

# Assessing incidence rates of mortality adjusted for unobserved deaths among free-ranging village chickens

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## Abstract

Village chickens are an important livestock species for many rural families in Myanmar and other developing countries. Village chickens are kept under free-ranging conditions, with confinement only at night. Therefore, it is likely that some deaths are not observed by farmers. A longitudinal study was conducted over a period of 6 months to describe temporal patterns of mortality of village chickens in 10 villages in Myanmar. Field veterinarians first identified the numbers of birds in all chicken-owning households in each village. A total of 307 households were then selected randomly with stratification by flock size. Each household was visited once each month and questionnaires completed recording current flock structure, and hatchings, losses, sales and birds consumed since the previous visit. Incidence rates were calculated as observed deaths per 900 bird-days at risk. In addition, discrepancies between the number of birds present at a visit and the number of birds expected based on reported additions and withdrawals since the previous visit were identified. Based on these discrepancies, numbers of unobserved mortalities were estimated and adjusted incidence rates calculated. Median adjusted incidence rates were consistently higher than median observed incidence rates. The adjusted incidence rates assume that all data except reported numbers of deaths are recorded without error. Although this assumption is unlikely to be met consistently, the adjusted incidence rates are still likely to represent a more accurate measure of mortality frequency in a village chicken environment than observed incidence rates.

## Introduction

Village chickens are the most important livestock species for many rural families in Myanmar as they provide a source of income as well as food for the household. Village chickens are kept under free-ranging conditions, with confinement only at night. Therefore it is likely that some deaths are not observed by farmers, particularly at times of the year when other agriculture activities are of greater importance than chicken keeping (Henning et al., 2006). Newcastle disease is considered to be the major constraint to the raising of chickens in Myanmar villages, but deaths can also occur due to predation, exposure to extreme weather conditions (heat stress, drowning in the raining season) and other diseases (Henning et al., 2006). In addition, older birds can be lost due to theft (Henning et al., 2006). Incidence measures for mortality in village chickens are rarely reported because data from repeated visits, including precise numbers of withdrawals and additions, are seldom collected in a rural village chicken environment. The intense data collection in our study allowed estimation of numbers of unobserved mortalities and incidence rates of mortality could be adjusted accordingly. The objective of this part of the longitudinal study was to describe the magnitude of discrepancies between observed incidence rates and incidence rates adjusted for estimated numbers of unobserved mortalities in a rural village chicken environment.

## Materials and Methods

### *Study Design*

A longitudinal (panel) study was conducted in 10 villages located in two townships in the north and the south of Yangon Division, Myanmar. No vaccination against Newcastle disease had been conducted in any of these villages before and during the study. A list of all chicken-owning households in all villages was prepared by field veterinarians. This list of households enumerated the entire target population, and was used as a sampling frame. The total number of households required to be sampled was calculated as 307. Probability proportional sampling was used to select

households for enrollment, with households with a larger number of chickens having a higher chance of being selected than households with a smaller number of chickens. The outcome of interest was defined as crude mortality. A questionnaire was developed to describe monthly changes in flock structure and the number of deaths since the last visit. The questionnaire was tested in a pilot trial in selected households in a village in South Yangon and adjustments made before commencement of the study. Six field veterinarians were trained in conducting face-to-face interviews with the farmers and recording the information in the questionnaires. Each household was visited approximately monthly over a period of 6 months, from November 2003 until May 2004.

### ***Data Collection And Statistical Analysis***

The chicken population of each household flock was categorised into the following age groups: 1) Adults: birds older than six months, 2) Growers: birds between six weeks and six months and 3) Chicks: birds younger than six weeks. Additions to a flock were specified as 1) Purchases and 2) Hatchings of new-born chicks. Withdrawals from a flock were divided into three categories: 1) Sales, 2) Consumption and 3) Observed mortalities. At each visit, numbers of purchases, hatchings, sales, birds consumed and observed deaths since the previous visit within each household were documented as recalled by the farmer. The chicken population for each household at the time of visit was also recorded by the field veterinarian by counting the number of birds present within each age group. Incidence rates were calculated based on an approximate method (Dohoo et al., 2003). Incidence rates for adults and growers accounted for additions via purchases and incidence rates for chicks also accounted for additions via hatchings. Sales, consumptions and observed mortalities were accounted for in incidence rate calculations for all three age groups. To calculate adjusted incidence rates, we first identified discrepancies between numbers of birds present at a visit and the expected numbers of birds after accounting for additions and withdrawals since the previous visit as reported by the farmer. Incidence rates were adjusted only where discrepancies could be explained by occurrence of unobserved mortalities ie where the number of birds expected was less than the number present. Adjusted incidence rates were calculated for each village using data pooled from all households within the village. Incidence rates are reported as the median incidence rate for all 10 villages for each of 5 successive monthly observation periods. All incidence rates were calculated as number of deaths per 900 bird-days at risk, as this can be related to observing an average flock size of 30 birds in Myanmar (Henning et al, 2006) for 30 days (or a monthly observation period).

