sell are healthy. There is no indication of avian influenza. I have been trading for almost 15 years and have never had a problem..."[253]

Although this respondent was not wearing PPE, he raises the issue of human vulnerability to a poultry disease in a way that suggests past exposure to some external public health campaign, and, in turn, a degree of consideration for the possibility that *flu burung* can infect humans. Nonetheless, with reference to his extensive experience in the market, he concludes that avian influenza is not a risk for humans.

In Aceh there is only one young slaughterer who routinely covers his nose and mouth, yet he does not use a mask and does not cover-up to prevent disease exposure. Rather, he uses a bandana to filter the air because he is allergic to dust and feathers; even so, he does not always wear the bandana when working. This particular PWP has worked at the market for 8 years and confirms that he is the only person in *Pasar Bireuen,* apart from the garbage collectors, who wear a mask. Surprised to see a PWP covering their nose and mouth, we enquired whether other PWP or customers ever comment on his mask. He responded:

> There were one or two people [PWP] who commented, but I do not care. If they insult me I do not care because this [wearing a mask] is for me. [They only commented] when I wore the mask for the first time but no more today. They made jokes about me wearing a mask but now it is common.[254]

[252] Interview in Aceh, 6 February 2010.
[253] Interview in Aceh, 4 February 2010.
[254] Interview in Aceh, 31 October 2010.

Image 44: Two PWP kill a chicken without gloves

Image 45: A child plays in crates used to transport live poultry

Another seller here said that PWP do not use PPE because customers may think that people wearing gloves or a mask are covering a "skin" infection.[255] Such opinions were not widely held, and wearing a mask was not openly stigmatized. Masks are not worn primarily because they are felt to be uncomfortable.

[255] Interview in Aceh, 31 March 2012.

There was only one respondent in Lampung who wears a mask, but she too does not always wear it. This lady is a boss at a poultry yard in Bandar Lampung and chooses to wear the mask when new shipments of *ayam potong* arrive "because the smell is not really good".[256] Another female employee at this poultry yard confirms that she does not use a mask even though they are freely provided, and despite the fact that her son, who used to live with her on site developed an "acute respiratory infection" which a doctor attributed to constant exposure to poultry in the environment where the child was living. As a result, this woman sent her two older children to live with their grandmother. "Only a third child who didn't get sick" remains with her; "hopefully he's strong", she concludes. When hundreds of birds are sorted on these premises, this child plays in a familiar manner amongst the cages (Image 45). Distinctly aware of the negative health implications of working closely with poultry, this respondent does not wear a mask - even though they are free - because they make her too "sweaty" when she works.[257]

There was one seller in Lampung who wears one glove on the hand that she uses to hold birds' bodies with when cutting their carcasses into pieces because, she says,

> I cut a lot of chickens: if it's only 100-200 chickens it's ok. But for 400- 600 chickens it [my hand] will become hot – just the same as people playing badminton.[258]

For this seller wearing one glove facilitates work. For others, gloves are an impediment to productivity. A female seller in Lampung who sells innards, heads, and feet of *ayam kampung* says that she tried wearing gloves after presenting with a rash on her hands that she attributes to preparing these by-products, but quickly abandoned wearing them because they hindered her productivity.[259] Some think that gloves make slaughtering more dangerous because you cannot grip the birds properly and thus may cut yourself.[260] In sum, observations and interviews confirm that very few people wear masks or gloves.

PPE are not regularly used, even when freely provided. As reported in other studies (Samaan et al. 2012; Kosen et al. 2009), most PWP who speak explicitly about not wearing PPE state that such equipment can be uncomfortable or hinder productivity: wearing a mask, for example, is too hot. PPE use is largely mediated by practical economic calculations: wearing gloves slows down work. Even those who voice a degree of concern about human infection with avian influenza do not wear PPE. These data on PPE-related behaviours make it clear that, while most PWP acknowledge that working in the market can be dirty and that certain behaviours,

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[256] Interview in Lampung, 27 July 2012.
[257] Interview in Lampung, 27 July 2012.
[258] Interview in Lampung, 7 April 2012.
[259] Interview in Lampung, 25 August 2012.
[260] Interview in Aceh, 4 February 2010.

like wearing an apron, can keep blood and other bird by-products from staining clothes, there are few perceived benefits and significant perceived disadvantages from wearing a mask or gloves.

Sourcing and caging poultry

This section looks at behaviour associated with buying birds - including sick birds - and caging practices in the market. As discussed in greater detail in Chapter 1 and Chapter 8, poultry from larger commercial farms as well as backyard birds are traded via an elaborate and dynamic network determined largely by supply and demand. When sourcing birds, the WHO recommends that PWP buy from "reputable and trusted suppliers" and "be educated to undertake visual checks on the health status of birds to look for signs of infection", thereafter removing sick birds from the market (WHO 2006, 32–33). When new birds are bought, they should be caged separately from other species, as well as birds from other stocks, to avoid the potential for disease transmission and viral replication (WHO 2006).

This section begins by reiterating the manner in which birds are brought to the market to illustrate the difficulties in identifying the origin of most poultry. From here, it proceeds to discuss behaviour related to sourcing birds and to examine what people do with sick birds, before moving on to look at the rationale for caging practices. This section has a similar conclusion to the two previous sections: maximizing economic gains and minimizing economic losses are primary influences on behaviour related to sourcing and caging both sick and healthy poultry.

Markets where PWP primarily sell commercial broiler or layer chickens, as is the case in *Pasar Tugu* in Lampung, can normally track the origin of poultry to one of a few larger companies that source their birds from contract farmers. However, in markets that sell a variety of species, such as *Pasar Rau* and *Pasar Bireuen*, tracing the origin of birds is difficult. Village chickens, ducks, and geese are most often brought to these two latter markets by independent poultry traders – *agens* and *mugees* respectively – who travel by motorbike to source birds from multiple households across different villages and from rural markets where small-hold farmers sell birds. When traders bring birds to the market, these animals may have changed hands multiple times, and in the process been carried across district and provincial borders.

Pak Isan, for example, is a *mugee* who buys birds from villages in Bireuen, and other Acehnese districts to the south. He sometimes drives his motorbike as far as Medan, in North Sumatra, to buy birds. Although he normally sells these animals at *Pasar Bireuen*, he takes bigger chickens, ducks, and geese over the Gayo Mountain range to Meulaboh, the largest city on the west coast of Aceh because "these types of birds are rare there" and he can make around 10,000 IDR more per animal.[261] When Pak Isan arrives in Meulaboh, the birds he carries with him may have travelled hundreds

[261] Interview in Aceh, 28 March 2012.

of kilometres from where they hatched - all for incremental economic gain – a prime example of how difficult it can be to trace the origin of non-commercial poultry.

The WHO recommends that PWP "be educated" to inspect birds and identify illness (WHO 2006), despite the fact that it is very difficult to accurately diagnose a bird with H5N1 through observation alone. Nonetheless, most PWP in this research self-identify as relative experts in vetting the health of poultry – expertise derived from extensive time working in markets and with poultry. PWP may not be able to prevent illness, as discussed in Chapter 9, but they claim ability in distinguishing a sick bird from a healthy one. As one PWP in *Pasar Rau* states with reference to knowing when a bird is sick: "I see chickens often enough to know if anything strange is going on".[262] Drawing on their expertise, however, may not lead PWP to the desired WHO outcomes; when PWP identify a sick bird they do not remove and report it to government officials. Rather, economic considerations predominate.

Both customers and PWP intensively inspect birds they are looking to buy to determine the health and value of each bird. PWP often scrutinize individual animals, feeling their breasts, throat, and feathers, before turning each bird over to examine their anus. PWP touch birds as a point of entry for negotiating price with independent poultry traders and individuals who bring a few birds to the market to sell (Image 46); the price of commercial birds is mostly set between company and buyer and not open to daily renegotiation.

