

Midterm Review of the Hong Kong Strategy and Action Plan on Antimicrobial Resistance 2017-2022

Endorsed by the
High Level Steering Committee on Antimicrobial Resistance
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Abbreviations

AFCD	Agriculture, Fisheries and Conservation Department
AMR	Antimicrobial Resistance
AMRIS	AMR Information System
AMU	Antimicrobial Use
ASP	Antibiotic Stewardship Programme
AWaRe	Access, Watch, Reserve
CFS	Centre for Food Safety
CGAT	Community Geriatric Assessment Team
CHP	Centre for Health Protection
CLSI	Clinical and Laboratory Standards Institute
CME	Continuing Medical Education
DH	Department of Health
EC	Expert Committee on Antimicrobial Resistance
eHR	Electronic Health Record
eHRSS	Electronic Health Record Sharing System
EQAP	External Quality Assessment Programmes
FEHD	Food and Environmental Hygiene Department
FHB	Food and Health Bureau
GLASS	Global Antimicrobial Resistance Surveillance System
GVP	Government Vaccination Programme
HA	Hospital Authority
HKCIP	Hong Kong Childhood Immunisation Programme
HKDU	Hong Kong Doctors Union
HKMA	Hong Kong Medical Association
HMRF	Health Medical Research Fund
HLSC	High Level Steering Committee on Antimicrobial Resistance
IMPACT	Inter-hospital Multi-disciplinary Programme on Antimicrobial ChemoTherapy
JCCVMLS	Jockey Club College of Veterinary Medicine and Life Sciences of City University

KAP	Knowledge, Attitude and Practice
MRSA	Methicillin-resistant <i>Staphylococcus aureus</i>
PHLC	Public Health Laboratory Centre
PHLSB	Public Health Laboratory Services Branch
PPBHK	Pharmacy and Poisons Board of Hong Kong
PPIs	Proton Pump Inhibitors
RCHE	Residential Care Home for Elderly Person
SADF	Sustainable Agricultural Development Fund
SFDF	Sustainable Fisheries Development Fund
SIV	Seasonal Influenza Vaccination
UK	United Kingdom
US	United States
VSS	Vaccination Subsidy Scheme
WG	Working Group
WHO	World Health Organization

Executive Summary

The “*Hong Kong Strategy and Action Plan on Antimicrobial Resistance 2017-2022*” (the “Action Plan”) which was launched in July 2017 outlined key areas, objectives and actions by adopting the “One Health” approach, to contain the growing threat of antimicrobial resistance (“AMR”).

2. A cut-off date as at 31 December 2019 and 2016 was used as a baseline for comparison where appropriate, a midterm review on the implementation of the Action Plan during the period from July 2017 to December 2019 was conducted.

3. The review revealed that **good progress** has been made when compared with the situation of 2016. Relevant activities had been carried out according to the timeline pledged in the Action Plan, with progress of key activities shown below -

- (a) Surveillance data on human side became available in a more organised and transparent manner compared with the baseline at 2016, with surveillance data and reports covering AMR and antimicrobial use (“AMU”) available in the public domain;
- (b) Surveillance mechanisms for the food animal sector and food were being developed, with initiation of AMR / AMU surveillance on food animals after the completion of a respective consultancy study since July 2019, and the pilot survey would be evaluated to formulate a long-term food surveillance system on AMR;
- (c) Enhanced regulatory measures with over 6 000 test purchases against retailers of antibiotics, together with related health promotional activities and working with different healthcare providers and community partners to advocate appropriate use of antimicrobials, have been shown to be effective. The percentage of total supply of antibiotics to community pharmacies decreased from around 18% in 2016 to 7.5% in 2019;
- (d) For optimising the AMU in the human health sector, data from the Hospital Authority (“HA”) reflected that over 90% use of two broad spectrum antibiotics, namely Piperacillin/Tazobactam and Meropenem, were found to be appropriately used in medical, surgical and orthopaedic and traumatology specialty of acute hospitals in 2019. In addition, updated guidelines for in-patient setting with antibiograms were in place. Under the Antibiotic Stewardship in Primary Care initiative, new guidance notes and patient information sheets on seven common infections have been developed for use by primary care doctors with training sessions arranged. For animal health, preparation for the implementation of the “veterinary prescription-only medication supply” policy was in progress;

- (e) To reduce incidence of infection, ongoing infection prevention and control trainings in the human / animal / food sectors were in place, with over 30 000 and 6 000 attendances per year for human health and food sectors respectively. On the other front, the Department of Health (“DH”) has been offering free seasonal influenza vaccination and pneumococcal vaccination to eligible target groups, and will continue to work closely with stakeholders, private doctors, kindergartens and primary schools to promptly and better prepare outreach vaccination activities on campus in relation to seasonal influenza vaccination;
- (f) Regarding health promotion, thematic webpages on AMR in relation to human health, animal health and food safety have been established by the DH, the Agriculture, Fisheries and Conservation Department (“AFCD”) and the Centre for Food Safety (“CFS”) of the Food and Environmental Hygiene Department (“FEHD”). Ongoing publicity activities to echo annual World Hand Hygiene Day and World Antibiotic Awareness Week have been organised over the years. For instance, under the “One Health” framework, the DH, the AFCD and the CFS joined together to launch publicity activities to echo the annual World Antibiotic Awareness Week during 18 - 24 November 2019 to promote proper use of antibiotics;
- (g) To encourage research on AMR by making AMR as one of the thematic priorities for open call for investigator-initiated projects under the Health Medical Research Fund (“HMRF”) of the Food and Health Bureau; and
- (h) Since the launch of Action Plan, stakeholders have been informed of the Action Plan through meetings, trainings, publications and media publicity. The DH, the AFCD and the CFS jointly organised a two-day regional symposium on AMR under the theme “Fighting AMR – Partnerships in Action” in November 2018, attracting more than 300 delegates from Hong Kong, Mainland China, Macao, Taiwan and overseas countries to join.

4. Apart from reporting the progress, the midterm review also collected comments from stakeholders, with a view to identifying lessons learnt from experience as well as room for possible improvement. Comments from Members of the High Level Steering Committee on AMR (“HLSC”), as well as development at the international level (e.g. the World Health Organization (“WHO”), Australia, Japan, the United Kingdom (“UK”) and the United States (“US”)) and Mainland China, were also taken into account. Major lessons learnt included but not limited to the following -

- (a) In terms of surveillance, one major lesson learnt was that stakeholder engagement/buy-in during data exploration and standardisation would be imperative for continuous development of AMR/AMU surveillance systems using a stepwise approach. A common problem encountered by key players was on the issue of availability of relevant surveillance data on AMR / AMU in a desirable and standardised manner. For the animal

health and food side, further expert advice and technical support from the academia had to be obtained to guide the way forward;

- (b) For optimising AMU, the implementation of antibiotic stewardship programme (“ASP”) in hospitals was affected by factors such as service model, resource, expertise and engagement. In the animal health sector, the AMU for various disease conditions in the local animal sector was still common, and there had been limited resources in the field for long standing AMR control. As such, efforts have been made for developing relevant guidelines, as well as codes of practice and service;
- (c) Regarding infection control and related publicities / capacity building activities, evidence based / need driven health promotion activities have been implemented in the fields of human health and food safety, whereas proper capacity building activities with respect of infection control for farmers were in the pipeline recognising a need;
- (d) Compared with Mainland China and overseas counterparts, Hong Kong has adopted a similar approach in combating AMR, by moving forward One Health AMR / AMU surveillance, emphasising on optimising AMU and carrying out awareness-raising activities across different target groups. Hong Kong has been on par with overseas countries such as Japan and the UK that the Action Plan had addressed on food safety aspect; and
- (e) On the other hand, similar to Australia and Japan, response actions in Hong Kong did not address much on environmental aspects. With an increasing recognition of the importance of environment conducive to AMR, it would worth attention and pointing to a need to engage the Environment Bureau and related parties as additional stakeholders in the long run for more comprehensive control of AMR in Hong Kong.

5. Arising from comments received from Members of the HLSC, enhancements have been made / under planning in response of identification of possible areas for improvement during the period. Examples included the development of One Health AMR Information System (“One Health AMRIS”), provision of personal protection advice for patients receiving proton pump inhibitors for treatment of medical condition, addressing infection prevention and control in residential care homes for elderly persons, and attempted to adopt “One Health” approach in publicity activities to echo World Antibiotic Awareness Week 2019.

6. All in all, the Action Plan has set a clear roadmap for the implementation of actions in response to the public health threat of AMR in Hong Kong using the “One Health” approach. It is recommended to continue to implement actions according to the directions set out in the Action Plan for the remaining years between 2020 and 2022, with fine-tuning by adjusting the priorities of implementing some action items, such as to accord high priority for making more surveillance data / surveillance mechanism(s) available, particularly those related to animal health and

food safety, as well as the development of One Health AMRIS. Other priority areas warranting continuous injection of resource would include enforcement measures at the community pharmacy level and develop relevant AMU guidelines and codes of practice in the animal health field to facilitate proper use of antimicrobials, and continuous engagement of relevant stakeholders in human health, animal health and food safety fields.

7. The findings and recommendations of the midterm review will serve as an important reference for the final review of the Action Plan, and to guide the formulation of strategic interventions for the next Action Plan. It can also serve as an important reference for experience sharing with the WHO and overseas partners where appropriate.

1. Background

1.1 In recognition of the major threat posed by antimicrobial resistance (“AMR”) to the global public health, the Hong Kong Special Administrative Region Government (the “Government”) announced in the 2016 Policy Address to set up a high-level Steering Committee to formulate strategies in collaboration with the relevant sectors to tackle the threat. The High Level Steering Committee on Antimicrobial Resistance (“HLSC”) was established in June 2016. Under the HLSC, an Expert Committee on Antimicrobial Resistance (“EC”) was established in October 2016 to provide expert opinions on priority areas for actions for the HLSC’s consideration.

