Application of a healthy food markets guide to two Indonesian markets to reduce transmission of “avian flu”

Gina Samaan,a Ferra Hendrawati,b Trevor Taylor,c Tangguh Pitona,b Dini Marmansari,b Ratna Rahman,b Kamalini Lokugea & Paul M Kellya

Problem The World Health Organization (WHO) developed a guideline with 10 control measures to reduce transmission of A(H5N1) avian influenza virus in markets in low-resource settings. The practical aspects of guide implementation have never been described.

Approach WHO’s guideline was implemented in two Indonesian markets in the city of Makassar to try to reduce transmission of the A(H5N1) virus. The guideline was operationalized using a participatory approach to introduce a combination of infrastructural and behavioural changes.

Local setting Avian influenza is endemic in birds in Makassar. Two of the city’s 22 dilapidated, poorly-run bird markets were chosen for the study. Before the intervention, neither market was following any of WHO’s 10 recommended control measures except for batch processing.

Relevant changes Market stakeholders’ knowledge about the avian influenza A(H5N1) virus improved after the interventions. WHO guideline recommendations for visual inspection, cleaning and poultry-holding practices, as well as infrastructural requirements for zoning and for water supply and utilities, began to conform to the WHO guideline. Low-maintenance solutions such as installation of wastewater treatment systems and economic incentives such as composting were well received and appropriate for the low-resource setting.

Lessons learnt Combining infrastructural changes with behaviour change interventions was critical to guideline implementation. Despite initial resistance to behaviour change, the participatory approach involving monthly consultations and educational sessions facilitated the adoption of safe food-handling practices and sanitation. Market authorities assumed important leadership roles during the interventions and this helped shift attitudes towards regulation and market maintenance needs. This shift may enhance the sustainability of the interventions.

Introduction

Live bird markets have been implicated in the circulation of avian influenza A(H5N1) virus1 and are a potential source of viral transmission among humans and animals.2,3 In 2006 the World Health Organization (WHO) developed a guideline – A guide to healthy food markets – to reduce contamination with and transmission of A(H5N1) virus in live bird markets.4 The guideline lists 10 control measures for the poultry area of markets, the main aims of which are to improve the environment and ensure safe food-handling practices. The 10 control measures involve education and awareness of how avian influenza is transmitted; monitoring of conditions and food-handling practices; visual inspection of fowl to look for signs of infection; use of personal protective equipment (masks, gloves, disposable aprons, rubber boots, etc.); market zoning to prevent public access to potentially contaminated areas; use of potable water for cleaning and hand-washing; appropriate cage design and holding practices; appropriate cleaning practices; properly designed utilities, such as drainage systems, and batch processing. This study reports on the lessons learnt from implementing the guideline in two live bird markets in Indonesia, a low-resource country with areas where avian influenza A(H5N1) virus infection is endemic in fowl.

Problem and local setting

The site of the study was the city of Makassar (population 1.6 million), where 80 000 birds are slaughtered daily and where avian influenza A(H5N1) virus infection is endemic in birds.1 Makassar has 22 live bird markets under the purview of the municipal market authority. All of them have dilapidated infrastructure, no health services and an inadequate operational environment. Two markets were selected for this study based on the management teams’ readiness to undergo the interventions. Market A had 186 kiosks, 17 management and sanitation staff, and 5 poultry kiosks that received and slaughtered a daily total of 500 birds; Market B had 247 kiosks, 17 management and sanitation staff, and 13 poultry kiosks that received and slaughtered a daily total of 2700 birds.

Before the intervention, an assessment was conducted to determine the extent to which WHO’s 10 control measures were being practised.5 The assessment showed that only one of the measures – batch processing – was being followed as recommended in the WHO guideline, which calls for separating poultry batches, cleaning between batches and at the end of the trading day, and having the capacity to trace back poultry through the use of regular suppliers. The other nine control measures were not met. For example, each poultry kiosk held, slaughtered and sold birds without separate zoning for these different processes; drainage, bins, electricity and water supplies were limited; work surfaces, cages and floors were hard to clean; and no regulated inspection or sanitation programmes were in place.

