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Afriflu—International conference on influenza disease burden in Africa

C. Steffen [1], O.M. Diop[2], B.D. Gessner[3], M.M. Hacen[4], M. Hassar[5], M.A. Katz[6], M.A. Miller[7], W.J. Paget[8], B.D. Schoub[9], G. Vernet[10]

[1]Agence de Médecine Préventive - AMP, 13, chemin du Levant, 01210 Ferney-Voltaire, France
[2]Institut Pasteur, Dakar, Senegal
[3]Agence de Médecine Préventive, Paris, France
[4]Retired WHO representative; President of the Mauritanian Association of Public Health, Nouakchott, Mauritania
[5]Institut Pasteur, Casablanca, Morocco
[6]Centers for Disease Control and Prevention, (based in) Nairobi, Kenya
[7]National Institute of Health, Fogarty Center, Bethesda, USA
[8]Netherlands Institute for Health Services Research - NIVEL, Utrecht, The Netherlands
[9]National Institute for Communicable Diseases, Sandringham, South Africa [1]
[0]Fondation Mérieux, Lyon, France

ABSTRACT

The burden of influenza disease is to a large extent unknown for the African continent. Moreover, the interaction of influenza with common infectious diseases in Africa remains poorly described. Solid scientific evidence on the influenza disease burden in Africa is critical for the development of effective influenza vaccine policies.

On 1st and 2nd June 2010 in Marrakech, Morocco, over eighty surveillance and influenza experts from 22 African countries as well as Europe and America met at the 'Afriflu' conference to discuss influenza challenges and solutions for the continent. During the meeting, participants exchanged their experiences and discussed a wide variety of topics related to influenza in Africa, including diagnosis, surveillance, epidemiology, and interventions.

The meeting concluded with a pledge to improve influenza knowledge and awareness in Africa, with an emphasis on accurate determination of disease burden to help orient public health policies.

1. The Afriflu initiative

The recent influenza A (H1N1) 2009 pandemic has significantly increased the interest of health authorities in influenza, leading to the initiation or reinforcement of influenza surveillance activities in many African countries. However, the understanding of the burden of influenza disease on the African continent remains insufficient.

Few influenza epidemiological studies have been conducted and the existing ones cover limited populations [1]. Influenza surveillance networks are active in some African countries; however interaction between the networks remains poorly organised.

Finally, influenza seasonality trends are not well documented, limiting the ability to employ models for estimating excess disease outcomes due to influenza. In its recommendations of 7 July 2009, the World Health Organization's Strategic Advisory Group of Experts (SAGE) on immunisation concluded that the strengthening of influenza surveillance is key in Africa [2].

In this context, Agence de Médecine Préventive (AMP, www.aamp.org), a non-profit organisation devoted to international health, organised 'Afriflu', an international conference focusing on influenza in Africa, which took place on 1st and 2nd June, 2010 in Marrakech, Morocco. This meeting was organised with the support of an international scientific committee and gathered over 80 participants from around the world, including 22 African countries: Algeria, Angola, Burkina Faso, Cameroon, Cape Verde, Congo, Côte d'Ivoire, Democratic Republic of the Congo, Egypt, Ethiopia, Ghana, Kenya, Madagascar, Mauritania, Morocco, Niger, Nigeria, Senegal, South Africa, Tanzania, Tunisia, and Uganda. International participation from a wide range of institutions included the World Health Organization (WHO) via the Head office in Geneva and the Africa and Eastern Mediterranean Regional Offices (AFRO and EMRO), the West African Health Organization (WAHO), the Coordination Organisation for the Control of Endemic Diseases in Central Africa (Organisation de Coordination pour la lutte contre les Endémies en Afrique Centrale – OCEAC), the Centers for Disease Control and Prevention (US-CDC), the National Institutes of Health (US-NIH), the European Commission (EC), the United States Naval Medical Research Unit 3 (NAMRU3), the German Agency for Technical Cooperation (GTZ), and the African Field Epidemiology Network (AFENET).