1.2 In July 2017, the “*Hong Kong Strategy and Action Plan on Antimicrobial Resistance 2017-2022*” (the Action Plan”) was launched. It outlined a total of six key areas, 19 objectives, 43 strategic interventions and 71 activities by adopting the “One Health” approach, with an aim to contain the growing threat of AMR. The six key areas of the Action Plan included –

- (a) Strengthen knowledge through surveillance and research;
- (b) Optimise use of antimicrobials in humans and animals;
- (c) Reduce incidence of infection through effective sanitation, hygiene and preventive measures;
- (d) Improve awareness and understanding of AMR through effective communication, education and training;
- (e) Promote research on AMR; and
- (f) Strengthen partnerships and foster engagement of relevant stakeholders

1.3 To ensure actions are being taken according to the Action Plan, and to evaluate whether those actions achieve the intended results, monitoring and evaluation is essential. It has been committed in the Action Plan that a midterm review would be undertaken to provide an objective measurement of the midterm progress of the proposed interventions.

2. Methodology of Review

2.1 This report provides a midterm review on the implementation of the Action Plan during the period from July 2017 to December 2019, taking reference from the following framework –

- (a) To review progress in the implementation of the Action Plan;
- (b) To evaluate the process and outcome by use of indicators;
- (c) To learn from experience; and
- (d) To identify how to strengthen implementation.

2.2 A cut-off date as at 31 December 2019 was used for review. The findings or situation in 2016 were chosen as the baseline for comparison where appropriate.

2.3 The above evaluation framework was endorsed by the HLSC meeting in May 2019, with examples of indicators for the review. Subsequent to the HLSC meeting, another list of indicators on AMR were endorsed during the EC meeting in October 2019. These indicators serve as good references for conducting the midterm review and are adopted where appropriate.

2.4 The preparation of this report involved the following processes -

- (a) An exercise in December 2019 to collect progress update on the implementation of the Action Plan and views from the Department of Health (“DH”), the Hospital Authority (“HA”), Agriculture, Fisheries and Conservation Department (“AFCD”) and Centre for Food Safety (“CFS”) of the Food and Environmental Hygiene Department (“FEHD”) on lessons learnt from experience, as well as room for possible improvement;
- (b) Relevant data as at 31 December 2019 as indicators were collected from relevant services of the DH, the HA, the AFCD, the CFS/FEHD and the Food and Health Bureau (“FHB”);
- (c) The latest development from the World Health Organization (“WHO”) and progress updates on AMR control of Australia, Japan, the United Kingdom (“UK”), the United States (“US”) and Mainland China up to December 2019 were appraised as part of this review exercise;
- (d) A draft report was circulated to the HA, the AFCD, the CFS/FEHD, the FHB and Members of the HLSC for further comment before finalisation.

3. Progress Made in the Implementation of the Action Plan

3.1 Good progress has been made when compared with the baseline situation of 2016, with items being carried out according to the timeline pledged in the Action Plan up to 31 December 2019. A list of activities outlined in the Action Plan with timeframe and progress made as at 31 December 2019 is shown in **Appendix**. A number of achievements, along with related indicators, were highlighted in the ensuing paragraphs below.

Key Area 1: Strengthen knowledge through surveillance and research

3.2 The Working Group (“WG”) on AMR One Health Surveillance was set up in October 2017. Four meetings were held before the cut-off date of the midterm review, with the latest one held in December 2019. The progress of AMR / AMU surveillance and the user requirements for the future One Health AMR Information System (“One Health AMRIS”) had been discussed in the latest meeting.

3.3 Compared with the baseline situation of 2016, surveillance data on human side has become available in a more organised and transparent manner. All hospitals under the HA were identified as surveillance sites. The initial AMR surveillance focused on analysis of blood culture specimens and would be further extended to faecal and urine specimens in a stepwise manner.

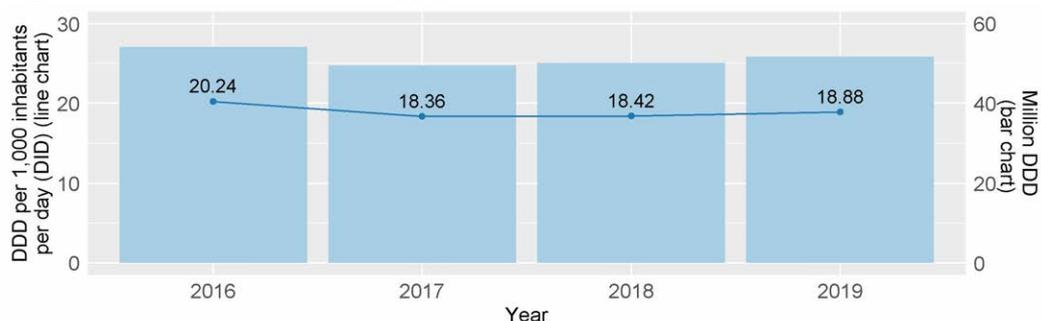
3.4 The DH has also been collecting the wholesale supply data of registered antimicrobials supplied to various sectors through relevant antimicrobial certificate holders and licensed drug wholesalers since 2017 as a proxy to gauge AMU by respective sectors in Hong Kong.

Related indicator

Level of AMU – human health

- Overall wholesale supply of antimicrobials decreased from 54.20 million DDD (20.24 DID) in 2016⁽¹⁾ to 49.53 million DDD (18.36 DID) in 2017 and then gradually increased to 50.09 million DDD (18.42 DID) and 51.75 million DDD (18.88 DID) in 2018 and 2019 respectively.

Figure 1. Overall wholesale supply of antimicrobials from 2016 to 2019



- When applying the new AWaRe surveillance tool⁽²⁾ as promulgated by WHO in 2017, Hong Kong has not yet reached the WHO proposed target but has been gradually moving towards it, with almost 60% of the overall antimicrobials supplied in Hong Kong falls under the Access group (56.1% in 2016; 59.2% in 2019).

Figure 2. Overall percentage of antimicrobials supplied by wholesalers from 2016 to 2019



Remarks:

- (1) DDD values were calculated using respective DDD constants annually updated by WHO in year 2019.
- (2) Introduced by the WHO in 2017, the Access, Watch, Reserve (“AWaRe”) classification is a tool for antibiotic stewardship at local, national and global levels. It classifies antibiotics into three stewardship groups: Access, Watch and Reserve, to emphasise the importance of their optimal uses and potential for AMR

3.5 Surveillance reports of the AMU surveillance in public hospitals and clinics, as well as the AMR surveillance in public hospitals making reference to the Global Antimicrobial Resistance Surveillance System (“GLASS”) of WHO, were published in the Centre for Health Protection (“CHP”) website by the second half of year 2019¹. The Regional Office for the Western Pacific of WHO was also notified of the related releases. New webpage on “Statistics on Antimicrobial Resistance Control”² was made in November 2019 for public access of surveillance statistics on AMR, AMU as well as infection prevention and control.

Related indicator

Trends of AMR among selected organisms – human health

- The WHO selected the frequency of bloodstream infection among hospital patients due to methicillin-resistant *Staphylococcus aureus* (MRSA) and *Escherichia coli* resistant to 3rd-generation cephalosporin as outcome indicators on AMR, with data source being data collected through the national AMR surveillance system and reported to GLASS⁽¹⁾.
- With reference from WHO recommendation, related susceptibility results are presented in Table 1 below. The proportion of non-susceptibility of *Staphylococcus aureus* with hospital onset towards oxacillin showed decreasing trend which was statistically significant whereas there was no statistically significant increasing trend on drug-bug combination for hospital isolates of *E. coli* and *Staphylococcus aureus* towards other antibiotics in Table 1.

Table 1. Susceptibility results on selected antimicrobials for *Escherichia coli* and *Staphylococcus aureus* isolated from blood specimens

		Non-susceptible Headcount/ Total tested headcount (Proportion of Non-susceptibility %)							
		Community Onset				Hospital Onset			
Organisms ⁽²⁾	Antimicrobials ⁽³⁾	2016	2017	2018	2019	2016	2017	2018	2019
<i>Escherichia coli</i>	Cefotaxime	1 275/ 4 583 27.8%	1 327/ 4 842 27.4%	1 375/ 4 912 28.0%	1 461/ 5 002 29.2%	372/ 952 39.1%	337/ 947 35.6%	359/ 966 37.2%	377/ 1 000 37.7%
	Ceftriaxone	778/ 2 815 27.6%	851/ 2 987 28.5%	800/ 3 076 28.6%	882/ 3 032 29.1%	226/ 566 39.9%	219/ 623 35.2%	209/ 557 37.5%	227/ 582 39.0%
	Meropenem	1/ 2 428 0.0%	0/ 2 598 0.0%	5/ 3 170 0.2%	4/ 3 263 0.1%	4/ 537 0.7%	4/ 528 0.8%	9/ 690 1.3%	6/ 710 0.8%
	Imipenem	2/ 4 566 0.0%	0/ 4 748 0.0%	2/ 4 336 0.0%	1/ 4 422 0.0%	2/ 965 0.2%	4/ 983 0.4%	4/ 842 0.5%	3/ 865 0.3%
<i>Staphylococcus aureus</i>	Oxacillin ⁽⁴⁾	403/ 1 001 40.3%	379/ 1 000 37.9%	422/ 1 037 40.7%	398/ 992 40.1%	415/ 692 60.0%	398/ 734 54.2%	468/ 834 56.1%	441/ 823 53.6%
	Vancomycin	0/ 997 0.0%	0/ 981 0.0%	0/ 970 0.0%	0/ 921 0.0%	0/ 691 0.0%	0/ 726 0.0%	0/ 798 0.0%	0/ 773 0.0%