When PWP identify a sick bird among a flock that they are thinking of purchasing, they will either buy the sick bird for a cheaper price or avoid it altogether because it will die soon. Some poultry traders, however, seek out sick birds because they are cheaper than healthy birds.[263] One small-hold farmer in Aceh says that he sells sick birds to *mugees.*[264] A *mugee* in Aceh confirms that he buys birds that he knows to be sick: "Yeah, I will buy it [a sick bird] and sell it again" because it is "cheaper, about half the price" of a healthy bird.[265] Another *mugee* says "there are many sick chickens brought here [to *Pasar Bireuen*], it is often. If the standard price of a chicken is 30,000 IDR, they [sick chickens] sell only for 15,000 IDR if it is not dead yet."[266] PWP in Aceh more frequently discuss buying visibly sick birds than PWP in other sites - a phenomenon that may result from the fact that birds brought to *Pasar Bireuen* are usually slaughtered and not caged at length in the market. In *Pasar Rau,* in Serang, for example, birds are kept on-site for longer periods of time and thus PWP there are more hesitant to buy sick birds that may die before they are able to sell them.[267]

While some PWP sell sick birds, most PWP who own a bird that becomes sick will kill it and eat it. As discussed in the next section, birds that die naturally are *haram*

[262] Interview in Banten, 6 May 2011.
[263] Interview in Aceh, 30 March 2012.
[264] Interview in Aceh, 2 February 2010.
[265] Interview in Aceh, 1 April 2012.
[266] Interview in Aceh, 5 February 2010.
[267] Interview in Banten, 6 May 2011.

and not sold for consumption or eaten. As one of the larger sellers in Serang explains, "if I knew the chicken was sick, before they die I will kill the bird to eat. It's okay [to eat] if a bird is sick."[268] Other PWP in *Pasar Rau* agree that if a bird is sick they will kill it promptly and consume it themselves.[269] Sick birds are killed, not because they are considered disease vectors, but rather because PWP want to minimize economic loss by killing sick birds before they die. Economic considerations also influence caging practices.

The *Healthy Market* guidelines recommend that birds be kept with like species and separated from birds that are not from the same stock (WHO 2006). In each of the three markets poultry from myriad stocks can arrive throughout the day, caged or bound to poultry traders' motorbikes, contained in crates on the back of trucks, or in the hand of an individual trying to sell a few birds. Whether these animals are eventually caged alongside other birds depends largely on the market.

In Bandar Lampung, birds rarely stay overnight in the market; if birds are kept at *Pasar Tugu* they are commercial broilers from the same source. There are *ayam kampung* at the market, but these village chickens are sold by individuals who take all unsold birds home at the end of the day. In Serang, by contrast, most sellers keep poultry in cages at the market until they are slaughtered. PWP here actively buy birds throughout the day: chickens are caged with chickens of a similar size, while ducks, and geese are kept separate. These birds may remain in the market for multiple days. In Bireuen, *mugees* bring non-commercial birds to the market in cages on their back of their motorbikes. These village chickens, ducks, and geese are also usually separated in each cage according to species and size rather than by their source.

PWP's separation of poultry in these sites is not driven by a construction of risk for animal health that suggests one type of poultry pose a risk to another. The decision to separate birds in Serang and Bireuen is economically motivated. PWP in these sites are concerned that smaller birds will be crushed or injured by larger, heavier ones. As one seller in Serang states: "If chickens and ducks are put together, the young chicken may die. Ducks' bodies are heavy, and they also have sharp nails on their feet" that can injure other birds if they are placed in a cage together.[270] These findings echo Kosen and colleagues (2009), who found that some PWP cage sick birds with healthy ones because of a lack of space.

[268] Interview in Banten, 8 May 2011
[269] Interviews in Banten, 4 May 2011, 7 May 2011.
[270] Interview in Banten, 30 July 2012.

Image 46: A PWP inspects ducks brought to him by an independent trader

Image 47: A dead chicken thrown away with general market refuse

This section illustrates the confidence that PWP possess in relation to their knowledge about sourcing and caging birds. Their behaviours confirm that economic considerations are paramount, and, ultimately, further illustrate that PWP

are not concerned about becoming sick from diseased poultry - findings that reinforce their construction of risk about avian influenza as a species-specific infection.

Disposal of unsold dead birds and bird by-products

H5N1 can persist outside of a host species for days, including in water (Horm, Gutiérrez, Nicholls, et al. 2012; J. D. Brown et al. 2007), in mud and soil (Horm, Gutiérrez, Sorn, et al. 2012), and on bird by-products such as faeces (Kandun 2010), feathers (Yamamoto et al. 2008) and in their meat (Nazir et al. 2011). Environmental contamination is pointed to as the potential source of exposure for multiple human infections with avian influenza in Indonesia (Aditama et al. 2012). The *Healthy Market* guidelines contain several recommendations regarding disposal of birds and their by-products to limit human exposure, disease spread, and environmental contamination, including that there should be daily disposal of "solid and liquid waste containing potentially infectious materials such as feathers and faeces" (WHO 2006, 36), and that separate areas in LBMs should be reserved for disposal of birds and by-products (2006, 34). The expectations underlying these recommendations are that the disposal of waste products will occur regularly and discretely, and that the exchange between customer and seller is essentially the end point of the poultry trade. Observations and interviews reveal a more dynamic trade where most bird by-products are used or passed on to other sellers for marginal economic gains, processes that lead various by-products to be transported outside of the market for further use. This section outlines and explains various practices associated with the disposal of birds and their by-products, and is divided into two subsections. The first examines what PWP do with birds that die naturally. The second looks at what PWP do with bird by-products such as innards and feathers.

PWP do not eat or sell dead birds for human consumption. Islamic dictates prohibit the sale or consumption of birds that die of natural causes, as one seller in *Pasar Rau* confirms: "it's prohibited" - to sell dead birds - "because it's *haram.*"[271] When a bird dies naturally in Indonesia, most PWP either throw the bird in the river, dispose of it with the market's garbage, or sell the carcass to fish farmers for feed.

Respondents from each site who have experienced die-offs in their flocks say that they discarded dead birds in a nearby river. A man who raises fighting cocks in Lampung recalls that after losing almost 60 birds to "*flu burung"* a few years earlier he threw their bodies into the river adjacent to his house.[272] A respondent in Aceh confirms that birds die frequently: "Sometimes they are crushed [in their cage], sometimes they are sick... [Recently] two chickens were sick and then died. We then threw them away, we threw them into the river." When asked what happens to the carcasses once they are in the river this respondent says that "there is a lizard" that

[271] Interview in Lampung, 28 July 2012.
[272] Interview in Lampung, 25 August 2012.

eats them.[273] Other studies in Indonesia confirm that people discard dead birds in rivers (Kosen et al. 2009; Forster 2012). The question arises: Why a river? Kosen and colleagues believe that PWP use a river to get rid of dead birds because it is a zero-cost means of disposal (2009, 46). Such calculations do not see water as an environment where H5N1 can persist. As highlighted in Chapter 9, there was only one PWP, an older man in Serang, who attributed disease transmission to dead poultry and thus threw birds that died from *"flu burung"* into the river rather then leave them in an "open area [where] the disease will spread and attack other chickens."[274] This respondent, however, was exceptional. Given the widespread belief that sick poultry do not pose a threat to other birds, it is likely that most respondents opt for the river because it is cheap and convenient.

When a dead bird arrives at the market or is pulled from a cage, some PWP throw the carcass in among other refuse that is removed by market cleaners daily (Image 47). These carcasses are not treated as exceptional. When asked how often he sees dead birds in refuse piles, one cleaner in Aceh responds "*sering"* – often – and goes on to confirm that he routinely places dead birds in with the market's general refuse.[275] Turning to leave following our discussion, this cleaner pushed his waste cart away, and a steady trail of blood dripped from the bottom of the cart's metal frame. In short, dead birds are not considered dangerous - simply garbage and inedible. For some PWP, however, dead birds and their by-products still offer an economic opportunity, with many sellers in each site selling dead birds and by-products from both sick and healthy birds to *petani lele* – catfish farmers.

Each day PWP across the three fieldsites place dead birds, as well as innards, heads, and feet from healthy animals, into plastic bags for fish farmers (Image 48). These relationships are often longstanding, and provide an opportunity for PWP to make money. A slaughterer in Aceh says that he receives 100,000 IDR per month from a fish farmer to bag dead birds and unsold innards, feet, and heads each day.[276] A fish farmer in Aceh confirms that he pays around 300,000 IDR a month for upwards of 8 bags of dead chicken and their by-products each day.[277] While not all PWP charge fish farmers for dead birds and by-products[278] these exchange-based relationships also exist in Lampung[279] and Serang.[280] Products that provide an opportunity for economic gain are not often wasted.