Approach

A municipal-level taskforce was established. It was composed of the finance and operations staff of the municipal market authority, general managers and sanitation teams of the live bird market, and members of the nongovernmental organization (NGO), CHF International, that was funded to implement the

Abstract: in العربية, 中文, Français, Русский and Español at the end of each article.

References

1 National Centre for Epidemiology and Population Health, College of Medicine, Biology & Environment, Australian National University, Canberra, ACT, 0200, Australia.
2 Disease Investigation Center, Ministry of Agriculture, Maros, South Sulawesi Province, Indonesia.
3 Australian Animal Health Laboratory, East Geelong, Australia.
4 Correspondence to Gina Samaan (e-mail: ginasamaan@yahoo.com).
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Interventions promoting infrastructural and behavioural changes were introduced over an 18-month period (January 2008–June 2009). The interventions were specifically aimed at achieving compliance with the nine recommended measures not being practised at the markets (batch processing was excluded since it was already being practised). A participatory approach involving market managers, sanitation teams and poultry vendors was applied to put the measures into operation. Under this approach, problems were posed and potential solutions discussed at monthly consultation meetings held at the markets until acceptable options emerged.

Interventions that required construction or introduction of new goods were designed to ensure sustainability, low ongoing costs and easy maintenance. Education sessions lasting two hours were held monthly to improve market managers’, sanitation teams’ and poultry vendors’ knowledge and practices in the area of sanitation and food handling. These 18 sessions were held at canteens near the markets and addressed waste management, food safety, recognition of signs of infection with avian influenza A(H5N1) virus and notification of affected fowl. The staff of CHF International developed key messages based on the WHO guideline and provided the training. Information was discussed and monitoring protocols and logs were developed during these 18 sessions.

Progress in implementing the intervention was evaluated through a post-intervention inspection, interviews with market managers, sanitation teams and poultry vendor surveys. These activities were conducted by a two-person team composed of one external evaluator (GS) experienced in avian influenza control in live bird markets and one NGO officer responsible for overseeing guideline implementation at both markets. GS developed the necessary evaluation tools based on the WHO guideline and provided one day of training to the NGO officer on questionnaire administration and data collection and recording.

An unannounced one-day inspection was conducted at each market by the team one month after the intervention. The team used a checklist to confirm that the necessary goods had been installed and that the protocols and logs developed were in use. Interviews with market managers and sanitation teams were conducted using semi-structured questionnaires developed with guidance from WHO and field tested locally. The questions explored the presence of any roadblocks to guideline implementation and the adequacy of the change process and the interventions. Answers to each question were summarized and differences in perspectives identified.

Changes in vendor knowledge, attitudes and behaviour before and after the intervention were measured using a field-tested, structured survey instrument containing 38 close-ended questions. The survey was conducted verbally in the local dialect. The NGO officer conducted the pre- and post-intervention surveys among 34 and 29 poultry vendors, respectively (Table 1). These numbers represent all vendors present in the market on the days the interviews were conducted. Changes in vendors’ knowledge, attitudes and behaviours before and after the intervention were analysed using χ² or Fisher’s exact tests, as required.

Ethics approval for the study was obtained from the Health Research Ethics Committee at the Indonesian Ministry of Health and from the Australian National University Human Research Ethics Committee.

**Findings**

**Education and awareness**

Poultry vendors’ knowledge and attitudes surrounding avian influenza A(H5N1) virus transmission improved after the intervention. Six vendors from both markets continued to slaughter sick chickens and to sell sick or dead chickens (Table 1). They stated that they sold these chickens as feed for fish farms, but no follow-up was conducted to verify this information.