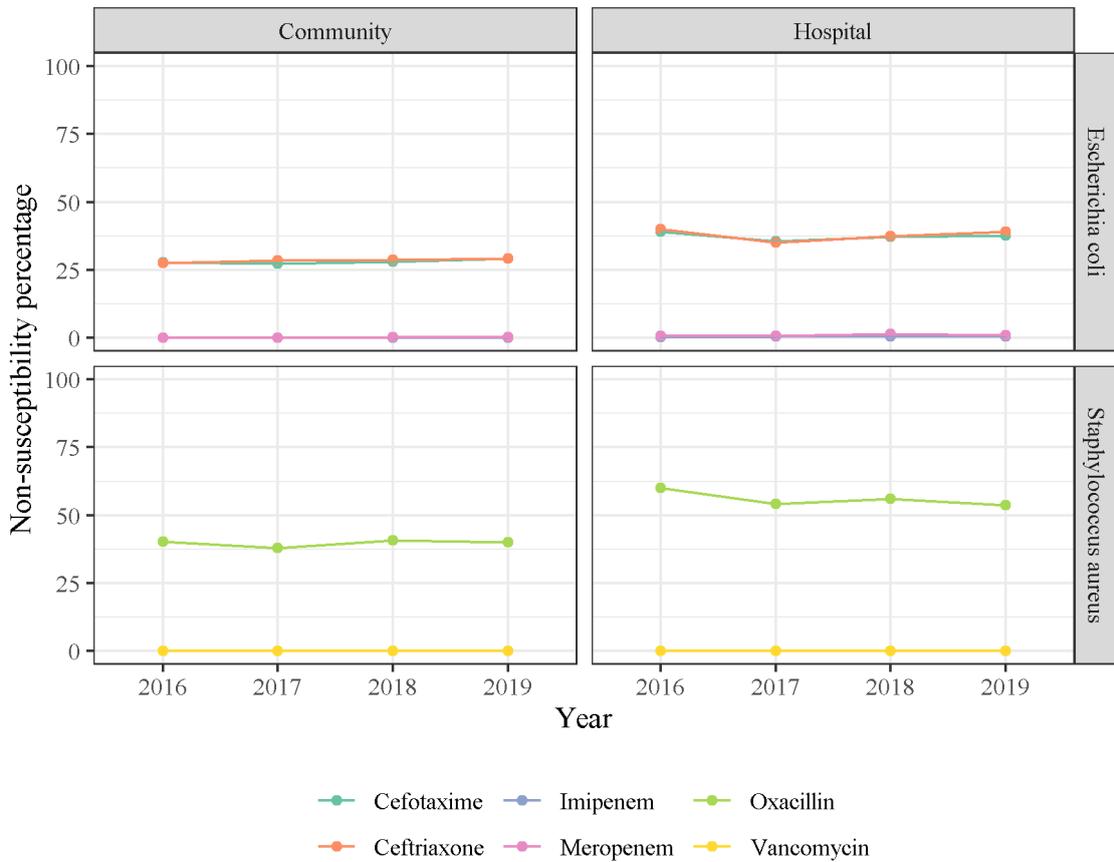
¹ <https://www.chp.gov.hk/en/features/47850.html#10006> [Accessed on 30 April 2021]

² <https://www.chp.gov.hk/en/static/101600.html> [Accessed on 30 April 2021]

Remarks:

- (1) <https://www.who.int/antimicrobial-resistance/global-action-plan/monitoring-evaluation/AMR-M-E-indicator-reference-sheets-web-high-December-2019.pdf> [Accessed on 30 April 2021]
- (2) *E. coli* and *Staphylococcus aureus* were selected for reporting because they are the most commonly gram-negative and gram-positive organisms isolated from blood respectively from year 2016 to 2019.
- (3) These antimicrobials were selected for reporting because they are the most commonly used antimicrobials for treating bloodstream infection caused by respective organisms
- (4) Sensitivity testing results of penicillinase stable penicillins (oxacillin, cloxacillin and methicillin) and cefoxitin towards *Staphylococcus aureus* were collectively grouped as “oxacillin” following the recommendation of CLSI. Isolates of *Staphylococcus aureus* non-susceptible to “oxacillin” in this context could be regarded as MRSA

Figure 3. Trend of non-susceptibility percentage on selected antimicrobials for *Escherichia coli* and *Staphylococcus aureus* isolated from blood specimens



Remarks:

- Headcounts were calculated according to methods from the WHO GLASS Early Implementation Manual, with local adaptation.
- Infection of community onset was defined as pathogen isolated from blood specimens collected from: (i) out-patient settings, or (ii) in-patient settings within 48 hours after admission.
- Infection of hospital onset was defined as pathogen isolated from blood specimens collected from in-patient settings 48 hours after admission.

Data source: Laboratory data from the HA

3.6 Surveillance mechanisms for the food animal sector and food were developed. The AFCD has initiated AMR/AMU surveillance on food animals since July 2019 after the completion of a consultancy study. Preliminary data on AMU collected from livestock farmers during the course of the study have also been analysed to study the ongoing trend and pattern of AMU. A surveillance study on AMR microorganisms in local day-old chicks was carried out from May to August 2019. In terms of AMU surveillance in the animal health side, fish farmers have been voluntarily reporting AMU data since May 2017. Pig and chicken farmers have been voluntarily reporting AMU data since June 2018. In addition, collection and testing of audit samples such as animal feed and faecal wastes on farms to detect unreported or inadvertent AMU have been commenced.

Related indicator

Table 2. Number of livestock and fish farmers reporting AMU data, as well as prescription data provided by registered veterinarians

Year	No. of pig farmers reported AMU data	No. of chicken farmers reported AMU data	No. of fish farmers reported AMU data	Prescription data by veterinarians
2016	N/A	N/A	N/A	N/A
2017	N/A	N/A	110/110	N/A
2018	41/43	27/29	110/110	N/A
2019	41/43	28/29	171/171	N/A

Remarks:

- Pig and chicken farmers have been voluntarily reporting AMU data since June 2018. Fish farmers have been voluntarily reporting AMU data since May 2017.
- Collection of prescription data is anticipated to take effect from late 2020 following the implementation of the “veterinary prescription-only medication supply” policy, subject to the maturity of the veterinary services for food animal farms provided by The City University of Hong Kong.
- No prescription data have been provided by registered veterinarians yet.
- The table above shows AMU data reporting rate of “number of farmers reported AMU data at least once in that year / total number of licensed farms (for pig and chicken farms) or total number of farms visited for AMU surveillance that year (for fish farms)”. Please note that farmers may report “no usage” especially for chicken and fish farmers.

Related indicator

Trends of AMU among local livestock and fish farmers (e.g. antimicrobial classes most commonly used)

- AMU data have been voluntarily and regularly provided by livestock farmers since June 2018. AMU data in year 2019 in the livestock sector were being collated and finalised for further analysis as at 31 December 2019. Therefore, no comparison could be made between the data in 2018 and those in 2019.
- Preliminary assessment indicated that the level of usage is constant, i.e. no significant increase or decrease. For pig farms, the most commonly used antimicrobial classes were penicillins, tetracyclines, amphenicols and macrolides in descending order. For chicken farms, the most commonly used antimicrobial classes were aminoglycosides, penicillins, macrolides and tetracyclines in descending order. Compared to pig farms, the overall level of AMU was much lower on chicken farms.
- For fish farms, using antibiotics was not a common practice in the local industry. Of antimicrobials occasionally administered in fish farms, they primarily belonged to tetracycline and amphenicol antimicrobial classes.

3.7 On food side, the CFS has engaged a tertiary institution since November 2018 to conduct a literature review on AMR microorganisms in food, a review on overseas surveillance systems on the AMR subject area, as well as a pilot survey on AMR microorganisms in food, under a two-year contract. The pilot survey included raw meat and ready-to-eat food. The results and experience gained from the pilot survey would be evaluated to formulate a long-term food surveillance system on AMR.

Related indicator

Trends of AMR among selected organisms in animal and food

Animal

- The collection and testing of AMR samples from fish farms and livestock farms have commenced since June and July 2019 respectively.
- Full laboratory results of the samples collected in 2019 were not available as at December 2019. Once available, the trend of resistance of all organisms monitored in the surveillance programme would be analysed in detail.

Food

- In the Pilot Survey on AMR microorganisms in food in Hong Kong, raw meat and ready-to-eat samples were collected in the period of December 2019 to June 2020. While the results were not available as at the cut-off date 31 December 2019 in this midterm review report, the results would be uploaded to CHP website once available.

3.8 To improve efficiency of data management and sustainability of surveillance in the long run, a new information system, namely One Health AMRIS, started to develop, for management of AMR / AMU data from different sources, including the DH, the AFCD, the CFS/FEHD and the HA. The One Health AMRIS, with tentative project completion by March 2022, would serve as a centralised surveillance system that could be further developed to cater for future surveillance needs of AMR / AMU. The development of One Health AMRIS was according to Strategic Intervention 1.5 (“Set up a centralized platform for AMR surveillance data on human, animal, food and environment”) under the Action Plan.

3.9 In terms of laboratory support, the Public Health Laboratory Centre (“PHLC”) under the Public Health Laboratory Services Branch (“PHLSB”) of the CHP of the DH continued to exhibit a local reference laboratory function for AMR in human health. The PHLC has been committed to the continuous improvement of the standard of medical laboratories in Hong Kong through the provision of external quality assessment programmes (“EQAP”) for laboratories in Hong Kong since 2017. The PHLC would also, on a case-by-case manner, help the AFCD to test bacterial isolates from animal specimens, such as performing resistance gene characterisation.

Related indicator

Table 3. Number of laboratories participating in the external quality assurance programme on antibiotic susceptibility testing organised by the reference laboratory (Situation as at 31 December 2019)

Year	No. of laboratories participating in the external quality assurance programme on antibiotic susceptibility testing organised by PHLSB (Situation as at 31 December 2019)		
	Labs under HA	Private labs	Row Total
2016 ⁽¹⁾	N/A	N/A	N/A
2017	9	12	21
2018	10	14	24
2019	11	15	26

Remark:

(1) The PHLSB of the CHP of the DH, as a local reference laboratory, has been providing external quality assessment programmes for laboratories in Hong Kong since 2017

Key Area 2: Optimise use of antimicrobials in humans and animals

3.10 The DH was committed to strengthening the regulation on over-the-counter purchase of prescription-only antimicrobials. In 2017, the DH requested the Pharmacy and Poisons Board of Hong Kong (“PPBHK”) to take note of the Action Plan and review the disciplinary action against licensees convicted of offences related to antimicrobials. The Board had subsequently revised the disciplinary action on offences related to antimicrobials. Over the past years, the Drug Office of the DH has also conducted more inspection against retailers purchasing large quantities of antimicrobials, as well as test-purchases of antimicrobials against retailers. The enhanced regulatory measures, together with relevant health promotional activities and collaborative work with different healthcare providers and community partners to advocate appropriate use of antimicrobials, have been shown effective. The percentage of the total supply of antibiotics to community pharmacies decreased from around 18% in 2016 to around 13% in 2017, around 8% in 2018 and 7.5% in 2019.