While the innards of birds that die naturally are discarded with the bird or reserved exclusively for fish farmers, slaughtered birds' by-products are either sold as fish feed, given to customers along with the bird that they buy, or marketed separately

[273] Interview in Aceh, 3 February 2010.
[274] Interview in Banten, 4 May 2011.
[275] Interview in Aceh, 1 April 2012.
[276] Interview in Aceh, 4 February 2010.
[277] Interview in Aceh, 1 April 2012.
[278] Interview in Lampung, 7 April 2012.
[279] Interview in Lampung, 27 July 2012.
[280] Interview in Banten, 16 March 2012.

to customers. Innards are available to purchase separately from birds in each site, but are most popular in Lampung, and especially during Ramadan.[281] There are also PWP who feed the innards of slaughtered birds to other poultry. This latter practice was observed only in Aceh, and by only a few sellers.[282]

During the first round of fieldwork in Bireuen I noticed one PWP exiting the slaughter area with two blue plastic bags filled with pieces of chickens. When I enquired about his destination, he explained that the bags were filled with innards that he was taking to feed to his ducks, and asked if I wanted to join him. There were stacks of empty orange-colour cages in the back of his truck, and he placed the blue bags in between the cages while we drove to his home, roughly 20 kilometres south from Bireuen. As we drove, he explained that he held a bachelor's degree in agricultural studies[283] but had been raising and selling poultry for around six years. When we arrived at his house he promptly took the blue bags into a nearby netted enclosure that housed a flock of ducks and a few banana trees. The ducks were expectant and crowding his feet as he poured the innards from the bags into two well-worn plastic saucers. They struggled to swallow the longer intestines and shook their heads violently in their effort to work down the beige entrails (Images 49 and 50). In minutes both saucers were emptied of their contents and the ducks retreated to scavenge. When asked why he feeds chicken innards to his ducks, this PWP stated that these by-products make his ducks *lebih kuat* – stronger – than feed that he buys or food that they scavenge. While this example is exceptional, it illustrates how PWP attempt to utilize the whole bird for economic gain. It also confirms once again that PWP do not see poultry or their by-products as disease vectors that pose a risk to other birds.[284]

Along with trade in intestines, feathers of slaughtered birds are also bagged and sold to external customers who use them for multiple applications. One respondent in Serang explains that he sells feathers to people who make shuttlecocks for badminton. A strong white feather, he says, may sell for 50 IDR, "more expensive than the ones made into dusters... or car or motorcycle seat filling." Feathers for dusters, the seller claims, do not have to be washed and are sold in bulk for about 3000 IDR per kilogram.[285] PWP in Aceh also save soft feathers from *ayam kampung* and ducks to sell to those who make shuttlecocks.[286] In *Pasar Bireuen* there is a young man who walks through the market each day with a red wheelbarrow, stopping to sort through piles of bloody, wet feathers in search of those from ducks and geese – *bulu engkot dan bebek* (Image 51). He arrives each day before the cleaners remove waste from the market, and each month he sends bags full of feathers that he collects from LBMs across Bireuen to buyers in Surabaya, a city on

[281] Interviews in Lampung, 25 July 2012, 8 April 2012.
[282] Interview in Aceh, 4 February 2010.
[283] This is the only PWP I know about who has completed post-secondary education.
[284] Seeing that avian influenza viruses can reside in the intestinal tract of some birds, feeding intestines to ducks may amplify the potential for disease transmission.
[285] Interview in Banten, 7 May 2011.
[286] Interview in Aceh, 6 February 2010.

Java that is hundreds of miles southeast of Aceh. He does not wash these feathers and receives 350,000-400,000 IDR a month for

Image 48: A bag of innards is set aside for fish farmers

Image 49: A PWP feeds chicken innards to ducks

Image 50: A duck struggles to swallow a chicken's intestine

Image 51: Sorting through piles of feathers for duck and geese feathers to resell

this work.[287] These practices further illustrate the extent to which PWP's behaviours are determined in large part by economic rationales rather than by constructions of the risk posed by H5N1 as a threat for humans or animals.

[287] Interview in Aceh, 28 March 2010.

This section has focused on examining the behaviours of PWP as they relate to the disposal of unsold dead birds and bird by-products. Data show that little is wasted. If birds and their by-products are thrown away, they are discarded because they are culturally unfit for consumption. Almost everything else has economic value. While behaviours associated with the disposal of dead birds and bird by-products are influenced by economic priorities, ultimately, such behaviours are also evidence that PWP do not perceive avian influenza as causing a personal health risk, or as a disease that can be transmitted between birds.

Conclusion

This chapter draws on observations in LBMs and semi-structured interviews with PWP to examine *what* people do - and don't do - in LBMs that may increase their risk of disease exposure, exploring *why* people undertake these behaviours and *how* these practices reflect underlying constructions of risk about H5N1. It juxtaposes PWP's behaviours with the WHO *Healthy Market* guidelines to highlight the gap between the WHO prescriptions that reflect the dominant outbreak narratives' preoccupation with averting human exposure to H5N1 - and the constructions of risk among PWP that frame H5N1 largely as a virus that does not pose a significant risk to humans. Rather than being guided by a desire to mitigate personal risk, PWP approach the slaughtering and selling process with an eye for profit maximization. Personal protective equipment that impedes work is rarely used. PWP prefer to sell as much of the bird as they can, rather than discard dead birds or by-products. Reinforcing the distinction that their work can be dirty - but not diseased or dangerous - most PWP try to avoid touching others when their hands have blood or other by-products on them by wiping their hands on their apron, or by adopting a modified handshake. Absent from these behaviours is any committed attempt to avoid contact with birds in order to reduce their own potential for exposure and infection, or to keep birds separated by stock and species to avoid transmission between poultry. Interventions that seek to align PWP's behaviours with the *Healthy Market* guidelines will find greater traction in the environments where avian influenza is endemic if they take into account PWP's experiential risk rationalities.

These data confirm conclusions drawn in Chapters 9, including the theory of species-specific infection. Considered on their own, data about PWP's constructions of risk from Chapter 9 could have conceivably been generated by disingenuousness in PWP's responses during our discussions about these issues. Perhaps the majority of PWP are, for example, actually concerned that avian influenza poses a threat to their health but were reluctant to admit this publicly to a foreign researcher. When data from Chapter 9 are examined in conjunction with data presented in this chapter on behaviours, however, it becomes clear that PWP do not construct H5N1 as a virus that puts them at risk in their daily exposures to poultry. Indeed, their routine behaviours – whether the normalized touching of birds during each day, or the habitual practices of slaughtering birds, cleaning and washing, and disposing of by-products – reflect and reinforce their opinions and ideas about avian influenza,

and provide further evidence that PWP are largely unconcerned about the threat of being infected with a poultry disease that is not perceived as contagious.

As a result, the emphasis in dominant disease narratives on the role PWP can, and some argue, should play in achieving the global public good of preventing or containing the spread of avian influenza does not carry over in PWP's own lives. Their deviation from prescribed behaviours, however, is not the result of a self-interested disregard for others. Indeed, PWP demonstrate a keen sense of social responsibility towards those in their community when they think their actions may negatively impact others. Rather, as long as PWP apprehend avian influenza to be a wholly manageable problem exclusive to animal health, they are unlikely to modify their behaviours in significant ways. The next chapter concludes this study, and focuses on overall conclusions, the limitations of this study, ideas for further research, and implications for policy and practice.

Chapter 11: Conclusion

Introduction

This chapter is divided into three complementary sections. It summarizes the key findings as they relate to the research questions posed in Chapter 1 before examining the policy implications of these data for avian influenza containment and control programming. It then outlines several researchable hypotheses that stem from the findings of this study, and finally goes on to look at the limitations of this study and points to some priorities for future research and policy.