This paper provides an overview of the outcomes of the two plenary sessions (influenza at global level and influenza in Africa), the four thematic workshops (surveillance; epidemiology research; laboratory and diagnostic aspects and antivirals and vaccine interventions on influenza in Africa), and the overall conclusions and recommendations of the 'Afriflu' conference.

2. INFLUENZA AT THE GLOBAL LEVEL – PLENARY SESSION

2.1. Influenza epidemiology

2.1.1. Seasonal influenza

The seasonality of influenza is well documented in temperate regions. Seasonality data has been used to model the contribution of influenza to excess seasonal morbidity and mortality inmanycountries.

However, few data are available for Africa. Outside Africa, data from a limited number of countries in tropical regions suggest virus circulation throughout the year, and probably increased activity during the rainy season [3]. Current evidence indicates that tropical regions play a crucial role in the global circulation of influenza viruses. Tropical regions, where some cyclic trends are observed, could be involved in the transition of seasonal influenza periods in the temperate regions [4]. Since Africa contains both temperate and tropical regions, a better understanding of regional seasonality could also contribute to further understanding global patterns.

2.1.2. Pandemic influenza A (H1N1) 2009

While seasonal influenza surveillance capacity existed in many countries before 2009, almost 80% of African countries within the WHO African Regional Office (AFRO) catchment area (primarily sub-Saharan African) had no functioning surveillance in place when the influenza A (H1N1) 2009 pandemic started. This became evident during the evaluation of oseltamivir resistant pandemic influenza isolates: while over 7000 isolates were available for testing from each of three WHO regions (Europe, the Americas, and Western Pacific), only 66 and 60 were available respectively for the AFRO and EMRO regions [5].

2.2. Influenza diagnosis

Due to high sensitivity and specificity as well as rapid attainment of results, the main diagnostic method used during the 2009 pandemic was reverse transcriptase polymerase chain reaction (RT-PCR). RT-PCR technique requires a laboratory equipped with the appropriate materials, infrastructure, and trained personnel.

An increasing number of African laboratories meet these requirements.

Specimen transport and supply management may result in significant delays in Africa due to organisational and financial issues.

Rapid influenza diagnostic tests (RIDT) are quicker to perform than RT-PCR and may be used easily at the point-of-care and in resource limited settings. However, these tests cannot differentiate seasonal and pandemic A (H1N1) 2009 influenza strains and their sensitivity is usually low, varying between 10 and 70% [6].

For this reason RIDT results alone should not be used as a basis for therapeutic decisions or lifting control measures.

The main clinical features relevant to influenza were also covered in the session.

2.3. Interventions against influenza

Vaccination is the cornerstone of influenza prevention in developed countries. The 2005 WHO position paper on influenza vaccines defines the target population groups to reduce the incidence of severe illness and death [7].

Seasonal influenza vaccine distribution in Africa is limited by low demand for costly yearly vaccination of high-risk population groups and lack of national vaccine policies: as of 2008, 120 countries – primarily in Africa and Southeast Asia – did not have a national seasonal influenza vaccine schedule in place [8].

In the context of pandemic influenza, theWHOGlobal Influenza program (GIP) reported that WHO received pledges for donations of 200 million vaccine doses, including 75 million for Africa. However, as of May 2010, only 20 million doses had been deployed.

Overall, the influenza A (H1N1) 2009 pandemic stressed the current limits of influenza surveillance in Africa and the need for building local vaccine manufacturing capacities. To support the development of capacities outside of high income countries, the WHO Initiative for Vaccine Research (IVR) has initiated a technology transfer programme for influenza vaccine production in lowand middle-income countries, which has raised interest in many countries. In 2007, six countries were selected by IVR to participate in the programme: Thailand, Vietnam, Indonesia, Brazil, Mexico, and India. Five others were selected in 2009: Iran, Romania, Egypt, Korea, and Serbia.

In Africa, as in other parts of the world, antivirals can play an important role in the case management of severe influenza disease.

However, limitations exist: resistance can occur; in Africa, antiviral treatment is often unavailable or delayed due to late consultation for care; cost may be prohibitive, although WHO recently provided limited supplies, free of charge, to a number of countries; and there may be limited stocks of antiviral drugs. The role of other interventions such as hand washing and social distancing has not been evaluated in an African setting.