Related indicator

Table 4. Number of test-purchases conducted against illegal sale of antimicrobials (Situation as at 31 December 2019)

Year	No. of test-purchase conducted
2016	Data not available
2017	2 704
2018	5 723
2019	6 203

3.11 The Advisory Group on Antibiotic Stewardship in Primary Care was established in 2017 and the Antibiotic Stewardship Programme (“ASP”) in Primary Care was launched in November 2017. Guidance notes and patient information sheets on seven common infections including acute pharyngitis, acute uncomplicated cystitis in women, simple (uncomplicated) skin and soft tissue infections, acute otitis media, acute rhinosinusitis, community acquired pneumonia and acute exacerbations of chronic obstructive pulmonary disease were issued. Continuing Medical Education (“CME”)-accredited training sessions were arranged jointly with the Hong Kong Medical Association (“HKMA”) and Hong Kong Doctors Union (“HKDU”) for promulgation.

Related indicator

Participant evaluation statistics for primary care ASP sharing sessions

- The DH organised a total of 20 briefing sessions (with 1 189 participants) to promote the use of Guidance Notes on ASP in Primary Care. These sessions were held in two separate periods from December 2017 to March 2018 and from December 2018 to October 2019 for registered medical practitioners in Hong Kong. Medical practitioners enrolled through the HKMA and the HKDU. The briefing sessions were co-organised with the HKMA and the HKDU, in order to reach out to as many primary care doctors as possible.
- Analysis of 221 questionnaires received revealed that up to 75.6%, 72.6% and 77.4% of the respondents either agree or strongly agree that the Guidance Notes, the patient education materials, and the antibiograms produced in ASP in Primary Care were useful respectively.

3.12 To drive performance improvement, the HA has been monitoring the appropriateness of antibiotic use in medical, surgical and orthopaedic and traumatology specialty of acute hospitals, by taking Piperacillin/Tazobactam and Meropenem, the two mostly consumed Group 1 “Big-gun antibiotics”, as the surrogate markers. In 2019, 92.7% of antibiotic use were assessed to be appropriate (as compared to 87.6% in 2018) while 89.7% of the concurrent feedback on antibiotic use has been accepted by the prescribing clinicians (as compared to 86.7% in 2018).

3.13 In November 2017, the 5th edition of Inter-hospital Multi-disciplinary Programme on Antimicrobial ChemoTherapy (“IMPACT”) guidelines mainly for in-patient setting was published, with antibiogram updated regularly to reflect the latest antibiotic susceptibility profiles of pathogens to steer therapeutic choices by healthcare providers. Since 1999, the IMPACT guidelines have been adopted by the HA for in-patients. Use of evidence-based guideline and ASP would continue to be advocated to private hospitals through the Working Group on Collaboration between CHP and Private Hospitals.

Related indicator

Table 5. Number of hospitals with implementation of ASP(Situation as at 31 December 2019)

Year	Number of hospitals with implementation of ASP	
	Public hospitals	Private hospitals
2016	17	11
2017	17	11
2018	17	11
2019	17	12

3.14 On animal health side, to prepare for the implementation of the “veterinary prescription-only medication supply” policy, the Sustainable Agricultural Development Fund has approved funding support to the Jockey Club College of Veterinary Medicine and Life Sciences of The City University of Hong Kong (“City University”) for providing veterinary services to local pig and chicken farms. Separately, the Sustainable Fisheries Development Fund has approved funding to City University as well for providing veterinary services to fish farms and conducting practical studies on fish disease management. Veterinary services for fish farms and livestock farms have commenced in September 2018 and March 2019 respectively. The AFCD has been taking parallel actions in sourcing vaccines and veterinary medications for food animal farms currently. Once the veterinary services mature, the sourcing of vaccines and veterinary medications would be mainly conducted by City University based on the farm-specific disease management plan for each individual farm.

Key Area 3: Reduce incidence of infection through effective sanitation, hygiene and preventive measures

3.15 Ongoing infection prevention and control trainings in human / animal / food sectors had been in place, which were essential to healthcare workers, farmers, food hygiene managers / supervisors for acquiring up-to-date knowledge. Taking the human health side as examples, over 30 000 HA staff completed the basic infection control training each year in 2018 and 2019. The Infection Control Branch under the CHP of the DH used to organise 85 infection control training programmes with around 8 350 to 8 450 participants per year, with increasing proportion of programmes related to AMR over the past years (from below 10 in 2016 to over 20 in 2018 and 2019). On the food side, over 6 000 attendances were recorded for training courses organised by the FEHD with AMR related training materials incorporated in 2019.

Related indicator

Table 6. Number of training and attendance for AMR related training/education among general population, healthcare workers, veterinarians, farmers and food handlers (Situation as at 31 December 2019)

Year	Human Health ⁽¹⁾	Animal Health (Livestock) ⁽²⁾	Animal Health (Fisheries) ⁽³⁾	Food Safety ⁽⁴⁾
2016	8 (834)	N/A	39 (174)	N/A
2017	9 (1 434)	Farmers: 3 (60)	30 (108)	113(6 017)
2018	21 (3 178)	Farmers: 3 (60) Government: 2 (40)	1 (54)	114(5 998)
2019	33 (2 352)	Farmers: 1 (21) Government: 1 (13)	36 (205)	114(6 150)

Remarks:

- (1) The Infection Control Branch of the DH used to organise 85 infection control training programmes with around 8 350 to 8 450 participants per year. The extracted statistics refer to those training conducted by the AMR Division, including training to students in healthcare stream.
- (2) The figures refer to the number of seminars/workshops and the number of participants (in parentheses) organised for livestock farmers and Government officials. In addition, in 2019, the AFCD also organised six exhibitions at shopping arcades (with about 11 570 attendants), and 4 exhibitions at government offices.
- (3) The figures refer to the number of seminars/workshops and the number of participants (in parentheses) organised for fish farmers under the “Good Aquaculture Practice” programme. Due to the widespread destruction on fish farms caused by the super typhoon in 2018, the majority of seminars in 2018 were rescheduled to 2019.
- (4) The figures denote number of training courses for hygiene supervisors run by FEHD and, in parentheses, number of attendance. AMR related training materials started to be incorporated into training courses for food hygiene supervisors organised by the FEHD in January 2017.

3.16 In parallel, vaccination programmes continued to take place, with enhancements over the years. According to cross-sectional surveys conducted in 2015 and 2018, the immunisation coverage of all vaccines (including primary series of pneumococcal conjugate vaccine) under the Hong Kong Childhood Immunisation Programme (“HKCIP”) for local children born in 2009 to 2014 were 95% or higher. The Government has been offering free seasonal influenza vaccination (“SIV”) to healthcare workers working in public sector, residential care homes for the elderly and residential care homes for persons with disabilities. The DH continued to work closely with stakeholders, private medical practitioners, kindergartens and primary schools to promptly and better prepare outreach vaccination activities at schools.

Related indicator

Percentage of vaccination coverage of SIV by general population and healthcare workers

Table 7. SIV

Target groups	Number of SIV recipients (% of the persons in the group)			
	2016/17	2017/18	2018/19	2019/20
Elderly aged 65 or above including elderly living in RCHEs	478 000 (40.8%)	531 400 (43.5%)	555 000 (43.6%)	610 600 (45.8%)
Elderly living in RCHEs	47 700 (80.5%)	48 100 (80.8%)	47 300 (77.9%)	47 400 (78.0%)
Persons aged 50 to 64 years old⁽¹⁾	6 700 (N/A for %)	7 400 (N/A for %)	156 800 (8.8%)	194 500 (10.7%)
Children between 6 months to under 12 years old	112 200 (17.4%)	151 400 (23.0%)	308 200 (45.8%)	400 700 (58.7%)
Others⁽²⁾	79 900	91 700	102 200	112 700
Total:	676 800	781 900	1 122 200	1 318 500

Remarks:

- (1) SIV coverage amongst persons aged between 50 and 64 for 2016/17 and 2017/18 are not available as persons aged between 50 and 64 had to be either receiving the Comprehensive Social Security Assistance or holding a valid waiver of medical charges to be eligible for SIV under the Government Vaccination Programme (“GVP”) in the two seasons. From 2018/19, the Vaccination Subsidy Scheme (“VSS”) expanded to cover all persons aged between 50 and 64
- (2) Others include healthcare workers; poultry workers; pig farmers or pig-slaughtering industry personnel; persons with intellectual disabilities, Disability Allowance recipients, Comprehensive Social Security Assistance recipients in receipt of standard rate of being certified as 100% disabled or requiring constant attendance aged between 12 to 49 & living in the community, and pregnant women, etc. Related percentages for "others" group would not be available due to lack of relevant denominators.

Table 8. SIV – Healthcare workers

Seasons	Number receiving SIV (% of the persons in the group)
2016/17	40 500 (34.8%)
2017/18	41 400 (34.4%)
2018/19	49 300 (39.8%)
2019/20	53 400 (41.3%)

Table 9. Pneumococcal vaccination – Persons aged 65 or above under the GVP and the VSS

Seasons	Number of recipients	Accumulative % of population in the age group vaccinated
2016/17	43 100	34.1%
2017/18	87 000	38.2%
2018/19	80 300	43.9%
2019/20	78 800	44.6%

Table 10. Pneumococcal vaccination – Coverage of primary series of pneumococcal conjugate vaccine amongst local born children under the HKCIP according to immunisation surveys

Year of birth	Sample size	Coverage rate (%)		
		First dose	Second dose	Third dose
2009 ⁽¹⁾	1 729	99.5	98.4	96.3
2010 ⁽¹⁾	2 010	99.4	99.3	99.1
2011 ⁽¹⁾	2 345	99.6	99.5	99.3
2012 ⁽¹⁾	886	99.9	99.8	99.6
2012 ⁽²⁾	726	100.0	100.0	99.7
2013 ⁽²⁾	731	100.0	100.0	100.0
2014 ⁽²⁾	885	99.9	99.7	99.7

Remarks:

- (1) Findings of the 2015 immunisation survey
- (2) Findings of the 2018 immunisation survey

Key Area 4: Improve awareness and understanding of AMR through effective communication, education and training

3.17 During the period from July 2017 to December 2019, surveys on knowledge, attitude and practice (“KAP”) towards AMR among different target groups have been conducted / were undergoing by the DH and the AFCD.