Summary of findings

This qualitative study investigates three related topics of inquiry: one, how people who work with poultry construct the risks associated with H5N1, for human health, animal health, for their own livelihoods, and in their engagement with political officials and organizations, and whether these constructions vary significantly across the three sites; two, what kinds of evidence are employed in order to make these assessments about risk; and three, to what extent these constructions of risk inform or underpin PWP's behaviours at the human-animal interface. The findings related to each of these inquiries will be summarized and analysed below.

Similarities and differences

Although not strictly designed as a comparative study, this research aimed to draw out similarities and differences among the three fieldsites: while slight variations are apparent, there are also many similarities across the three sites. Among the differences, there appears a greater willingness to discuss *flu burung* and the possible loss of poultry or business due to avian influenza in Bandar Lampung and Serang than in Bireuen. This may reflect the fact that there have been more cases in poultry and in people in the former two sites, rather than any reluctance to discuss poultry diseases in Aceh. As indicated in accordance with the availability heuristic, people who have more exposure to disease outbreaks – greater *familiarity* with the risk – may be more likely to speak about them openly.

In Aceh, where outbreaks have been less common, the extent to which PWP think *flu burung* exists in the province appears to be determined, at least in part, by their amount of contact with birds, suggesting that, again, familiarity is an important factor shaping constructions of risk. Birds are not caged overnight in *Pasar Bireuen* and people who slaughter and sell carcasses and other by-products here do not have to care for the animals for multiple days. Birds sold at the market in Bireuen arrive each morning and any unsold birds leave each afternoon. *Mugees*, on the other hand, keep birds that they source from myriad locations at their houses for multiple days, and are thus witness to more of the birds' life cycle than those who strictly slaughter and sell. This may be one explanation of why *mugees* are generally more willing than other PWP to admit that *flu burung* is present in Aceh.

While most respondents think that *flu burung* is simply a new name for older poultry diseases, in each site the majority of PWP acknowledge that some form of *flu burung* exists. Only in Aceh do a minority of PWP believe that, while avian influenza exists, it simply does not affect poultry in their province because there are no pigs in Aceh. These few respondents may be reflecting remnants of past public health campaigns for H1N1, also known as Swine Flu. Nonetheless, a sense of pious superiority is intertwined in this minority's aetiological beliefs. Beyond these small variations, there are far more similarities than differences across the three field sites. These are discussed in more detail below.

Constructions of risk

These data provide a comprehensive representation of PWP's constructions of risk and how these underpin PWP's behaviours, and illustrate the extent to which these constructions are largely informed by their long experience of working at the human-animal interface. Thus, PWP develop what Plough and Krimsky call "experiential risk rationalities", meaning assessments of different forms of risk that draw primarily on extensive and intensive experience and observation (1987). These types of assessments are particularly salient when constructions of risk between expert and lay individuals diverge significantly, as Fischer explains:

> When citizens have compelling reasons to suspect that a risk assessment is superficial or false, they can only turn to their own cultural logic and examine the results in terms of previous social experiences (2000, 137).

What becomes apparent in these data is that when PWP are confronted by a novel disease – and consequently forced to make an assessment of the risk for themselves and their animals – they draw upon their own observations and experiences that implicitly suggest a theory of species-specific infection in relation to H5N1. In this theory, disease is seen as exclusive to distinct species. Certain diseases infect particular chickens, certain diseases infect ducks, and certain diseases infect humans. In this, zoonotic transmission is not plausible. The majority of PWP therefore conclude that humans are not susceptible to poultry diseases because their experiences and observations provide no support for such a conclusion. Though PWP's experiential risk rationalities are not wholly reflective of established scientific understandings, they are loosely aligned with such consensus, in that available evidence suggests the actual risk of transmission between poultry and humans is low, as is the absolute number of human cases of H5N1 infection. Thus although PWP articulate constructions of risk about avian influenza that are not precisely in line with the scientific consensus, their general perceptions of the risks posed to humans from avian influenza are not unfounded.

It is important to reiterate that PWP do not report confusion about *flu burung* and are thus not actively seeking clarification about the disease. They appear generally content with their basis of knowledge about avian influenza although this is not to suggest that their beliefs are static and unresponsive to new information. It is thus conceivable that PWP might alter their attitudes and perceptions in the future if, for

example, they observed an increase in H5N1-related morbidity and mortality. At present, however, in a non-outbreak context, they find their theory of species-specific infection persuasive.

Implications for behaviours

That the majority of PWP do not consider themselves to be at risk from poultry diseases is manifested in their behaviour at the human-animal interface. PWP consistently demonstrate that their workplace practices are shaped by a desire to mitigate threats to their economic wellbeing while maximizing the potential for profits. Their constructions of risk about avian influenza are revealed through various behaviours. PWP place importance on removing visible poultry-related effluents, such as blood and faeces, without extending their behaviours to include practices – such as hand-washing with potable water and soap – that can help eliminate live virus. They eschew personal protective equipment because it would interfere with their comfort and efficiency in the workplace. Sick birds are killed and eaten rather than allowed to die naturally, and dead birds that do die naturally are avoided, not because they are seen as potentially infectious agents posing a threat to human health or other birds, but because they are *haram*. Bird by-products are sold onwards to extract further profit; feathers and innards find other uses rather than go to waste. In all of these behaviours, the desire to maximize priorities and protect livelihoods is paramount.

As noted in relation to constructions of risk, the behaviours consistently documented in this study might well change with new information and experiences, or if there are conspicuous increases in disease events among poultry or in people. Indeed, PWP describe prior disease outbreaks in poultry when both their own behaviour and that of customers did change in response to news of disease events in poultry or perceived risks associated with *flu burung*. Barring such disease events or rising human incidence, however, PWP's behaviour is likely to remain driven primarily by economic considerations.

From the perspectives of PWP, these constructions of risks and priorities obviate consideration of their societal obligations to others. Though some PWP describe instances when they modified their behaviours in order to avoid having a negative impact on their colleagues or neighbours, most do not believe that their behaviours at the human-animal interface require such adjustments. Rather, driven by their belief that avian influenza is a species-specific infection, incapable of infecting other types of poultry than chickens and unable to affect humans, PWP pursue their own self-interest of maximizing economic profit. Should their constructions of risk evolve in response to changes in observable disease, it is conceivable that notions of societal obligations towards others would evolve commensurately.

Taken together, these explorations into PWP's constructions of risk and associated behaviours – provide a more complete picture of what underpins PWP's practices in LBMs, and in turn, how these practices could influence assessments of risk among

animals and humans. The section below will now highlight specific aspects of the study that demonstrate a unique addition to knowledge.

Methodological and empirical contributions

This study makes five novel contributions to existing literature on emerging infectious diseases. First, findings from this study lend empirical support to Rhodes' challenge to a "shared, even single, rationality of risk avoidance" (2002), by indicating how constructions of risk among people who work with poultry diverge significantly from the constructions of risk reflected in some dominant disease narratives discussed in Chapter 3. As Leach and Dry argue, dominant narratives create the "appearance of a consensus about the risks of global outbreaks" that both "hide a set of assumptions" and mask the amount of variation between narratives (2010, 3). In providing an in-depth representation of how PWP conceptualize certain risks in their lives, these data align with Keck's claim that various "rationalities of risk" (2008) rather than a single, *correct* construction of risk, are reflected in the diverse narratives surrounding avian influenza. Furthermore, in highlighting the role of inductively derived assessments shaping PWP's constructions of risk, this study illustrates the underlying reasons why alternative narratives about H5N1 differ so significantly from dominant outbreak narratives, and calls into question the extent to which deficits of knowledge are the predominant factor. In sum, this study contributes to the effort of addressing the dearth of literature on the perspectives of people working at the human-animal interface.

Second, providing evidence that findings from this study are mostly consistent across the three fieldsites suggests that these data may provide a cautious baseline for understanding constructions of risk and associated behaviours of those working at the human-animal interface in LBMs in non-outbreak contexts in Indonesia. Consistency across the fieldsites also facilitates analysis of the extent to which cognitive heuristics can provide insights into constructions of risk. The majority of respondents across all sites identify certain risks as more familiar, salient, and recent than others, suggesting that the availability heuristic offers insight into how risks are assessed in this population. Most PWP view the risks posed by avian influenza to humans to be negligible or non-existent, indicating an almost complete non-familiarity with the nature of that particular risk. In contrast, PWP indicate familiarity with both the importance of maximizing economic profit as well as minimizing losses due to recent, salient encounters with fluctuating customer demand brought about by media and government communications about disease risk. In short, the familiarity, salience, and timing of personal experiences with disease and a range of other risks play a significant role in how PWP construct different risks in their lives.