3. Influenza in Africa – plenary session

3.1. Influenza surveillance in Africa

The World Health Organization African Regional Office (WHOAFRO) has established different regional objectives for influenza surveillance: (i) to monitor circulating strains, (ii) to detect new influenza strains with pandemic potential, (iii) to identify the epidemiologic characteristics of influenza and other unusual respiratory disease events, and (iv) to characterise and monitor trends in illnesses and deaths attributable to acute respiratory infections.

Some African countries have conducted influenza surveillance for years, such as Madagascar, Senegal, and South Africa. Currently, 25 National Influenza Reference Laboratories in 21 countries (46% of all

WHO-AFRO countries) in Africa are participating in the Regional Influenza Laboratory Network with the support of WHO and partners.

Twelve Influenza Reference Laboratories in 11 countries (24% of all WHO-AFRO countries) in Africa are registered as National Influenza Centres (NICs) and are also members of the WHO Global Influenza Surveillance Network (GISN) [9]. Since the beginning of the influenza A (H1N1) 2009 pandemic, many sub-Saharan countries have expanded or established influenza sentinel surveillance and are reporting national laboratory and epidemiologic data to AFRO.

Within Africa, virological and epidemiological surveillance differ by country, as illustrated by the examples below: In Morocco, virological and epidemiological surveillance rely on 16 regional hospitals, over 380 health centres, 110 private cabinets, and 16 emergency service centres. More than 20 regional laboratories dedicate a part of their activity to viral detection using RT-PCR (4 laboratories) and immunofluorescence (16 laboratories) techniques for viral detection. The surveillance system permits evaluation of severe acute respiratory infections (SARI), acute respiratory infections (ARI), influenza-like illness (ILI), laboratoryconfirmed influenza cases; calculation of incidence rates; and identification of risk groups (such as specific age groups).

In South Africa, the NIC is responsible for a viral watch programme and collaborates with several hospitals to run a SARI surveillance programme. The NIC can test for influenza by RT-PCR and antigen detection, perform phylogenetic and resistance analysis, and identify other respiratory pathogens. In addition, it is establishing a biosafety level 3 laboratory to allow work on highly pathogenic strains such as H5N1. The surveillance system permits evaluation of SARI, ARI, ILI, and laboratory-confirmed influenza cases; calculation of incidence and mortality rates; identification of risk groups (age, underlying illness, gender, and others); identification of non-influenza ARI etiologies; and genetic evaluations such as determining the evolution of viruses and identifying pathogenic markers. The surveillance system is connected to the Ministry of Health and the National Immunisation Technical Advisory Group, allowing for the use of data to establish influenza immunisation policy. Lastly, the NIC provides support and training to other Southern African countries.

In Côte d'Ivoire a sentinel surveillance network managed by the Côte d'Ivoire Pasteur Institute and the National Public Health Institute is in charge of seasonal influenza sentinel surveillance at nine sites. SARI surveillance is carried out at eight sites in university hospitals, emergency services, and resuscitation services.

Laboratory analysis includes RT-PCR, culture, and antigen detection.

The surveillance system permits identification of the relative occurrence of influenza subtypes and risk groups.

Morocco and Côte d'Ivoire both use the WHO influenza case definitions for ILI and SARI [10]. However, depending on national infrastructures, there are differences in the algorithms used, the methods of sample collection (nasopharyngeal or throat swabs) and transport – type of viral transport medium (VTM) and shipping frequency (three times a week in Côte d'Ivoire as opposed to every day in Morocco).