Related indicator

Awareness levels on AMR – human health

- (i) A telephone survey of general public was conducted for the period between December 2016 and January 2017. A total of 1255 eligible respondents completed the interview. Among others, the survey revealed that over half (54.0%) of all respondents mistakenly identified cold and flu were treatable with antibiotics and around half (51.4%) considered not much they could do to stop antibiotic resistance. With that, publicity efforts were made to rectify these misconceptions during 2017 - 2019 which included but not limited to establishment of thematic webpages, production of publicity animations, poster and social media publicity.
- (ii) A questionnaire survey targeting registered medical practitioners in Hong Kong on their KAP towards AMR was conducted between September and December 2019. Data collection completed in December 2019, with a total of 1 074 completed questionnaires received.

Awareness levels on AMR – animal health

- (i) As at 31 December 2019, two KAP surveys for local livestock farmers have been conducted.
- (ii) The first KAP survey was conducted in January 2018. In the light of the survey results, topics for enhancing farmers’ KAP and areas for assisting farmers in combating AMR were identified. Topics for enhancing farmers’ KAP included the adverse effects of AMR on livestock farms and measures to effectively reduce AMU. Assistance required by farmers mainly concerned methods to properly record AMU.
- (iii) The second survey was conducted from December 2018 to January 2019 to continuously assess farmers’ KAP towards AMR. From the results of this survey, it was evident that farmers’ KAP had improved compared to the first survey. However, it was realised that farmers still needed to gain better understanding of the practice and benefits of “prudent and responsible AMU”.

3.18 In terms of health promotion, the AMR thematic webpage of under the CHP³ has also been enhanced with inclusion of new materials for education. Ongoing publicity activities to echo annual World Hand Hygiene Day and World Antibiotic Awareness Week were organised. For instance, to echo the World Antibiotic Awareness Week of the WHO 2019, the DH launched the Antibiotic Awareness Week from 18 to 24 November 2019 to raise the awareness of public and

³ <https://www.chp.gov.hk/en/features/47850.html>

stakeholders on the threat of AMR, and to promote proper use of antibiotics, in order to control the problem of AMR together effectively. Publicity activities included production of a new animation “*Act together now to combat Antimicrobial Resistance*” to educate the public on the cause, impact and prevention of AMR. The video was publicised through various social media, public and private medical and dental clinics, as well as Home Affairs Enquiry Centres of the Home Affairs Department. Other activities included media interviews on radio and newspaper, setting up of thematic webpage, display of publicity posters, advertising on social media, and publications of the DH. Under the “One Health” framework, the AFCDC and the CFS/FEHD also echoed with the DH on related promotion during the week.

Related indicator

Table 11. Hit count of the AMR thematic webpages under the CHP

Year	Hit count
2017	Data not available
2018	57 716
2019	159 737

3.19 On the animal health side, posters, leaflets, advertisements and an educational animation were produced and distributed to the public and relevant stakeholders. A series of six roving exhibitions with information booths, interactive games, AMR mascots distributing souvenirs at shopping malls in six different districts were arranged. Educational animations have also been produced to educate the public on the necessity for and extent of actions taken by the AFCDC in controlling AMR on local livestock farms. A total of 73 education seminars for local farmers were organised between 2017 and 2019.

3.20 On the food side, the promotion of Five Keys to Food Safety has been CFS’ strategic remit to prevent the spread of AMR via food. New food safety advices have also been published to address specific health needs for expectant mothers, babies and young children, the elderly and people with weakened immunity in related to high-risk food and AMR. The CFS has been maintaining a thematic webpage on AMR since 2019 to provide a one-stop area for public and trade to access related publicity materials. To echo with WHO’s World Antibiotics Awareness Week, the CFS also collaborated with the DH and the AFCDC to enhance public awareness and understanding on AMR via a social media campaign on Facebook.

3.21 In parallel, the CFS has enhanced its publicity efforts on accentuating inherent risks associated with raw and undercooked food consumption. Besides providing AMR-related training to food handlers since 2017, the CFS issued the “Guidelines for Food Businesses on Providing Consumer Advisory on High-risk

Foods on Menus” in 2019 to facilitate food business in informing consumers of the increased risk of consuming raw/undercooked foods and ingredients in ready-to-eat foods served to customers. Topics on AMR and Food Safety together with survey results for food traders completed in 2018 were presented during the CFS biennial event, Food Safety Seminar for Trade, held in October 2019. Results of the survey, which were also uploaded online for public access, would be used to streamline educational efforts for food traders on using Five Keys to Food Safety to prevent the spread of AMR.

Key Area 5: Promote research on AMR

3.22 The Secretariat of Health Medical Research Fund (“HMRF”) of the FHB accepted the feedback and new priority areas, e.g. health burden of AMR and novel diagnostics, were added for applications to support researches related to AMR starting in 2018. By December 2019, AMR remained to be one of the thematic priorities for open call for investigator-initiated projects under the HMRF.

Related indicator

Table 12. Research projects related to AMR control supported by HMRF

Year of announcement of open call	Innovative technology and medical science	Behavioural science and psychology	Health and economic burden
2016	2	0	2
2017	7	1	0
2018	4	0	0
2019	6	0	0

Source: Secretariat of the HMRF of the FHB

Key Area 6: Strengthen partnerships and foster engagement of relevant stakeholders

3.23 Since the launch of the Action Plan, stakeholders have been informed of the Action Plan through meetings, trainings, CHP Facebook page, media interviews and CHP publications. The Action Plan has also been disseminated in relevant publications and social media as appropriate.

3.24 The DH, the AFCD and the CFS/FEHD jointly organised a two-day regional symposium on AMR under the theme “Fighting AMR – Partnerships in Action” on 13 and 14 November 2018. More than 300 delegates from Hong Kong, Mainland China, Macao, Japan, Singapore and Korea joined the Symposium.

3.25 Moreover, in November 2019, delegates from the DH, the AFCD and the CFS/FEHD jointly visited the Technical University of Denmark and various government agencies to exchange the experience in AMR surveillance on human, animals and foods. The delegation gained knowledge on the operations of the Danish integrated AMR surveillance system, and would explore to apply the experience and knowledge learned in the development of AMR / AMU surveillance system for Hong Kong where appropriate.

Related indicator

Table 13. Participation in international meetings related to AMR

Year	Attendance of officers in the aspect of		
	Human Health	Animal Health	Food Safety
2016	N/A	N/A	N/A
2017	2	2	1
2018	1	2	1
2019	4	5	2

4. Lessons Learnt from the Local Experience

4.1 The DH initiated an exercise in December 2019 to collect views from the HA, the AFCD and the CFS/FEHD on lessons learnt from experience, as well as room for possible improvement. Key issues were highlighted in the following paragraphs. Of note, some enhancement measures have been implemented or under planning.

4.2 In terms of surveillance, one major lesson learnt was that stakeholder engagement/buy-in during data exploration and standardisation would be imperative for continuous development of AMR/AMU surveillance systems using a stepwise approach. A common problem encountered by key players was on the issue of systematic collection of relevant surveillance data on AMR / AMU. For the animal health and food side, further advice and technical support from experts such as the academia had to be obtained to guide the way forward. In the human health sector, even if such data was available, the existing data served for clinical purpose instead of purpose-built for surveillance, resulting in difficulties to retrieve, clean and compile relevant data for reporting. Additional time had to be spent with stakeholder engagement for data exploration and interpretation in view of the complexity of data. This necessitated continuous effort had to be made and the development of the One Health AMRIS could be a solution to improve surveillance data management.

4.3 Regarding the optimise use of antimicrobials, the enhanced regulatory measures with over 6 000 test purchases against retailers of antibiotics in 2019, together with related health promotional activities and the work with different healthcare providers and community partners to advocate appropriate use of antimicrobials, have been shown to be effective. A continuous drop in the percentage of the total supply of antibiotics to community pharmacies from around 18% in 2016 to 7.5% in 2019 indicated potential room for further improvement. Regarding the implementation of the ASP as another arm of key activities for optimising AMU, difficulties were encountered for implementation of the ASP in both public and private hospitals. In public hospitals, the clinical service model was different among all HA hospitals and thus it was difficult to interpret the use of antibiotics from an integrated data as a benchmarking. To this end, each public hospital would monitor the practice of antibiotics use and optimise use of antibiotics according to its specific clinical service model. However, constraints in resource and manpower may affect the sustainability of the programme and further development of ASP related initiatives. Working level staff involved in ASP of some private hospitals also expressed difficulties in implementation of ASP in terms of resource, expertise and engagement. There might be potential room for more effective implementation of ASP in these private hospitals if the DH could provide professional assessments and advice tailor-made to the private hospital setting after understanding their actual practice.

4.4 In the animal health sector, the usage of antimicrobials for various disease conditions in the local livestock farming sector was still commonplace despite efforts to raise awareness and improve knowledge among relevant stakeholders. One major factor contributing to this issue was the lack of relevant guidelines, code of practice and comprehensive veterinary services for food animal farms. The AFCD was therefore in the process of developing relevant guidelines and codes of practice for veterinarians and farmers with reference to those developed by international organisations including the World Organisation for Animal Health and World Health Organization.

4.5 Apart from limited data, limited resources was another challenge identified for optimising AMU in the animal field. For instance, the availability of veterinary services to local food animal farms by non-government veterinary sector was found to be very limited. The AFCD had provided funding support under the Sustainable Agricultural Development Fund (SADF) and Sustainable Fisheries Development Fund (SFDF) to the Jockey Club College of Veterinary Medicine and Life Sciences of City University (“JCCVMLS”) to develop and provide veterinary services to local farms.