These data lend further empirical support to the notion that PWP are called upon to assess a range of risks in their lives and offers a provisional challenge to conceptualizations of multiple, simultaneous risk assessments as a hierarchy, of the

sort ventured in some literature (Forster 2012; Padmawati and Nichter 2008). This representation suggests that constructions of risk are formed in relation to one another, such that people may discount subtle and complex threats because of the sheer multitude of direct and obvious threats in daily life. In relation to this study, this kind of conceptualization would indicate that a decrease in perceptions of economic risks would lead to an associated rise in perceptions of risk for human health. The findings from this study suggest, rather, that PWP do not engage in such compensatory, relational risk re-calibration. People assess each type of risk on its own merits, based on their own inductively derived reasoning. Thus, even if the economic risks associated with disease control programmes were somewhat alleviated, for instance, by introducing appropriate compensation schemes, PWP are unlikely to suddenly revise their theory of species-specific infection and conceptualize the risks posed to humans on completely different terms.

Third, this study provides empirical insights into the challenges that may be faced in attempting to change behaviours through imparting informational resources from external sources of authority. As discussed above, PWP regularly suggest that they have little to no contact with or trust for established veterinary or public health authorities, nor that they desire more involvement or information from these government officials. This may be, in part, due to scepticism about levels of competence among government bureaucrats in post-Suharto Indonesia (Robertson-Snape 1999). There is still widespread nepotism and other forms of corruption in lower levels of government service, leading many in the general population to conclude that those in positions of power have not earned their way (Mcleod 2005). Yet as data from this study suggest, an additional reason may be because PWP consider their basis of knowledge to be complete. As Kramer observes, trust in others is predicated on feelings of uncertainty (1999). This notion is echoed in Siegrist and Zingg's study of public trust during pandemics: "Trust is most important in situations in which people lack the knowledge needed to make a decision" (2014: 23). Yet this relies on the premise that people are in agreement that they lack certain kinds of knowledge. In contexts where people do not feel they have a deficit of knowledge, trust in others may be a peripheral concern. Thus, though trust has been associated with adopting recommended preventative behaviours, "it is unlikely that trust influences people's behaviour if no personal risk is perceived" (Siegrist and Zingg 2014: 25). These insights suggest that, in the absence of a significant change in observable incidence and prevalence of human cases of avian influenza, PWP may not perceive there to be significant gaps in their basis of knowledge. As a result, they have no reason to invest trust in external sources of information or authority to manage what they perceive to be a wholly manageable problem residing exclusively with poultry, and may continue to have little to no reliance on veterinary and public health authorities for information or resources.

Of course, PWP's reliance on inductively-derived assessments means that any aspects of avian influenza pathogenesis that are not readily observable by a lay person may be unheeded. Such is the case with respect to asymptomatic infections

of avian influenza, of the kind often manifested in ducks. Thus, PWP may note the presence of a sick chicken and attribute the cause to avian influenza, but they may not connect that incidence back to the wider population dynamics of avian influenza, wherein ducks can act as reservoirs of infection. PWP are also liable to conflate diseases in poultry that bear similar characteristics. For instance, the clinical presentation of avian influenza in chickens is similar to those stemming from Newcastle Disease (Balasubramaniam et al. 2012; Gardner and Alders 2014; Alders and Bagnol 2007), making it challenging to correctly diagnose avian influenza infection without the assistance of laboratory diagnosis. Experientially-derived constructions of risk also obscure certain invisible risks, such as the presence of virus in certain environments (Indriani et al. 2010). Lastly, as noted throughout this thesis, PWP are unlikely to construct the risks of avian influenza for humans to be severe in the absence of widespread human infection.

Fourth, investigating how PWP conceptualize and assess risk alongside exploring factors underpinning their behaviour facilitated a degree of triangulation in analysis and discussion that would not have been available if another methodological approach had been taken. For instance, had this study only used semi-structured interviews to investigate constructions of risk, one could suspect that respondents answered in disingenuous ways because they were reluctant to speak openly about threats to human health or their livelihoods, or because of my presence as a foreigner. Similarly, if this study had only explored behaviours through observation, it would have been difficult to ascertain the underlying constructions of risk that animated such practices. Additionally, from the examination of behaviours alone, it would be natural to conclude that PWP are engaging in certain behaviours because they do not have enough information about avian influenza. Only by examining these data together does it become clear that PWP's constructions of risk for themselves, their animals, and their livelihoods align with their observed and reported behaviours.

These data thus confirm that PWP's behaviour can best be explained as motivated by a theory, grounded in their own experience, of species-specific infection, coupled with the desire to maximize profits and avert losses. These findings provide strong support for the importance of calibrating the methodological approach with the underlying aims of the study. Particularly in instances where research is intended to develop a deeper understanding of the reasons for particular behaviours, self-reporting alone is insufficient. While the biases introduced into research through respondents' desire to respond in socially desirable ways have been well-documented (Lewis-Beck, Bryman, and Liao 2004), this study provides additional insight into how research can circumvent such obstacles.

Fifth, this study contributes to discussions about how qualitative social science studies can compliment interdisciplinary research on emerging infectious diseases. While calls for greater involvement of social scientists are increasing (Kleinman et al. 2008b; Janes et al. 2012), the study of emerging infectious diseases including avian influenza has historically been more the domain of biomedical scientists,

disease modellers, and veterinarians, than of anthropologists, sociologists, or political scientists. A more holistic understanding of "risk environments" (Rhodes et al 2002) such as live bird markets requires a complementary combination of disciplinary perspectives and methods (Liverani et al. 2013). Data from this study lend weight to arguments for greater involvement of qualitative social scientists in the study of emerging infectious diseases. In the future, the number of social scientists looking at EID will surely increase, spurred on in part by global initiatives such as One Health.

The One Health agenda is defined as the "collaborative efforts of multiple disciplines working locally, nationally and globally to attain optimal health for people, animals and our environment".[288] The initiative is upheld as the way forward for interdisciplinary collaborations to control zoonosis, and is endorsed by the WHO, the FAO, and the OIE – the three multilateral bodies charged with global policy development for avian influenza and other zoonotic pathogens.[289]

Though a lot of lip service is paid to the value of interdisciplinary collaboration in the study of emerging infectious diseases, the specific form of these collaborations remains underspecified and largely untested (Coker, Rushton, et al. 2011). No existing studies outline, for example, how epidemiologists and anthropologists can usefully collaborate to collect and analyse complementary data on EID. Any such future collaboration must first contend with the fact that these two disciplines, for example, approach the study of problems in the world in fundamentally distinct ways (Buckley and Chapman 1996; Kanbur 2001; Bardhan and Ray 2008).

Attempts to identify disciplinary differences and uncover the possibilities of bridging between them have occurred in a number of other public-policy areas, which may be instructive for interdisciplinary research on EID. In a classic study of interdisciplinary collaborations to address common-pool environmental issues, *The Contested Commons: Conversations between Economists and Anthropologists,* the authors observe that "economists and anthropologists are still divided on their views of human agency, on what constitutes data, on how to interpret their respondents' words, and on what counts as an adequate explanation" (Bardhan and Ray 2008, 4). These epistemological differences do not make collaborations impossible, but they do create challenges and require careful consideration to overcome. A similar initiative among a diverse group of researchers involved in poverty appraisal identified some key advantages and disadvantages of qualitative and quantitative methods:

[288] See: www.onehealthinitiative.com

[289] At present, however, there are no social scientists who employ qualitative methods to focus on zoonosis working as permanent staff at either the FAO or the OIE; whether or not there are social scientists dedicated to these concerns at the WHO is unknown. The absence of social sciences in the dominant global policy organizations speaks to a more general deficit of qualitative social science engagement with EID.