**Monitoring**

With the aid of municipal agriculture officers, both markets developed disease-

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**Table 1. Comparison of poultry vendor knowledge, attitudes and practices before and after intervention to reduce transmission of A(H5N1) influenza virus in two poultry markets, Makassar, Indonesia, 2008–2009**

<table>
<thead>
<tr>
<th>Control measure and related knowledge, attitude or practice</th>
<th>Before (n = 34) No. (%)</th>
<th>After (n = 29) No. (%)</th>
<th>P</th>
</tr>
</thead>
<tbody>
<tr>
<td><strong>Education and awareness</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Aware that people can get sick from working with poultry</td>
<td>8 (24)</td>
<td>18 (62)</td>
<td>0.002</td>
</tr>
<tr>
<td>Practising slaughter of sick birds and sale of sick or dead birds</td>
<td>5 (15)</td>
<td>6 (21)</td>
<td>0.533</td>
</tr>
<tr>
<td><strong>Education and awareness, monitoring, visual inspection</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Able to identify three symptoms of avian influenza infection in chickens</td>
<td>26 (76)</td>
<td>27 (93)</td>
<td>0.092</td>
</tr>
<tr>
<td><strong>Personal protective equipment</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Wearing rubber boots†</td>
<td>22 (65)</td>
<td>16 (55)</td>
<td>0.441</td>
</tr>
<tr>
<td>Wearing plastic aprons†</td>
<td>5 (15)</td>
<td>16 (55)</td>
<td>0.001</td>
</tr>
<tr>
<td><strong>Cages and holding practices, cleaning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Cleaning cages daily</td>
<td>28 (82)</td>
<td>29 (100)</td>
<td>0.027</td>
</tr>
<tr>
<td><strong>Cleaning</strong></td>
<td></td>
<td></td>
<td></td>
</tr>
<tr>
<td>Using soap when cleaning chopping boards, knives and defeathering machines</td>
<td>13 (38)</td>
<td>18 (62)</td>
<td>0.059</td>
</tr>
</tbody>
</table>

† Based on observation of poultry vendors.
monitoring protocols. These protocols provided for simple visual inspection of incoming birds, a cost-free intervention. Monitoring logs were filled daily by market managers in both markets and kept in the communal poultry holding zone.

**Visual inspection**

Posters and protocols for poultry inspection and disease notification were developed and placed in a visible location in the poultry area of each market. More poultry vendors could correctly identify signs of avian influenza A(H5N1) virus infection in birds after the intervention than before it ($P = 0.09$) (Table 1).

**Personal protective equipment**

Poultry vendors rejected face masks and goggles because they made them feel too hot when worn during poultry slaughter. However, the use of plastic aprons increased after the intervention ($P = 0.001$).

**Market zoning**

The poultry area was completely reconstructed within a four-month period in both markets. The new structures adhered to zoning and unidirectional workflow, as per the WHO guideline (Fig. 1). Of the 29 poultry vendors surveyed after the intervention, 25 (86%) expressed satisfaction with the changes. The remaining vendors indicated that they had fewer buyers because the area where poultry is sold to the public had been isolated. Eleven vendors (38%) mentioned a dip in sales after the interventions, but seven of these vendors (64%) still felt satisfied with the changes.

**Water**

In both markets, existing water wells were closed and city water was piped to the poultry areas. Toilets with hand-washing facilities were installed, with easy access for all workers and customers.

**Cages and holding practices**

After the intervention, poultry species were placed in separate holding zones and kept in clean cages. More vendors reported cleaning cages and trays daily ($P = 0.027$; Table 1). Market A vendors expressed concern that the poultry holding zone was too hot because of limited airflow. Additional fans were installed to overcome this design problem, but management still faced difficulty in getting vendors to hold poultry in that zone.

**Cleaning**

Market sanitation teams were provided with high-pressure hoses. Easy to clean stainless-steel work surfaces were installed. Cleaning logs were filled daily by the market sanitation teams. Cleaning practices by poultry vendors improved after the intervention (Table 1).