4.6 Concerning the infection control and related publicities / capacity building activities in human health side, the hand hygiene compliance data of public hospitals was collected by their hospital infection control teams, followed by tedious data input work to computer for analysis. As such, the HA has established an electronic Infection Control (“eIC”) Platform to facilitate data input, analysis and reporting of hand hygiene auditing. A flexible approach for individual hospitals to develop local promotional plan according to their own culture was another lesson learnt, as evidenced by the acceptance rates of healthcare workers and patients for the programme varied between hospitals / clusters during preparation for promotion of patient empowerment programme on hand hygiene mutual reminding. From the public health perspective of the DH, evidence-based health promotion activities have been implemented. For example, over half (54%) of the respondents mistaken cold and flu were treatable by antibiotics identified in earlier survey. The results provided the key theme for ongoing publicity campaigns to promote proper use of antibiotics; and demonstration of improvement in knowledge on AMR amongst primary students and undergraduate nursing students attending AMR training sessions reflected that kind of training should be regularised.

4.7 For infection control and related publicities / capacity building activities on the animal health side, the AFCD commented that there was room for livestock farms to further improve their existing infection prevention and control programmes to reduce infection / disease and hence the cost of production of the captioned activities to raise the farmers’ awareness in this aspect. Also, most farmers lacked the incentive to further invest their resources to make the programmes more

comprehensive. As such, the AFCD had provided funding support under the SADF and SFDF to JCCVMLS to devise tailor-made farm-specific disease management plans.

4.8 From the food safety perspective, people knowing the Five Keys to Food Safety might not necessarily understand that improper food handling processes could contribute to contracting microorganisms with AMR through food. A survey interviewing 475 food handlers on their awareness, knowledge, attitude and behaviour on AMR was conducted in 2018. About one-fifth of respondents were not aware that poor kitchen hygiene and improper food handling could aggravate the spread of microorganisms with AMR. A majority of respondents believed that avoid eating raw food could prevent contracting microorganisms with AMR through food, whilst only about a quarter of the respondents informed that they always or often advised vulnerable populations to avoid eating raw or undercooked food. With reference to the above survey results, the CFS would, based on the Five Keys to Food Safety, highlight practical tips on hand hygiene, environmental hygiene and separation of raw and ready-to-eat food, and link these tips with prevention of spreading or contracting microorganisms with AMR through various online and offline communication channels. This would continue to form part of the CFS' main remit in promoting food safety, with a view to enabling the trade and the public to become fully aware of the practical means to prevent the spread of and infection caused by AMR microorganisms through food over time.

4.9 Last but not least, there has been increasing recognition of the importance of environment in the contribution of AMR, as evidenced by media reports and enquiries on environmental contamination by antibiotics. This might point to the need to engage the Environment Bureau and related parties as stakeholders in the long run for more comprehensive control of AMR in Hong Kong.

5. Learning from Overseas and Mainland Experience

5.1 The following paragraphs denoted the development of the WHO and progress updates from Australia, Japan, the UK, the US and Mainland China on AMR control up to December 2019.

5.2 Back in 2015, the Global Action Plan published by the WHO⁴ outlined five strategic objectives to combat AMR, namely –

- (a) To improve awareness and understanding of AMR;
- (b) To strengthen knowledge through surveillance and research;
- (c) To reduce the incidence of infection;
- (d) To optimize the use of antimicrobial agents; and
- (e) To ensure sustainable investment in countering AMR.

5.3 According to the WHO Regional Office for the Western Pacific, progress had been made but it had been uneven across countries in the Western Pacific Region. Many countries still faced enormous challenges in tackling the multiple dimensions and systemic issues of AMR and its drivers, particularly in an environment of competing priorities and needs. In October 2019, the Regional Committee of the Western Pacific reaffirmed AMR as a priority for WHO's work in the region in the coming years. There was an urgent need to accelerate action on AMR by adopting new ways of working to enable Member States to implement long-term, future-oriented, evidence-based, sustainable solutions that use existing systems and programmes whenever possible. Member States were urged, among others, to (i) strengthen systems as foundation for sustainable actions; (ii) to work beyond health; (iii) to take actions today, guided by their vision of the future; and (iv) to build solutions from the ground up, while ensuring country impact. Level of commitment and actions against AMR could be raised through means including (i) long-term, evidence-based and future-oriented planning; (ii) integrating AMR interventions into existing programmes and systems; (iii) ensuring multisectoral engagement and societal participation; and (iv) strengthening local resilience.⁵

5.4 In Australia, according to their first national AMR strategy progress report published in November 2017⁶, Australia would focus in the upcoming years on areas including (i) driving behavioural changes in both health professionals and consumers; (ii) implementing measures to reduce inappropriate prescribing; (iii) build levels of awareness of AMR across different target groups. The Australian progress report also highlighted the importance of improving AMR governance as a

⁴ WHO Global action plan on antimicrobial resistance (2015). <https://www.who.int/antimicrobial-resistance/global-action-plan/en/>

⁵ WHO Regional Committee for Western Pacific. Resolution on AMR (10 October 2019). WPR/RC70.R2.

⁶ Australian Government Department of Health. Australia's First National AMR Strategy 2015-2019. Progress Report (November 2017).

short term priority, and the need to achieve an integrated “One Health” surveillance system.

5.5 In Japan, their efforts on combating AMR involved continuation of surveillance activities, promotion of measures against AMR, and ensuring adherence to prudent use of antimicrobials. Japan had made progress in surveillance related to food. Emphasis would be put on AMR trend surveillance and monitoring in areas of human health, animals and food.⁷

5.6 The UK published a 20-year vision for AMR along with a five-year national plan in January 2019.⁸ According to the UK vision document, achievement had been made in reducing antibiotic use in both humans and food-producing animals, strengthening surveillance data, increasing investment in better coordinated research, stimulating global awareness and momentum, and helping to secure global commitments to address resistance. On the other hand, the drivers, spread and impact of resistance in the environment and food chain remains poorly understood. The UK would reinforce the approach with “One Health” perspective to combat AMR and attempt to strengthen AMR control by 2040, using surveillance, research, awareness and education activities underpinned by regulation, investment and advocacy. The UK’s five-year national action plan (2019-2024) published in January 2019⁹ focused on three key ways of tackling AMR, namely (i) reducing need for, and unintentional exposure to, antimicrobials; (ii) optimising use of antimicrobials; and (iii) investing in innovation, supply and access.

5.7 In the United States, according to a progress report of its national action plan published in October 2017¹⁰, efforts had been / would be made for improving antibiotic use with implementation of antibiotic stewardship programmes, promotion and veterinary oversight. The US approach also covered “One Health” surveillance, development of diagnostic tests for resistant bacteria, research and development of therapeutics via public private partnership, and international collaboration.

5.8 Mainland China had a national action plan to contain AMR in place since 2016¹¹. Adopting the “One Health” approach, the Mainland action plan aimed to establish comprehensive management strategies and measures for the overall implementation of strengthening the supervision of antimicrobial research and

⁷ The AMR One Health Surveillance Committee. Nippon AMR One Health Report (NAOR) 2018 (29 November 2018)

⁸ UK Government. Contained and controlled: The UK’s 20-year vision on antimicrobial resistance (24 January 2019)

⁹ UK Government. Tackling antimicrobial resistance 2019–2024 (24 January 2019)

¹⁰ United States Task Force for Combating Antibiotic-Resistant Bacteria. National Action Plan for Combating Antibiotic-resistant bacteria: Progress Report for Years 1 and 2 (October 2017).

¹¹ National Health and Family Planning Commission, People’s Republic of China. National Action Plan to Contain AMR (2016-2020) last updated on 26 August 2016.

development, production, circulation, use and environmental protection, promoting advocacy and education, as well as international exchanges and cooperation. Key areas of actions included increasing investment in research and development of antimicrobials, strengthen supply, optimising use of antimicrobials, AMR surveillance system, capacity building of professional personnel, strengthen enforcement, publicity, as well as international cooperation and exchange. In March and July 2019, notices were issued by the Mainland human health and animal health authorities respectively^{12,13} to enhance actions related to AMR with emphasis on AMU, infection control, surveillance, publicity, as well as regulation of AMU in animals which included banning their use as growth promoters.

5.9 Compared with overseas and Mainland counterparts mentioned above, Hong Kong has also adopted similar One Health approach in combating AMR, in terms of moving for One Health AMR / AMU surveillance, with emphasis on optimising AMU and implementing awareness raising activities across different target groups. Hong Kong has also been on par with overseas countries such as Japan and the UK that the Action Plan had addressed on food safety aspects. On the other hand, response actions in Hong Kong up to December 2019 did not address much on the environment, similar to Australia and Japan.

5.10 With reference from the aforesaid examples, combating AMR remained to be one of the action priorities in global health. WHO, as well as counterparts in overseas countries, would make efforts in an ongoing and sustainable manner. The following features for combating AMR which were in common in overseas countries or Mainland China have been / could be applied for the setting of Hong Kong –

- (a) Act beyond human health (e.g. WHO, Australia, Japan, the UK, the US, Mainland China);
- (b) To improve surveillance system to come up with a One Health surveillance system (e.g. Australia, Japan, the UK, the US, Mainland China);
- (c) Partnership with stakeholders for awareness raising, promotion, and other activities (e.g. Australia, Japan, the UK, the US, Mainland China); and
- (d) Optimise use of antimicrobials with strengthen stewardship (e.g. the UK, the US, Mainland China).