> Those in the qualitative tradition agreed that some numerical information could and should be collected in participatory poverty appraisal. There was also agreement (less strong) that the credibility of qualitative studies with policy makers and others would be greater if site selection could be put into a sampling frame… By the same token, those in the quantitative tradition agreed that the introduction of more subjective and open ended questions in a standard household survey could in fact provide a better handle on defining and measuring poverty even in standard income/consumption terms (Kanbur 2001, 2).

These forays into the specifics of interdisciplinary collaboration could be instructive for future implementation of a truly interdisciplinary research agenda. Indeed, with increased interest and funding for EID, more social scientists will surely engage in this research, and they will contribute valuable disciplinary perspectives to the more holistic understanding of risk environments and the human-animal interface. Simply tacking a qualitative component onto basically quantitative studies, however, is not sufficient, and may actually present a danger to research teams. While the involvement of qualitative researchers in EID research is desirable, perhaps even necessary, the exact manner of collaboration between different disciplines needs further attention. This study offers substantive reflections on the practice and ethics of conducting qualitative research on EID in contexts where researchers must endeavour to reduce opportunities for infection among themselves and their research team, while also prioritizing respectful and trusting relationships with respondents.

The next section looks at how data from the current study may complement and inform biosecurity interventions in live bird markets and disease surveillance at the local level. Drawing from this, thereafter, I propose two hypotheses, focused on testing low-cost interventions to bolster biosecurity, and which may ultimately help to prevent disease introduction, maintenance and evolution in LBMs, and the dissemination of avian influenza viruses from these environments.

Policy recommendations

Biosecurity, as discussed in Chapter 3, is broadly defined as "the product of all the actions taken to prevent the introduction of disease agents into a specific area and to safeguard the health of living organisms from hazards" (FAO 2013b, 50). Biosecurity measures are primarily preventative, and broadly aimed at exclusion and containment of disease at source, in animals, along with the promotion of hygiene. While increasing biosecurity across farms, and in backyard flocks, for example, are important elements in the promotion of biosecurity (FAO, OIE, and WHO 2008), building better biosecurity in live bird markets is increasingly prioritized, as seen in recent interventions to limit human H7N9 infections in China through market closure and restructuring programmes (Fournié and Pfeiffer 2013). Biosecurity measures often work in combination, and in LBMs can include: market restructuring, the implementation of rest-days, market closure (both temporary and

permanent), cleaning and disinfection, waste removal, and behaviour change communications. While the FAO and others readily acknowledged that the appropriate combination of interventions in any particular LBM will necessarily be contextually determined, overall, it is understood that biosecurity measures need to be difficult to avoid and easy to comply with (FAO, OIE, and WHO 2008).

Biosecurity interventions to decrease the risk of H5N1 infection and transmission among poultry and in people at the human-animal interface may benefit from consideration of the findings from this study. Below, five such interventions - behaviour change communications, market restructuring, market cleaning and surveillance, disease surveillance through particular poultry traders, and greater interface between officials and PWP – are discussed with reference to data from this study.

Behaviour change communications

Significant attention and resources have been focused on building the scientific literacy of people working at the human-animal interface.[290] As Kim and colleagues write, "increasing knowledge and risk perceptions" are the "cornerstone" of avian influenza control programmes implemented among people working in LBMs (J. H. Kim et al. 2011). The primary aim of these programmes is to impart knowledge about the risks associated with disease in poultry and in people, with the expectation that once these respondents are able to accurately recall modes of transmission, appropriate preventative behaviours, they will align their conceptualizations of risk with scientific understandings, and consequently adopt preventative behaviours. These programmes remain a priority in spite of evidence that increasing scientific knowledge about H5N1 in poultry workers in Indonesia does not necessarily translate into risk-avoidance behaviours (Samaan et al. 2012; Naysmith 2013b). Attempts to raise scientific literacy must take into account the question whether competing aetiologies are prominent among PWP, and whether these populations consider themselves to be lacking information.

Findings from this study pose challenges for behaviour change communications. In demonstrating that PWP derive their assessments about risk largely through inductive processes, these data suggest that, barring changes in the observations and experiences available to PWP, their assessments about the risks posed by avian influenza are unlikely to be swayed. Furthermore, data from this study show that the majority of Indonesian PWP do not consider themselves to be lacking knowledge when it comes to *flu burung,* or other poultry diseases. On the contrary, most PWP believe that they are well informed about afflictions that infect their birds.

Efforts to convince PWP of the truthfulness of claims that are not readily observable – such as the notions that humans are susceptible to infection, or that ducks can become infected with avian influenza – may be stymied by the lack of empirical

[290] As discussed in Chapter 3, most of these behaviour change communication programmes have been undertaken by UNICEF

evidence in support. These claims may, however, be bolstered by explicit references to the experiential manner in which PWP derive their constructions of risk. Thus, rather than simply informing PWP that avian influenza can infect humans – a supposition likely to be dismissed as nonsensical – communication efforts could explicitly address the fact that there have not been widespread human infections, and provide explanations for why this is the case.

In short, data from this study suggest that behaviour change communications may face difficulties gaining traction among PWP, precisely because they are easy to avoid – being voluntary, and hard to comply with – requiring adjustments in behaviour that are unsubstantiated by PWP's own experiential reasoning. Similar challenges exist for other common biosecurity interventions in live bird markets.

Market restructuring

An overarching, long-term aim in the promotion of biosecurity is the modernization of the poultry industry, especially in countries with a high proportion of birds sold through LBMs. As discussed in Chapter 3, market restructuring and the temporary or permanent closure of markets are measures that are increasingly utilized in endemic countries (H. Yu et al. 2013; Fournié and Pfeiffer 2013; FAO, OIE, and WHO 2008, 20; Samaan et al. 2012). Market restructuring, however, is expensive to implement, especially in countries like Indonesia with thousands of LBMs, and thus likely unsustainable to implement widely. Although temporary or permanent market closure has been associated with decreased risk for disease in humans (H. Yu et al. 2013), such interventions may have unintended consequences, in that PWP may seek to market their birds through more informal channels, and thus potentially outside the reach of disease surveillance. In short, although market restructuring and closure may limit environmental contamination and disease in poultry and people, these interventions can have negative impacts on PWP and thus they may not always be accepted or adhered to by those who work in the markets (Samaan et al. 2012; Fournié and Pfeiffer 2013; Naysmith 2013b; Forster 2012).

These challenges raise the question of whether there are alternative, low-cost interventions that are both easy to comply with, and difficult to avoid.
Findings from the current study identify several key points of entry for bolstering biosecurity in LBMs. These include: supporting existing market cleaning structures, utilizing poultry traders – *agens* or *mugees* – as resources for surveillance, and increasing the interface between PWP and government officials.

Market cleaning and surveillance in LBMs

The isolation of waste from slaughtering and sale sites in LBMs, and the application of disinfectant to surfaces used in these processes, can greatly decrease environmental contamination and, in turn, limit human exposure to pathogens and disease spread between animals (FAO, OIE, and WHO 2008). Data from the current study suggest that existing cleaning structures in live bird markets could be better utilized. Each LBM has dedicated personnel who clean the market daily, including the areas where PWP cage, slaughter, and sell poultry. These cleaners derive their

salary in part from taxes PWP pay to operate each day. Although different parts of the markets are considered dirty, they are not widely regarded as diseased and cleaners are not stigmatized for wearing PPE such as gloves or a mask when they work. Interventions aiming to bolster biosecurity in these environments would be well advised to allocate resources to improved training for market cleaners, alongside salary support and necessary equipment, including PPE and disinfectant, so as to promote routine and effective cleaning of markets. Structural changes to waste sites may also be needed.

Cleaners could also bolster disease surveillance in LBMs. To recall, salvaging dead birds that died naturally for human consumption is not common in Indonesia. If a bird dies naturally they are considered *haram*, and either thrown away, or perhaps, sold to fish farmers for feed. Birds that die naturally at the markets where this research was undertaken were often seen thrown in the communal garbage, to be picked up later in the day by market cleaners. In this process, for example, market cleaners can offer an overview of trends in the market place, and whether or not there are increasing numbers of dead birds in the garbage.