WHO and its technical partners have recently evaluated influenza surveillance capacities in 12 AFRO-Region countries (Angola, Benin, Burkina Faso, Côte d'Ivoire, Democratic Republic of the Congo, Ethiopia, Kenya, Mali, Mauritania, Nigeria, Senegal, and Togo). Five countries have sentinel surveillance systems for influenza in place (some since 1997) with between 2 and 10 sentinel sites per country. Half of the countries have PCR capacity for influenza testing and there is an ongoing effort to increase this number. In parallel, Integrated Disease Surveillance and Response (IDSR) systems included some measure of lower respiratory infection in 11 out of 12 countries, but the specific case definitions used varied between countries. Identified weaknesses included limited geographical representation and a small total population under surveillance, sub-optimal data analysis and reporting mechanisms, lack of data on respiratory infection mortality at the national level in most countries, and irregular supplies available at sites conducting influenza analysis. The evaluations also demonstrated the importance of stakeholder involvement at all levels of the sentinel surveillance system to ensure sustainability. The existence of a functional influenza laboratory within the country appeared to be a key basic element upon which a robust influenza surveillance system was built.

3.2. Lack of published data

Asystematic review of seasonal influenza epidemiology demonstrated the lack of published data in Africa, with 48 articles available between January 1980 and December 2009, of which over half (29) were from South Africa and Madagascar (Gessner et al., submitted for publication). Influenza seasonality was available from only four articles with data from more than 20 samples. Overall, little published data needed for decision making were available, such as attack rates (in older children and adults), seasonality in most countries, case fatality ratios in the absence of isolated outbreaks, the contribution of prevalent health conditions, and the impact of influenza on workplace or school absenteeism. It was emphasised that publishing of influenza data is a critical issue for influenza management in Africa.

3.3. Influenza: current challenges for Africa

The following points were made during the plenary sessions.

First, the current level of influenza surveillance data is limited and not sufficiently representative of the African population. Second, there are limited national resources allocated to influenza surveillance, which prevents expansion of surveillance activities.

Third, hospital-based sentinel surveillance does not capture mild influenza cases or those occurring in individuals who do not seek medical assistance. Fourth, the delay in reporting and analysis of surveillance data is a challenge shared by many countries. Fifth, there should be more influenza laboratories in Africa, and some existing influenza laboratories need to improve their quality. Sixth, logistical issues can cripple surveillance efforts, including lack of laboratory reagents, consumables and other supplies. Seventh, there are inconsistencies in the influenza surveillance case definitions, which prevent easy comparisons across countries. Eighth, it is currently impossible to link systematically virological to epidemiological data. Ninth, qualified human resources are insufficient in all sectors (clinical, laboratories, epidemiology, and surveillance), particularly during a pandemic situation. Tenth, collaboration between countries to share surveillance resources and capacities is currently insufficient.

3.4. Funding research efforts

The sustainability of research programmes, laboratory networks and surveillance systems is a critical issue. Political will and early planning are key in these domains andmanycountries have already established financing programmes in this context. Financing efforts are constrained by severely limited budgets, competing health priorities, and lack of access to interventions such as vaccines and antivirals that would motivate ongoing commitments to disease burden data gathering. In the African context, external partners continue to play a major role. International institutional partners present at the conference and currently involved in supporting/ implementing influenza activities in Africa include the US-CDC, the US-NIH (including the Fogarty International Center) [11], the European Commission, and the GTZ.

4. Report of workshop sessions

4.1. Workshop on influenza surveillance in Africa

Various surveillance systems currently exist in Africa. These include the Integrated Disease Surveillance and Response (IDSR) system (supported by WHO-AFRO), community-based surveillance systems (in the near future to be part of IDSR), sentinel surveillance (for example, in Nigeria, the Democratic Republic of Congo, Senegal, Cameroon, Madagascar, and other countries) and population-based surveillance systems (such as one planned for Malawi). Among the objectives of surveillance systems, estimation of influenza disease burden is key, as is understanding of influenza severity including incidence of hospitalisation and fatal cases. Understanding how influenza interacts with or otherwise contributes to the burden of other diseases – such as malaria, HIV or dengue – is also a matter of importance.

An ideal influenza surveillance system in Africa should have several qualities. Case definitions, age group categories, and reporting forms should be standardised to allow comparability of results within and between countries. The system should have a functioning laboratory with adequate materials and human resources.

It should integrate syndromic surveillance in healthcare facilities with a limited number of sentinel sites for laboratory-confirmed influenza, and combine outpatient and inpatient sites.