¹² 中華人民共和國國家衛生健康委員會. 國家衛生健康委辦公廳關於持續做好抗菌藥物臨床應用管理工作的通知 (發佈時間：2019年03月29日)

¹³ 中華人民共和國農業農村部公告 第194號 (發佈日期：2019年07月10日)

6. Enhancements already Made/Planned before the Review Exercise

6.1 The midterm review has also identified areas for improvement as advised by some HLSC members at the meetings of the HLSC in May 2018 and 2019. Arising from these comments, there has been / will be enhancement in the areas as summarised in the table below -

Examples of area with improvement	Enhancement done / under planning
(a) Need of a centralised surveillance platform	<ul style="list-style-type: none"> ● Webpage entitled “Statistics New webpage on “Statistics on Antimicrobial Resistance Control” was made in November 2019 for public access ● A new IT system, namely One Health AMRIS, was being developed.
(b) Contribution of surveillance data to the WHO GLASS	<ul style="list-style-type: none"> ● The latest AMR surveillance reports with reference to the WHO GLASS, were published by the DH in the second half of year 2019. The Regional Office for the Western Pacific of WHO was also notified of related releases.
(c) Providing personal protection advice while taking proton pump inhibitors	<ul style="list-style-type: none"> ● The HA has revised and combined the health advice for both antibiotics and proton pump inhibitors (“PPIs”) into one label which has been implemented in all HA pharmacies since April 2019. The same contents are also available under Drug Information on TouchMed, and are accessible by scanning the barcode on the dispensing label of the antibiotics or PPIs. ● The DH was also preparing the dispensing label with health advice for the dispensing of PPIs at DH dispensaries.
(d) Wholesale antimicrobial supply data provided a good marker to extrapolate the practice across sectors	<ul style="list-style-type: none"> ● Endorsement of the PPBHK was sought to formalise the wholesale supply data collection as an annual exercise and would continue to monitor the trend of AMU by various sectors via this mechanism.
(e) Using WHO AWaRe as a benchmarking of the drug usage in Hong Kong	<ul style="list-style-type: none"> ● The wholesale antimicrobial supply data would incorporate the analysis using the WHO AWaRe scheme.
(f) Addressing infection prevention and control in residential care homes for elderly persons	<ul style="list-style-type: none"> ● Ongoing infection control initiatives at residential care home for elderly person (“RCHE”) setting were conducted by the DH, Community Geriatric Assessment Team (“CGAT”) of the HA and the Social Welfare

Examples of area with improvement	Enhancement done / under planning
	<p>Department in various forms, ranging from capacity building of RCHE, inspection of RCHE, ad hoc training in response to identified outbreaks. Moreover, the DH organised outbreak prevention programme targeting RCHE.</p>
(g) Antibiotics supply at community pharmacies and related control measures	<ul style="list-style-type: none"> ● The DH had stepped up and would continue to enhance inspections and test purchases of antimicrobials against drug retailers. The enhanced regulatory measures, together with related health promotional activities and worked with different healthcare providers and community partners to advocate appropriate use of antimicrobials, have been shown effective. The percentage of total supply of antibiotics to community pharmacies decreased from around 18% in 2016 to 7.5% in 2019.
(h) Missing links of contribution of the environment in AMR control	<ul style="list-style-type: none"> ● To engage the Environment Bureau as stakeholder in the long run.
(i) Disclosure of antibiotic consumption in services of hospitals	<ul style="list-style-type: none"> ● The Report on AMU Surveillance in Public Hospitals and Clinics - Hospital Authority Antibiotics Dispensing Data (2014 - 2016) was published in the CHP website.
(j) Highlight One Health Approach	<ul style="list-style-type: none"> ● “One Health” approach in publicity activities to echo World Antibiotic Awareness Week 2019.

7. Recommendations

7.1 Based on the findings reported in the previous sections and upon discussion with relevant stakeholders in the Government and the HA, it is recommended to continue implementing actions according to directions set out in the Action Plan for the remaining period from 2020 to 2022. A list of possible areas for continuous efforts / further improvement is presented in the following table –

Possible areas for continuous efforts / further improvement
<p><i>Key Area (1) : Strengthen knowledge through surveillance and research</i></p> <ul style="list-style-type: none">(i) Continue to adopt a stepwise incremental approach for AMR / AMU surveillance covering human, animal and food aspects(ii) Develop the One Health AMRIS to accommodate surveillance data from different data source(iii) Update the content of “Statistics on Antimicrobial Resistance Control” webpage regularly
<p><i>Key Area (2) : Optimise use of antimicrobials in humans and animals</i></p> <ul style="list-style-type: none">(i) Continue the enhanced enforcement at the community pharmacy level and relevant health promotional activities(ii) Strengthen implementation of ASP in private hospitals(iii) Develop relevant AMU guidelines and codes of practice for veterinarians and farmers taking reference to countries with long-standing AMR control measures in place(iv) Make veterinary services to local food animal farms sustainable
<p><i>Key Area (3) : Reduce incidence of infection through effective sanitation, hygiene and prevention measures</i></p> <ul style="list-style-type: none">(i) Conduct ongoing infection prevention and control measures with regular training(ii) Continue to implement infection prevention and control measures in residential care settings such as elderly homes(iii) Continue to educate livestock and fish farmers to adopt good farming practice and improve biosecurity.(iv) Devise tailor-made farm management plans by Jockey Club College of Veterinary Medicine and Life Sciences of City University of Hong Kong
<p><i>Key Area (4) : Improve awareness and understanding of AMR through effective communication, education and training</i></p> <ul style="list-style-type: none">(i) Conduct ongoing education and publicity with AMR as a core message(ii) Conduct more coordinated publicity actions involving the DH / the AFCD / the CFS in partnership(iii) Conduct KAP surveys to target groups to understand the knowledge gap (with measures to enhance response rates) and devise training and publicity materials accordingly

Possible areas for continuous efforts / further improvement
<p><i>Key Area (5) : Promote research on AMR</i></p> <p>(i) Provide continuous funding support to research on AMR under HMRF</p>
<p><i>Key Area (6) : Strengthen partnerships and foster engagement of relevant stakeholders</i></p> <p>(i) Continue policy commitment and resource provision (ii) Ensure sustainable manpower and resource in the DH / the AFCD / the CFS/FEHD / the HA to combat AMR</p>

7.2 Amongst the aforesaid items, higher priority could be accorded to the following items in the remaining period of the Action Plan –

- (a) Make more surveillance data / surveillance mechanism(s) available, in particular those related to animal health and food where a majority was still in the exploration stage by end December 2019;
- (b) Ensure timeliness in the development of One Health AMRIS;
- (c) Continue the enhanced enforcement at the community pharmacy level and develop relevant antimicrobial usage guidelines and codes of practice for veterinarians and farmers to facilitate optimal AMU; and
- (d) Conduct more awareness raising activities with collaborative efforts of the DH, the AFCD and the CFS to engage relevant stakeholders.

7.3 On the other hand, the Action Plan suggested to explore the feasibility of using the Electronic Health Record Sharing System (“eHRSS”) to capture prescription data from private sector, in order to monitor AMU in human (Activity 3.2.2). According to the eHR Office of the DH, as at mid-December 2019, only about 34 healthcare providers (including the DH and the HA) were technically capable of uploading patient information to the eHRSS with patients’ sharing consent. Besides, out of the about 1.22 million patients that had joined the eHRSS, with only about 0.58 million patients had given consent to share health records with one or more private healthcare professionals. With the relatively low number of healthcare providers technically capable to upload patient information to the eHRSS, it might not be appropriate to use the eHRSS to extract data for AMR monitoring at this stage.

7.4 The exploration also revealed that information systems operated in health management organisations and private hospitals were designed for operational needs of the designated premises and the data itself was not standardised to fit surveillance purpose. As such, direct collection of private antimicrobial prescription data was unlikely to be a way for monitoring AMR in Hong Kong at the moment, taking into account the availability and feasibility of data. It is thus suggested to use wholesale data as a proxy for AMU surveillance of the private medical sector and not to pursue for the option of the eHRSS for the time being.

8. Conclusion

8.1 During the period from July 2017 to December 2019, good progresses have been made in combating AMR in Hong Kong in accordance with the roadmap set out in the Action Plan compared with the year 2016 baseline. For instance, surveillance has been started in a stepwise manner, efforts were made to optimise use of antimicrobials with updated guidelines and enhanced enforcement measures, etc. Training on infection control, vaccination programmes and publicity activities were arranged in an ongoing manner. Relevant activities have also been carried out according to the timeline pledged in the Action Plan up to 31 December 2019.

8.2 In addition, enhancements have been made / under planning in response of identification of possible areas for improvement during the period. Examples include the development of One Health AMRIS, provision of personal protection advice while taking proton pump inhibitors, addressing infection prevention and control in residential care homes for elderly persons, and attempts to adopt the “One Health” approach in publicity activities to echo World Antibiotic Awareness Week 2019, which were not stated in the Action Plan when it was launched in July 2017.

8.3 On the other hand, major challenges were encountered in respect of technical issues including the limited availability and complexity in handling AMR / AMU surveillance data, provision of veterinary support service, as well as implementation of stewardship programme. Like other counterparts in overseas countries, the environmental aspects of AMR have not been covered at this juncture. All these reflected potential rooms for further improvement which might be addressed in the upcoming years in a stepwise incremental manner taking practicability into account.

8.4 All in all, the Action Plan has set a clear roadmap for implementation of actions in response to the public health threat of AMR in Hong Kong using the “One Health” approach. It is recommended to continue implementing actions according to the Action Plan for the remaining years between 2020 and 2022, with minor fine-tuning by assigning higher priorities for activities such as the development of One Health AMRIS and making more surveillance data / surveillance mechanism(s) related to animal health and food safety available, enhancing enforcement at the community pharmacy level and developing relevant antimicrobial usage guidelines and codes of practice in the animal field to facilitate proper AMU, and engaging stakeholders in AMR control.

8.5 The findings and recommendations of this midterm review will serve as an important reference for the final review of the Action Plan. It is also a guide for the formulation of strategic interventions for the next Action Plan beyond 2022. In addition, it can serve as an important reference for experience sharing with the WHO and overseas partners where appropriate.