Disease surveillance through particular poultry traders

People who only slaughter and sell carcasses and their by-products do not have the same degree of extensive experience with poultry diseases as do poultry traders - *agens* or *mugees* - who buy birds from multiple communities to resell at LBMs. These poultry traders are likely to be among the first to witness disease events in rural communities. Indeed, there are economic incentives for them to find sick birds. Local disease surveillance systems for a range of pathogens may be made more robust by working closely with poultry traders who travel between different communities. Even if the data they supply is general, poultry traders can provide informal early warning signals to enable officials to plan for future disease threats. Compensation must be appropriately calibrated and promptly dispersed to encourage these traders to share information about disease events, as well as to ensure that people raising birds are not negatively affected by any intervention resulting from these data. In this way, rather than see poultry traders as potential vectors for transmission, it is possible to consider these traders as key sources of knowledge.

Greater interface between officials and PWP

An essential part of biosecurity in LBMs is the participation of people at the human-animal interface. This study suggest, however, that the interface between officials – from government, NGOs, and international and bilateral agencies – and PWP in LBMs is either extremely limited or non-existent: very few PWP have ever directly interacted with an official working as part of a disease-control programme. The Participatory Disease Surveillance Response programme, outlined in Chapter 3, trained thousands of Indonesian civil servants. As these government employees continue to be integrated into animal health ministries more generally, future programming could include a dedicated policy of providing these officials with opportunities to interact routinely with PWP in live bird markets and elsewhere.

This may assist in building familiarity and trust between key stakeholders, and may serve to provide officials with a better understanding of what people know about disease, whether PWP believe themselves to be susceptible to infection, and what factors motivate their behaviour. Spending more time regularly in LBMs should also enable government officials to help identify both structural barriers hindering the collaboration of PWP with disease-control policies, and specific facilities, such as public hand-washing basins, that might constitute important foci for disease transmission in people. In turn, fostering better relations may facilitate the development of more efficacious programming tailored to specific locations.

Along with expanding the interface between themselves and PWP, officials from different jurisdictions and organizations need to coordinate activities better among themselves. The spread of avian influenza across the archipelago - and across provincial boundaries - can be traced to the country's extensive poultry trade. Yet government officials in neighbouring provinces, though bound together by the movement of poultry between their jurisdictions, rarely meet to discuss strategy; this is in part a consequence of Indonesia's decentralization. While it is crucially important for the control of infectious diseases to resonate with local priorities, there may also be a need for a greater degree of centralized authority and national commitment. Increasing cooperation and coordination across political boundaries in Indonesia will take time, but should be an integral part of a long-term strategy for controlling infectious diseases like avian influenza.

Having outlined several policy implications stemming from the findings of this study, the following section will highlight two researchable hypotheses that build on insights from this research.

Hypotheses

Two sets of hypotheses to explore in future research are drawn from these data, the first focusing on market cleaners, and the second on poultry traders.

First, seeing that cleaners are already employed in markets to generally clean the slaughtering and sale areas, future research could explore whether increasing the number of market cleaners, and the specificity of their job description in the slaughter and sale areas would lead to a decrease in environmental contamination - disease maintenance and evolution - as well as decrease the risks posed to birds and to people, and onwards transmission from markets identified as potential reservoirs of infection. And, related to this, seeing that salvage of birds that die naturally is uncommon in Indonesia, and that these birds are usually thrown away or sold on to fish farmers, could market workers provide local surveillance of disease in poultry through reporting the frequency with which dead birds are found in the garbage of LBMs?

Second, given that poultry traders – identified as *mugees* and *agens* in the current study - travel widely, between villages, farms, and markets, future research could

explore the extent to which it is possible to incentivize these poultry traders to share information about disease events in poultry across different communities, and in doing so, bolster disease surveillance. Seeing that economic margins are slight, one such incentive could be the provision of a nominal amount of petrol at a specific location at the market that is convenient for traders. And, related to this, if these traders see an incentive to gather at this central location, would it be possible to couple their reporting of informal surveillance with a disinfection programme of their equipment, such as their motorbikes?

Feasibility studies are required to determine the acceptability and sustainability of any interventions. These measures are likely more efficacious in combination, and may complement other low-cost interventions, such as the implementation of rest days rather than outright market closure or restructuring, and targeting specific markets identified as hubs for traders and potential reservoirs of infection (Fournié et al. 2013; Fournié et al. 2011).

Avian influenza viruses are likely to remain for a long time, if not forever, a threat to human health, animal health, and consequently, the livelihoods of those who depend on work at the human-animal interface. There is, of course, no single intervention that can comprehensively prevent the spread of disease in poultry and in people, but there may be more effective ways to control the spread of avian influenza in birds or limit human exposure to these viruses. However, some interventions – such as market closure or the promotion of hand-washing – may in some circumstances actually amplify disease spread and human exposure and infection to avian influenza or other pathogens. It is important that those designing intervention programmes consider potential unintended consequences. Any such intervention will require both short- and long-term agendas (FAO 2013), but will hinge on long-term engagement and the participation of those at the human-animal interface. Participation, however, can be an empty phrase – and even problematic - if it is not accompanied by a careful consideration and calibration of how PWP assess the risks associated with avian influenza and how these assessments underpin behaviours.

Barring widespread outbreaks of human infection by avian influenza, it may be unlikely that PWP will adjust their conceptualization of human susceptibility to bird flu or other zoonotic diseases. It is possible, however, that incentivizing the reporting of sick birds by paying people a fair price for them could prove a means of securing the cooperation of PWP in effective intervention policies without the need to challenge their belief that disease cannot be transmitted from birds to humans.

Limitations of this study and future directions for qualitative research

This section concludes the chapter by outlining two directions for future research, in the light of some particular limitations of the present study.

These include: One, expanding research to more diverse parts of Indonesia; and two, undertaking qualitative research in post-outbreak or post-intervention environments.

Comparable research in other sites
This research was conceptualized as a qualitative study across three live bird markets in one country. All three of the provinces where this research was undertaken have majority Muslim populations. While there is a degree of generalizability in these data, they may not be representative of PWP in other parts of Indonesia where the majority of the population is not Muslim. How religion and piety - among other local contextual factors - influence the actions and understandings of PWP requires more research across diverse sites in Indonesia.

Qualitative research in post-outbreak, post-intervention environments
Although this current study consisted of multiple visits to each site, there were no wide-scale, diagnosed disease events during the course of fieldwork. In spite of some mentions by PWP of recent disease in their birds, these data reflect essentially how PWP perceive poultry disease and behave in the absence of a major outbreak. Thus, these data represent and convey a sense of normalcy. For example, only a minority of Acehnese respondents in the present research dissociated themselves from avian influenza. By contrast, in the aftermath of an outbreak of H5N1 influenza which had provoked an official intervention designed to control it, PWP in a Balinese LBM readily stigmatized others in relation to avian influenza (Naysmith 2013b). Future research could examine how PWP and others at the human-animal interface alter their constructions of risk and associated behaviours when disease events are more frequent, when human morbidity and mortality increase, and when public-health messaging and official interventions are more constant.

Conclusion
This thesis draws on the notion of disease narratives in order to reflect on diverse conceptualizations of H5N1 avian influenza in Indonesia. It situates analysis among those people who work with poultry on a daily basis, and examines their constructions of risk from H5N1. In order to assess the risks posed by avian influenza to themselves, their animals, and their livelihoods, PWP draw on their experiential risk rationalities, founded in empirical observations and habitual experiences. These constructions of risk underpin PWP's behaviours in LBMs, reflecting their prioritization of economic gains. This research concludes that, barring widespread animal-to-human or human-to-human outbreaks, these inductively-derived constructions of risk and associated behaviours may be unlikely to change. The success of interventions attempting to control disease transmission in animals and in people may be predicated, to some degree, on the extent to which constructions of risk and rationales for behaviours among PWP, of the kind described in this study, are taken seriously.

Appendix 1: Qualitative research guide

These research questions derive from the research guide developed and used by Padmawati and Nichter (2008).