Timely dissemination of reports that include epidemiological and laboratory data is a crucial component of surveillance. Reports should be developed on aweekly basis, be timely and concise, easy to share and may include maps and graphs. Reference to historical data would permit the results to be put in a more global context.

Stating how the indicators are chosen would allow the harmonisation of data between countries. International Internet databases like FluID and FluNet should be used more widely to enable global data sharing. Regular feedback to all data collection sites is crucial to sustain motivation of staff and the quality of the surveillance system in the long run.

Final recommendations on surveillance included the following:

• Standardise methodology globally or within Africa such as case definitions, age group categories, and reporting forms.
• Finalise and translate regional and international guidelines for surveillance into national languages.
• Adapt regional and global guidelines to national contexts.
• Use data generated by surveillance networks for research purposes.
• Make publicly available regular reports of summary surveillance data that integrate virological and epidemiologic data.
• Develop mechanisms for sustainability of surveillance systems.

4.2. Workshop on influenza epidemiology research in Africa

Several research activities are ongoing in Africa to assess influenza disease burden. Epidemiological research activities exist in Senegal, South Africa, Togo, Kenya, and The Gambia and cover the evaluation of morbidity and mortality, risk groups, co-morbidity factors, and disease incidence. South Africa also employs data modelling and molecular epidemiology to assess seasonality and comorbidity, for instance. Egypt and South Africa have ongoing programmes for non-human influenza surveillance. The follow-up of mass gathering events like the Hajj and the FIFA Football World Cup is also a research priority, and in particular studying the impact of these events on global influenza epidemiology. Finally, Kenya, Senegal, and South Africa have ongoing vaccine intervention studies designed to provide data on vaccine effectiveness as well as to use a vaccine probe approach.

Recommendations included the following:
• The following indicators where considered as priority outcomes to be measured:
- Assessment of influenza morbidity and mortality, and estimation of disease burden.
- The role of co-infections and comorbidities in severe influenza infection.
- Incidence of mild and severe laboratory-confirmed influenza infection.
- Influenza seasonality across different climatic zones and over multiple years.
- Risk groups.
- Economic burden.

• The following methods were identified as particularly relevant: - Engaging in vaccine intervention studies, including vaccine probe designs.
- Including data on outpatient illness, workplace, and school absenteeism.

4.3. Workshop on influenza laboratory and diagnostic aspects in Africa

Currently, several laboratory networks exist in Africa, including those supported by the US-CDC, NAMRU3, and the Pasteur Institutes.

To detect influenza, RT-PCR is considered the “gold standard”.

Use of rapid diagnostic tests may have a place if based on existing WHO guidelines. In particular, they are likely to be useful for rapid outbreak identification and monitoring of epidemics but not for individual clinical diagnosis.

Among the main identified challenges during this workshop, ensuring the quality of specimens delivered to the laboratories ranked number one. Suggested solutions to address this problem are improved training and motivation of field personnel, the use of appropriate transport media and more effective shipping (speed, security, and the cold chain maintenance).

Recommendations included the following:

• Strengthen National Influenza Centres (NICs), by:
- Developing influenza PCR testing and culture capacity.
- Developing capacities to test for a wide array of common respiratory pathogens.
- Improving specimen sampling strategies to obtain better demographic and geographic coverage.
- Implementing functioning quality assurance programmes within every laboratory.
- Identifying and resolving bio-security gaps.
- Utilising current funding opportunities to improve laboratory quality.

• Increase the use of diagnostic tests: - Rapid influenza diagnostic tests should be available.
- RT-PCR should remain the gold standard.
- Rapid influenza diagnostic test use should follow WHO guidelines.

• Strengthen laboratory networks: - Objectives of networks should be clarified.
- Network activities should be synergised.
- Networks should improve database harmonisation and data sharing.

4.4. Workshop on antivirals and vaccine interventions against influenza in Africa

Antivirals, whether branded or generic, are available in limited quantities in some African countries. No local production exists, although in some countries the drugs are packaged locally.

Similarly, no influenza vaccines are manufactured in Africa and vaccines are only available through leading manufacturers. This may change since Egypt has joined and South Africa might join in the near future the WHO vaccine technology transfer programme.