Tracking of Items Pledged in the Action Plan

Activities		Timeframe	Target met (Y/N/NA¹⁴)
Objective 1 – Set up AMR surveillance system under One Health for Hong Kong			
1.1.1	Setup a “Working Group on AMR OneHealth Surveillance” to coordinate and plan on collection and dissemination of AMR / antimicrobial use data	Commence by 2017	Y
1.2.1	Harmonise AMR surveillance reporting criteria with reference to GLASS of WHO	Set criteria by 2017	Y
1.2.2	Develop surveillance at laboratory level for in- and out-patient service providers	Commence data collection from HA by 2018	Y
1.3.1	Commission a consultancy study to devise a plan for the surveillance on AMR microorganisms in food animal production farms	Commission by 2018	Y
1.3.2	Conduct surveillance studies on AMR in imported day-old chicks and breeding pigs	Commence by 2017	Y
1.3.3	Carry out surveillance on AMR in food animal production farms	Commence by 2019	Y
1.4.1	Conduct pilot survey to guide development of a surveillance system on food	Develop preliminary survey protocol by 2018	Y
1.5.1	Link data related to AMR surveillance and monitoring across different sectors	Develop preliminary protocol by 2018	Y
Objective 2 – Build laboratory capacity to support surveillance activities in both human and animal sectors			
2.1.1	Identify Public Health Laboratory under DH as a local reference laboratory on AMR to advise the Administration and to support local medical laboratories	On-going	NA
2.2.1	Promulgate adoption of international standards and guidelines for antibiotic sensitivity testing such as CLSI or EUCAST	Commence by 2018	Y
2.3.1	Coordinate with laboratories to conduct quality assurance programme for continuous improvement of standards of laboratories in Hong Kong	Commence by 2018	Y

¹⁴ “NA” denotes “Not Applicable” whereby the recommended intervention as set out in the Action Plan has been implemented in an ongoing manner and there is no specific time restricted target to be met.

Activities		Timeframe	Target met (Y/N/NA ¹⁴)
Objective 3 – Monitor antimicrobial use in humans and animals			
3.1.1	Setup a “Working Group on AMR One Health Surveillance” to coordinate and plan on collection and dissemination of AMR / antimicrobial use data	Commence by 2017	Y
3.1.2	Collect supply data on antibiotics from different sectors using standardised reporting formats	First report by 2017	Y
3.2.1	Collect antibiotic dispensary data from HA and monitor antibiotic use in public hospitals and clinics	First report by 2018	Y
3.2.2	Explore feasibility of using electronic health record (eHR) to capture prescription data from private sector	Commence by 2017	Y
3.3.1	Commission a consultancy to devise a plan for monitoring antimicrobial usage in food animal production farms	Commission by 2017	Y
3.3.2	Strengthen surveillance on antimicrobial use in local food animal production farms through interim measures such as imposing record keeping requirement and surprise inspection	Commence by 2017	Y
3.3.3	Carry out systematic monitoring of antimicrobial use in food animal production farms	Commence by 2019	Y
Objective 4 – Strengthen regulation on over-the-counter purchase of prescription-only antimicrobials			
4.1.1	Conduct special inspection against authorised sellers purchasing large volumes of antimicrobials	On-going	NA
4.2.1	Enhance test purchase	On-going	NA
4.3.1	Advise PPBHK to consider reviewing the disciplinary action on offences related to antimicrobials	Commence by 2017	Y
4.4.1	Solicit support from licensed drug retailers	On-going	NA
4.5.1	Review the effect of strengthened measures against authorised sellers of poisons and review the necessity to amend relevant ordinances	As when necessary	NA
Objective 5 – Implement and enhance training in prescribing antimicrobials through ASP in human health sector			
5.1.1	Assess resource implication for implementation of ASP	On-going	NA
5.2.1	Continue to review and update the IMPACT guideline regularly for in-patient antibiotic stewardship and promulgate its use	On-going	NA
5.2.2	Continue ASP in public hospitals	On-going	NA

Activities		Timeframe	Target met (Y/N/NA ¹⁴)
5.2.3	Advocate ASP in private hospitals	On-going	NA
5.2.4	Formulate and promulgate evidence-based guidelines in primary care setting	Produce guideline by 2018	Y
Objective 6 – Monitor compliance with antibiotic prescription guidelines of human health practitioners			
6.1.1	Encourage evaluation and audit of ASP and establish feedback loop to reflect performance	On-going	NA
6.1.2	Conduct surveys to gauge knowledge, understanding and prescription behaviour of human health practitioners	Commission in 2017 to 2019	Y
Objective 7 – Ensure proper use of antimicrobials in animals			
7.1.1	Facilitate and support development of projects for the provision of veterinary services to food animal production farms by non-government veterinary sector	Commence by 2017	Y
7.1.2	Formulate tailor-made farm-specific disease management plans	Commence by 2018	Y
7.1.3	Assist farmers in sourcing vaccines and veterinary medications for disease prevention and management	Commence by 2018	Y
7.1.4	Arrange training activities for non-government veterinarians to build up their capacity for providing veterinary services to local food animal production farms	Commence by 2018	Y
7.2.1	Develop guidelines and code of practice on the proper use of antimicrobials and use of critically important antimicrobials in animal disease management in accordance with prevailing international guidelines	Commence by 2018	Y
7.2.2	Organise education and publicity programmes for food animal farmers and veterinarians on the proper use of antimicrobials	On-going	NA
7.3.1	Implement “veterinary prescription-only medication supply” policy and tightly regulate the use of critically important antimicrobials in animal husbandry	Commence by 2019	Y
7.3.2	Review relevant legislation on exemption of using antimicrobials in animal feeds	Commence by 2017	Y
Objective 8 – Strengthen infection prevention and control measures in healthcare settings			
8.1.1	Assess resource implication for implementation of the infection control programmes	On-going	NA
8.2.1	Review ward design according to international guidelines and recommendations	On-going	NA

Activities		Timeframe	Target met (Y/N/NA ¹⁴)
8.3.1	Review and strengthen hand hygiene programmes to improve compliance by healthcare workers	On-going	NA
Objective 9 – Strengthen infection control training for healthcare workers			
9.1.1	Continue to provide infection control training with refresher information to new intakes of healthcare workers	On-going	NA
9.1.2	Raise awareness and solicit healthcare workers' support to patient engagement programme on reminding healthcare workers to perform hand hygiene	Engage HCWs by 2018 Pilot by 2019	Y
Objective 10 – Develop and strengthen infection prevention and control programmes in veterinary settings and along food supply chain			
10.1.1	Devise tailor-made farm-specific disease management plan for the purpose of disease prevention, management of disease spread and minimise the usage of antibiotics	Commence by 2018	Y
10.1.2	Consider relocation and consolidation of livestock farms if necessary	As and when necessary	NA
10.2.1	Commission a consultancy to assess the significance of food animal production in contributing to AMR and formulate suitable measures to address the AMR issues associated with food animal production	Commence by 2020	NA
10.2.2	Review overseas studies to identify potential control points to contain AMR	Commence by 2018	Y
10.3.1	Provide regular education seminars on biosecurity, disease control and prevention and farm management to farmers and their workers	On-going	NA
10.3.2	Include AMR in training courses under the Hygiene Manager and Supervisor Scheme	On-going	NA
Objective 11 – Enhance vaccination uptake			
11.1.1	Encourage uptake of seasonal influenza and pneumococcal vaccines	On-going	NA
Objective 12 – Raise awareness of AMR among general public, students and target population			
12.1.1	Monitor KAP towards AMR and antimicrobial use among general public and target population by survey	Commission in 2017 to 2019	Y
12.1.2	Develop and review key messages to raise public awareness and call for action based on KAP results	On-going	NA
12.1.3	Support and participate in annual world Antibiotic Awareness Campaign and Hand Hygiene Day	On-going	NA

Activities		Timeframe	Target met (Y/N/NA¹⁴)
12.1.4	Develop and disseminate information on AMR and related topics through existing health promotion channels, healthcare service providers and platforms commonly used by target populations including patients, food animal farmers, private veterinarians and food business operators	On-going	NA
12.1.5	Provide regular education and training to food animal farmers on antimicrobial use and measures on control of veterinary products	On-going	NA
12.1.6	Explore the merits and feasibility of labelling of pre-packed antibiotic-free food	On-going	NA
12.2.1	Review high school liberal studies curriculum in relation to AMR	Commence by 2017	Y
12.2.2	Develop education materials on AMR and related topics for primary students	Training of staff in 2017 to 2018 Pilot in 2018. Commence by 2019 with on-going evaluation	Y
Objective 13 – Engage patients in adopting infection control measures and proper use of antibiotics			
13.1.1	Develop and provide health education materials in hospital wards, clinics and pharmacies	On-going	NA
13.1.2	Encourage provision of health information on personal hygiene measures on antibiotic drug prescription bags	On-going	NA
13.1.3	Educate patients to use antibiotic appropriately	Produce guideline for primary care by 2018. Health promotion commence by 2019	Y
13.2.1	Continue to provide accessible hand hygiene facilities and products in healthcare settings	On-going	NA
Objective 14 – Include AMR and related topics in school curricula and continuous training of human health and veterinary professionals			
14.1.1	Include AMR and related topics in undergraduate curricula for human health and animal health professionals and encourage continuous professional development	On-going	NA
14.2.1	Strengthen infection control training for healthcare workers, veterinarians and workers along food supply chain	On-going	NA

Activities		Timeframe	Target met (Y/N/NA¹⁴)
Objective 15 – Promote research on innovative technology and medical science			
15.1	Promote development of novel diagnostics tools to aid diagnosis and treatment of infections and AMR	Promote source of funding to stakeholders starting in 2017	Y
15.2	Promote development of novel preventive measures on AMR	Promote source of funding to stakeholders starting in 2017	Y
15.3	Promote development of novel antimicrobials or other alternative agents	Promote source of funding to stakeholders starting in 2017	Y
Objective 16 – Promote research on behavioural science and psychology			
16.1	Promote research on awareness and education regarding AMR, infection prevention and control, and antibiotic stewardship	Promote source of funding to stakeholders starting in 2017	Y
Objective 17 – Promote research on health and economic burden			
17.1	Promote research on estimating local health burden of AMR	Promote source of funding to stakeholders starting in 2017	Y
Objective 18 – Strengthen international partnerships and regional collaboration			
18.1.1	Host a regional symposium on AMR	Organise symposium by 2018	Y
Objective 19 – Inform public policy and facilitate stakeholder engagement			
19.1.1	Organise information sharing session(s) for different stakeholders and target audience	Commence by 2017	Y