**Utilities**

The poultry areas were provided with electricity, and an anaerobic wastewater treatment system that decreases organic matter was installed in them. Composting bins and rubbish bins with lids were provided and placed in visible locations, and drains were covered and sloped. One vendor who was unhappy with the intervention claimed that drainage was slow. On verification, market managers suggested that this vendor was unhappy with his corner location in the sale area as he felt that it was isolated. No other vendor complained about the drainage.

**Conclusion**

Behavioural change was critical to the adoption of hygienic practices and the implementation of the WHO guideline. Since people tend to resist changes in their work routines, we achieved success in this respect by applying the participatory approach consisting of regular consultations, educational sessions and by making infrastructural changes that facilitated and provided an incentive for behaviour change. Market managers and the municipal market authority assumed important leadership roles in overseeing adoption of the guideline. All stakeholders recognized the need to regulate market sanitation practices and utilities to maintain consumer interest and sustain live bird markets as points of municipal revenue. This resulted in a commitment by the municipal market authority to use funds already allocated by the local government to provide maintenance and uninterrupted supplies of electricity and water, without additional cost to vendors in the two markets. We believe this commitment will ensure the intervention’s sustainability. It may also provide impetus for the municipal market authority to roll out the intervention in Makassar’s other 20 live bird markets over the next 5 years using municipal funds.
Anaerobic wastewater treatment systems and composting reduce the risk of contamination with the A(H5N1) virus and are cheap and easy to maintain. Composting also enables sanitation staff to supplement their income by turning poultry waste into a marketable commodity. Such economic incentives increase compliance with interventions, especially in low-resource settings.

The intervention did not result in any increase in kiosk fees, since it was funded through CHF International. Although cost-sharing would have been favourable, initial buy-in from authorities and vendors was limited by the fact that WHO’s guideline had never before been applied in Indonesia. Therefore, this experience was treated as a proof-of-concept. Future applications of the guideline in Indonesia should explore other funding models (e.g. public–private co-contributions).

The fact that the two bird markets were chosen because their management teams showed readiness to implement the interventions may have increased the likelihood of success. However, the intervention should yield similar results in other low-resource settings, since the workflow in markets is generic. Furthermore, managers of other live bird markets may be motivated by the lessons learnt from this experience (Box 1). Since the WHO guideline prioritizes certain interventions more than others, managers of markets with limited resources may choose to implement the interventions having higher priority.

**Box 1. Summary of main lessons learnt**

- The interventions outlined in the World Health Organization’s guide to healthy food markets can be implemented in low-resource settings endemic for avian influenza A(H5N1) virus.
- To implement the interventions and maximize potential for sustainability, various stakeholders had to be involved in the change process, including the government market authority, market managers, sanitation teams and poultry vendors.
- Regular consultation and education sessions, as well as infrastructural changes with financial incentives, facilitated behaviour change and the adoption of hygienic practices by market stakeholders.

**Acknowledgements**

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**Competing interests:** None declared.

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Резюме

Реализация указаний по охране здоровья на продовольственных рынках на двух индонезийских рынках в целях снижения передачи "птичьего гриппа"

Проблема Всемирная организация здравоохранения (ВОЗ) разработала указания, содержащие 10 мер, направленных на снижение передачи вируса птичьего гриппа A(H5N1) на рынках в условиях с ограниченными ресурсами. Практические аспекты реализации инструкции ранее никогда не были описаны.

Подход Указания ВОЗ были реализованы на двух индонезийских рынках в городе Макассар в целях уменьшения передачи вируса A(H5N1). Реализация указаний была осуществлена с использованием активного подхода и была нацелена на совместное внедрение инфраструктурных и поведенческих изменений.