Since African countries span both sides of the equator, local production should take into account the need for both northern and southern hemisphere vaccine formulations. Globally, regulatory bottlenecks impeding vaccine technology transfer should be overcome. Financial considerations also limit the use of influenza vaccines in Africa. In the absence of specific studies in the African context the cost-benefit ratio is unclear.

Estimation of vaccine and antiviral needs in Africa depends on the evaluation of the disease burden. The necessity to have publications of high quality data was stressed. Another key aspect for the use of vaccines and antivirals is the need to identify clear priority groups. These priority groups may be similar to those in industrialised countries but African-specific priority groups may exist as well. Data must also be generated to assess the impact of influenza on several other diseases (e.g. bacterial pneumonia including tuberculosis (TB), meningitis, malaria or HIV/AIDS) and health conditions, such as example pregnancy.

More detailed data on circulating strains in Africa will help to reassess the need and urgency for northern/southern hemisphere vaccine formulations and production. Other studies should assess vaccine effectiveness in priority groups in Africa such as children younger than five years of age, pregnant women, HIV-infected individuals, and persons with acute meningococcal or pneumococcal infection.

Recommendations included the following:

• Establishing the evidence base for effective use of seasonal and pandemic influenza vaccines in Africa.

• Improving advocacy with policy makers to increase political commitment for evidence-based influenza vaccine and antiviral use.

• Updating or adapting existing influenza policies, plans, and guidelines to the countries' contexts.

• The WHO Strategic Advisory Group of Experts should review its recommendations for seasonal influenza immunisation.

• As for other vaccine-preventable diseases, national immunisation policies for influenza should be evidence-based and follow a sequential and progressive process.

• Increasing collaboration between countries, donors, and vaccine manufacturers.

• Establishing and developing activities of National Immunisation Technical Advisory Groups (NITAGs) in Africa with regard to all vaccine-preventable diseases, including influenza.

5. CONCLUSIONS

Until recently little attention was paid to influenza disease burden in Africa. The absence of epidemiological data was commonly interpreted as an absence of influenza disease. Since 2005, this perception has changed. The ongoing sporadic H5N1 outbreaks in poultry and humans in particular in Egypt and the recent influenza A (H1N1) 2009 pandemic have demonstrated that influenza is a global issue that can only be addressed by a close collaboration of countries on a global level.

Tackling influenza in Africa requires an approach specifically tailored to the requirements of the continent and necessarily different from that of the developed world. Firstly, in Africa, there is a lack of data with respect to incidence, mortality burden, clinical outcomes and vaccine effectiveness. Acquiring these data would allow for comparisons between African countries and more temperate developed countries. Secondly, public health decision-making in African countries involves considerations that may differ substantially from other areas of the world. As an example, many African countries have serious competing communicable disease priorities such as HIV/AIDS, TB, and malaria and little understanding of how these diseases interact with influenza. This situation, in combination with severely limited resources, is a strong argument to develop an Africa-specific influenza policy and research agenda.

To develop an adapted response to influenza in Africa, the first step is to get a better understanding of the disease burden on the continent and how influenza interacts with other prevalent diseases.

Influenza surveillance capacities are still limited in Africa.

All countries should develop some influenza surveillance capacities adapted to their national context. These capacities should combine out-patient and in-patient sites, use standardised case definitions and diagnostic techniques and be able to generate epidemiological and virological data.

The data generated should be of benefit not only to the country itself, but also to the neighbouring countries and to the global community at large. Therefore, every effort should be made to report surveillance data in a timely fashion and to publish surveillance and research results in the scientific literature.

Several programmes, driven by competent groups and individuals exist in Africa to assess influenza burden. The research agenda is broad: data are needed on influenza seasonality in tropical countries, disease burden, mortality, morbidity, and incidence rates and the relationship of these outcomes to other etiologies of acute respiratory infections. African at-risk groups for influenza should be identified. A small group of countries, which includes South Africa and Senegal, is currently leading the influenza surveillance and research effort on the continent [12–14]. Other countries are encouraged to join this group to increase the evidence base for Africa.