Guiding research questions include:

1. What is the economic and cultural importance of different types of poultry?
    a. Poultry as food: how often consumed?; what form?
        i. Poultry as food
            1. What species of domestic poultry are important sources of food?
            2. Chickens, duck, quail, turkey, etc.
            3. What types of poultry are preferred and why: comparative data?
            4. When making comparisons consider such variables as: taste, status, strength giving qualities, etc.
            5. Broiler (farmed) meat versus domestic (local) meat and eggs
            6. Wild birds versus farmed and domestic birds
    b. Household economics and backyard poultry raising
    c. Poultry as flexible/convertible capital
    d. Livelihood: consider gender dimension to this form of capital
    e. Human and animal relationships, etc.
    f. Ritual uses
    g. Poultry business: stakeholders in poultry business
    h. Consider cultural preferences
        i. Gender of bird preferred for consumption, if any
        ii. Age of bird for consumption: local and broiler
        iii. Preference in terms of what bird consumes as source of food
        iv. Use rank order technique to rank birds by consumption preference, cost, social status, etc.
2. Markets and market price for different poultry products: domestic and farm bred birds
    a. What is consumed locally and what is sent to more distant markets – where?
    b. Fluctuation of prices by season, etc.
3. Susceptibility of Birds to Disease: Domestic vs. farmed vs. wild birds
    a. Consider opinions of different stakeholders: backyard vs. commercial farmers, consumers, etc. about
    b. General ideas of birds' susceptibility/resistance to disease
    c. What do people think makes different types of birds relatively susceptible/resistant to disease?
    d. Backyard poultry raising
        i. If birds are kept in houses, where are they caged?

        ii. Safety, to harvest manure, part of ecological system, etc.
        iii. If left free, are they allowed to enter the home?
        iv. Poultry farms: what are common patterns of bird housing for broilers and egg layers?
4. Human Contact with Birds
    a. With different types of birds
    b. Poultry, pets (exotic birds)
    c. Adults, children
    d. Within family farm contact
    e. Chicken farms: contact with others outside farm workers
    f. Precautious taken not to infect birds with human disease and humans with chicken disease
    g. Document all practices
5. Sick Birds
    a. Sick birds separated from other birds?
    b. Sick birds eaten?
        i. By whom?
    c. Sick birds sold?
        i. To whom?
        ii. Legal or illegal?
    d. Document vendors who purchase dead birds form farms
    e. Sick Birds buried or burned?
        i. How and where?
6. Food Safety
    a. Follow the chain of: production, distribution, sale and preparation of poultry and eggs for consumption
    b. Poultry
    c. Eggs
    d. Look for all points of contact and contamination
    e. Practices taken to reduce contamination at each nodal point
    f. Practices of cooking poultry: details on how cooked, and for how long
    g. How much do health concerns play into cooking process, and does this vary if bird already dead vs. purchased alive?
    h. Consumption of uncooked eggs or meat for health or ritual or in indigenous health care purposes
7. Poultry Purchases
    a. Patterns of purchase: pre-cooked or processed chicken, live chickens in the market?
    b. If live, where cleaned –home or butcher
    c. Preferred patterns of purchase and why?
    d. Consider by social class
8. Wet Market
    a. What kinds of birds sold and how?
    b. Contact with public
    c. Hygiene of market – all aspects (photo document), droppings, feathers, blood, contact with other animals

d. Birds' slaughter in market—by whom?
e. Contact with children in market place

9. Bird Dropping
    a. Disposal and Use
    b. How and where are droppings disposed?
    c. Backyard birds vs. poultry farms of different sizes
    d. How often collected, by whom, how
    e. Practices to protect collector
    f. How are dropping collected for use as fertilizer?
    g. Follow the fertilizer trail from bird faeces → to how often collected → how processed → how they are transported and stored → how they are sold → how they are used and stored at the farm level
    h. Is fertilizer transported to distant locations?
    i. How handled at point of use?
10. Bird Illness
    a. Diagnosis
        i. What types of poultry illness are recognized locally: symptoms, how distinguished?
        ii. Terminology for diseases like Newcastle's disease (chicken cholera), etc.
        iii. When are illnesses thought to be most common during the year?
        iv. Perceptions of cause of these illness and whether or not contagious
        v. How sick poultry treated, or disposed of ?
    b. What have people heard about avian flu?
        i. What do they think are causes of avian flu?
        ii. What are prominent symptoms?
        iii. How do they diagnose avian flu in birds?
        iv. Who do they consult for diagnosis – after how many birds have died?
    c. Is the disease associated with different symptoms in different types of birds?
        i. Wild birds
        ii. In backyard poultry
        iii. Broilers
        iv. In young birds versus older birds
    d. Sources of Risk
        i. What sources are seen as greatest risk in spreading avian flu?
            1. Poultry from backyard farms
            2. Small farms
            3. Large commercial farms, Layer farms
            4. Wild birds
            5. Exotic birds as pets
            6. Quail and pigeons that come and go
            7. Pigs

e. Perceptions of Contagion
    i. What are perceived vectors of transmission?
        1. Poultry to poultry?
        2. Wild birds to poultry?
        3. Poultry to wild birds?
        4. Poultry to humans?
        5. Humans to poultry?
        6. Spread between other animals, e.g. pigs?
        7. Between poultry products (e.g. faeces) and birds or humans?
    ii. How do people think the bird disease is transferred between different species of birds?
    iii. Between poultry and other animals on a farm, such as pigs?
f. Poultry Risk to Avian Flu
    i. What increases the risk of poultry infection with avian flu?
        1. Age of bird
        2. Overall health or resistance to disease
        3. Stress
        4. Type of bird
        5. Hygiene of farm
        6. Exposure to faecal matter
        7. Exposure to other birds, humans
    ii. Method for assessing perceptions of relative risk:
        1. Rank order within poultry with relationship to perceived susceptibility and risk of avian flu
        2. Also rank order of non-domestic birds, and risk
        3. Then rank order complete list of birds
g. Seasonality
    i. When do outbreaks happen across the seasons?
        1. In which seasons do avian flu outbreaks (as well as other poultry diseases) usually happen?
        2. How does this effect reporting, testing, and surveying poultry?
        3. Are delays in reporting associated with seasonality?
        4. How do local explanations for outbreaks change according to season?

11. Response to interventions
    a. Testing of Birds for Avian Flu
        i. What types of diagnostic tests are used by different testing facilities?
            1. On live and dead birds, and droppings
            2. In what order are tests administered if more than one is used?
            3. Time needed for farmers to get results
            4. Test results reported to whom

5. How does public understand tests in terms of suspected and confirmed cases?

ii. What are farmers most likely to do when they suspect a case may be avian flu?
    1. Who do they inform and how?
    2. How fast do they send birds for testing?
    3. Do they send dead or live sick birds, feces, etc.?
    4. What are the most common places for testing?
    5. How long is the wait period for results?
    6. Does anyone visit farm –when in the process?

iii. What tests are available from different vets and agencies?
    1. How is the accuracy of tests given by different people or agencies viewed in terms of trust

iv. Delay in Reporting Birds or Bringing for Testing
    1. Logistics
    2. Delay in distributor or farmer communication
    3. Chain of command –who decides when to go for testing and where to go
    4. Confidentiality

b. Vaccinations
    i. What are perceptions of the effectiveness and need for poultry vaccinations?
        1. What are the perceived goals and effectiveness of vaccinations?
        2. Differing opinions about live and dead vaccine
        3. Consider expense of vaccine in relation to perceived effectiveness
        4. When are vaccinations deemed appropriate?
        5. For example in different seasons and age of birds?
        6. What are perceptions of risk and benefit for birds of different ages (early first vaccinations versus vaccinations later in the life cycle) and health status of birds?

    ii. Are there different vaccination policies for different birds, e.g. layers, broilers, domestic poultry?
        1. How does the length of breeding cycle for broilers affect acceptance of vaccinations?
        2. When in breeding cycle are birds vaccinated? How often?
        3. Does timing of vaccination affect willingness to accept vaccination?

    iii. Is there trust in vaccinations and vaccinators associated with the government as distinct from vaccine purchased in private sector?
        1. After a bird flu outbreak, how do farmers respond to government offers of :

2. Free vaccine to be administered by farmers themselves
3. Offers of government contracted vaccinators to administer vaccines to poultry directly
4. Consider relationship of farmer to administrator/vet

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