## **Results**

Discrepancies between numbers of birds present at the time of visit and expected numbers of birds occurred in 37% of household-months for adults, 62% for growers and 60% for chicks (data not shown). The distribution of discrepancies in all age groups included both negative and positive values. Amongst growers and adults, positive discrepancies (ie more birds were present than expected) were frequently observed indicating effects of birds moving from younger age groups whereas amongst chicks, discrepancies were mostly negative (ie less birds were present than expected). Median values for adjusted incidence rates were larger than observed incidence rates during the same time period for all age groups for all periods, with largest differences occurring amongst chicks (Table 1).

## **Discussion**

The discrepancies between observed and expected bird numbers were probably not due to errors in counts of total bird numbers, because birds were usually counted at early morning visits, before they had left the household to scavenge within the village. These discrepancies are also unlikely to have been due to errors in recall of numbers of sales, purchases, hatchings and birds consumed. In the study population, sales of birds are important events that are conducted only a few times per year (data not shown) and therefore it likely that these were recalled accurately. Purchases of

chickens to supplement farmers' flocks are very seldom made in Myanmar because of both financial constraints and the traditional practice of restocking of flocks using existing birds. Thus farmers' recollection of the number of birds purchased would also be expected to be highly accurate. Nests for brooding are always prepared by Myanmar farmers (Henning et al., 2006). Considering farmers care towards brooding hens a good accuracy in the recall of the number of new-hatched chicks would be expected. Similarly, birds are consumed only occasionally during important family and religious events, and so accurate recall would be also expected. Errors in counts of birds entering a particular age group from a younger age group since the previous visit may also have occurred. Such errors are likely to have occurred in periods where the numbers of birds present exceeded that expected. However this requires errors in the categorisation of birds by age group and these errors are likely to have been low. Birds were not individually identified and so birds moving from one age group to another were not recorded at the individual bird level. However, the number of birds belonging to a particular age group was recorded at each visit and errors in the categorisation of birds by age group were probably low as the veterinarians were experienced in age categorisation, household visits were conducted at regular intervals and the hatching dates of new-born birds were always recorded. Accordingly, the main reason for these discrepancies is likely to be unobserved mortalities. Adult birds are the most valuable and most visible birds in free-ranging environments. Therefore one would expect few unobserved mortalities amongst this group. The frequency of unobserved mortalities amongst chicks was probably much higher, as chicks were present in largest numbers, chicks are not easily visible under scavenging conditions and they have the lowest financial value. This probably explains why differences between median observed incidence rates and median incidence rates adjusted for unobserved mortality are largest among this age group.

Table 1: Observed and adjusted incidence rates for mortality (per 900 bird-days at risk) stratified by age for 10 villages in Myanmar for 5 successive monthly observation periods.

Period	Observed incidence rate of mortality (per 900 bird-days at risk)		Adjusted incidence rate of mortality (per 900 bird-days at risk)		
	Median	Range (Min-Max)	Median	Range (Min-Max)	
Adults					
	1	0.0	5.9 (0.0-5.9)	1.4	5.9 (0.0-5.9)
	2	0.0	2.8 (0.0-2.8)	1.6	3.6 (0.0-3.6)
	3	0.0	2.0 (0.0-2.0)	0.7	5.7 (0.0-5.7)
	4	0.3	16.4 (0.0-16.4)	1.1	16.4 (0.0-16.4)
	5	1.2	4.5 (0.0-4.5)	1.4	4.8 (0.0-4.8)
Growers					
	1	0.0	8.6 (0.0-8.6)	1.0	11.8 (0.0-11.8)
	2	0.0	11.6 (0.0-11.6)	0.8	18.1 (0.0-18.1)
	3	1.5	17.4 (0.0-17.4)	4.2	21.0 (0.1-21.1)
	4	0.6	22.4 (0.0-22.4)	2.1	23.3 (0.2-23.5)
	5	0.2	7.4 (0.0-7.4)	0.3	35.0 (0.0-35.0)
Chicks					
	1	3.3	14.1 (0.0-14.1)	14.3	33.4 (3.4-36.8)
	2	2.7	12.8 (0.0-12.8)	14.8	58.4 (5.8-64.2)
	3	3.5	8.2 (1.9-10.1)	7.2	33.4 (3.0-36.4)
	4	6.8	21.2 (1.7-22.9)	10.9	32.0 (3.8-35.8)
	5	4.0	16.0 (1.3-17.3)	14.8	29.2 (1.3-30.5)

## Conclusion

Unobserved mortalities should be considered when making estimates of mortality incidence in chickens under free-ranging conditions as is often practiced in developing countries. Incidence rates based only on observed mortalities can underestimate actual incidence rates, particularly amongst chicks.

## References

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