Местные условия Птичий грипп является эндемическим для птиц в Макассаре. Для исследования были выбраны два из 22 ветвей и плохо организованных птичьих рынков. До реализации мероприятий ни один из рынков не выполнял ни одной из 10 рекомендуемых ВОЗ мер контроля, за исключением контроля партий товара.

Осуществленные перемены Осведомленность заинтересованных лиц, участвующих в работе рынка, о птичьем гриппе A(H5N1) после реализации мероприятий улучшилась. Рекомендации ВОЗ, касающиеся визуального осмотра, чистки и содержания птиц, а также инфраструктурные требования к зонированию, водоснабжению и системам коммунального обслуживания стали соответствовать указаниям ВОЗ. Такие решения снизили эксплуатационные расходы, улучшили систему очистки сточных вод, а также такие экономические стимулы, как, например, компостирование, были хорошо приняты и подходят для условий с ограниченными ресурсами.

Выводы Сочетание инфраструктурных изменений с мерами, направленными на изменение поведения, имеет решающее значение для реализации указаний. Несмотря на первоначальное сопротивление изменению поведения, подход, предполагающий активное участие и включающий ежемесячные консультации и учебные занятия, способствовал принятию практик безопасного обращения с пищевыми продуктами и санитарии. Руководство рынка в течение проведения мероприятий приняли на себя важную направляющую роль, что помогло склонить заинтересованных лиц в пользу осознания необходимости регулирования и содержания рынка в надлежащем состоянии. Такое изменение отношения может повысить устойчивость результатов от реализации мероприятий.
Resumen

Aplicación de la guía para mercados de alimentos saludables en dos mercados indonesios con el fin de reducir la transmisión de la «gripe aviar»

**Situación** La Organización Mundial de la Salud (OMS) desarrolló una guía con 10 medidas de control para reducir la transmisión del virus de la gripe aviar A(H5N1) en mercados en entornos con escasez de recursos. Nunca se describieron los aspectos prácticos de la aplicación de dicha guía.

**Enfoque** La guía de la OMS se aplicó en dos mercados indonesios de la ciudad de Makassar con el fin de intentar reducir la transmisión del virus A (H5N1). La guía se hizo más funcional a través de enfoques participativos para introducir una combinación de cambios tanto en las infraestructuras como en los comportamientos.

**Marco regional** La gripe aviar es endémica en las aves de Makassar. Para este estudio se eligieron dos de los 22 mercados de aves deteriorados y mal gestionados de la ciudad. Antes de la intervención, ninguno de los dos mercados seguía ninguna de las 10 medidas de control recomendadas por la OMS, exceptuando la de procesamiento en lotes.

**Cambios importantes** Tras la intervención, se observó una mejora considerable de los conocimientos de los participantes en el mercado sobre el virus de la gripe aviar A (H5N1). Empezaron a aplicarse las recomendaciones de la guía de la OMS en cuanto a inspección visual, limpieza y prácticas de explotación avícola. Del mismo modo, los requisitos infraestructurales de distribución en zonas, suministro de agua y servicios públicos empezaron a adherirse a la guía de la OMS. Las soluciones de bajo mantenimiento como la instalación de sistemas de tratamiento de aguas residuales y los incentivos económicos como el del compostaje fueron bien recibidos y adecuados para este entorno con escasez de recursos.

**Lecciones aprendidas** La combinación de intervenciones para realizar cambios en las infraestructuras y en el comportamiento resultó fundamental en la puesta en práctica de la guía. A pesar de la resistencia inicial a los cambios de comportamiento, el enfoque participativo con consultas mensuales y sesiones educativas facilitó la adopción de unas prácticas seguras de manipulación de alimentos y de saneamiento. Las autoridades competentes asumieron un importante rol de liderazgo durante las intervenciones, lo que ayudó a cambiar actitudes respecto a las necesidades de regulación y de mantenimiento de los mercados. Este cambio podría potenciar la sostenibilidad de las intervenciones.

**Referencias**