Strengthening and maintening diagnostic laboratories to ensure consistent high quality standards over the long term is amajor issue in a context of limited resources. Laboratories should extend their activity to other respiratory viruses. Maintaining sustainability of national laboratories and networks, whether technical or financial, is a key issue and must be actively supported by national authorities.

International donor support is currently available but must be further coordinated and maintained over time. Ethics is a cornerstone in the relations between different partners: benefits must be transparent and the development and use of best practices should be enforced.

Africa must improve its preparedness and fight against influenza. Policies to prescribe vaccines, antivirals and other interventions should be evidence-based and locally adapted and NITAGs should take an active role in the development of national guidelines.

Access to vaccines should increase, whether through national investments, local manufacturing, or simplification of regulatory procedures. Political commitment, national planning, good surveillance data, coordinated research and stable funding will allow a more accurate assessment of the burden of influenza disease in Africa in the coming years.

‘Afriflu’ is a useful forum to measure and report on the progress on influenza activities in Africa and should continue to support stakeholders in the area through regular meetings.

The conference agenda in provided in the Appendix A.

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[APPENDIX A]

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[APPENDIXES]

Appendix A. Appendix: Afriflu conference agenda

Tuesday 1 June 2010	
Topic	*Chair and speakers*
Opening	*P. Ndumbe, A. Da Silva (AMP), A. Ben Mamoun (MoH Morocco)*
Plenary 1: General and global aspects of influenza, burden of disease, surveillance, vaccination	*M. Hassar (chair), M.M. Hacen (co-chair), J. Paget (rapporteur)*
Key facts on influenza epidemiology and burden of disease globally	*B. Schoub (NICD, South Africa)*
Pandemic Influenza	*S. Briand (WHO GIP)*
Clinical Management and Diagnosis of Influenza	*K. Rooney (Royal Alexandra Hospital, UK)*
New influenza vaccine developments	*J.F. Saluzzo (Sanofi Pasteur, France)*
Seasonal influenza vaccination: current situation, drivers and barrier	*P. Duclos (WHO IVB)*
Plenary 2: Burden of disease of influenza on the African continent	*B. Schoub (chair), O. Diop (co-chair), T. Nguyen (rapporteur)*
Influenza in Africa	*F. Da Silveira (WHO AFRO)*
Case study 1 Morocco	*A. Ben Mamoun (MoH, Morocco)*
Case study 2 South Africa	*M. Venter (NICD, South Africa)*
Case study 3 Côte d'Ivoire	*D. Coulibaly (MoH, Côte d'Ivoire)*
The epidemiology of seasonal Influenza in Sub-Saharan Africa	*B. Gessner (AMP)*
Review of influenza surveillance capacity in 12 AFRO countries	*C. Steffen (AMP)*
Influenza research needs for Africa	*C. Viboud (NIH, USA)*
The African Network for Influenza Surveillance and Epidemiology (ANISE) and CDC's Influenza Work in Africa	*M. Katz (US-CDC, Kenya)*
Panel Discussion Influenza disease burden: What challenges is Africa faced with?	*Representatives from Madagascar, Nigeria, Senegal, Kenya*
Round table: Developing an evidence base for policy. Discussing financial barriers and solutions for influenza disease burden determination	*Representatives MoH Cameroon, US-CDC, Fogarty Center, European Commission, GTZ, NIH*

Wednesday 2 June 2010	
Topic	*Chair and speakers*
Workshops(in parallel)	
Influenza surveillance in Africa	*J. Paget (moderator), M. Katz (rapporteur)*
Influenza epidemiology research in Africa	*B. Gessner (moderator), B. Schoub (rapporteur)*
Antivirals and vaccine intervention against influenza in Africa	*M.M. Hacen (moderator), M. Hassar (rapporteur)*
Diagnostic and laboratory aspects	*G. Vernet (moderator), O. Diop (rapporteur)*
Summary, recommendations and conclusions	*P. Ndumbe (chair), M. Miller, M. Katz, B. Schoub, M. Hassar, M. M. Hacen*