Environmental spread of antimicrobial resistance: Bangladesh perspective

Mohammad Aminul Islam, PhD

Associate Scientist & Head

Enteric and Food Microbiology Laboratory

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New Delhi, India

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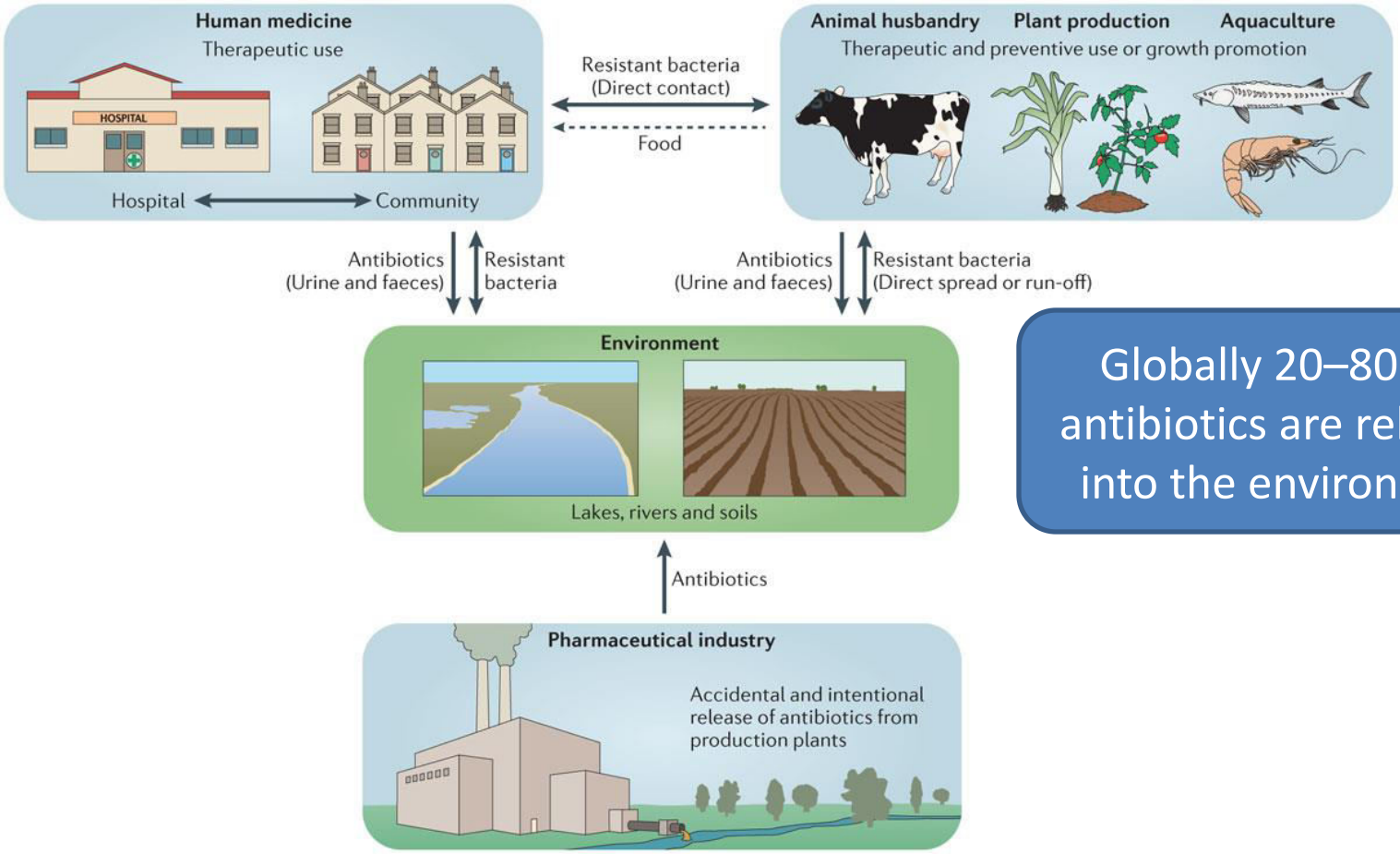
Ecological cycle of antibiotics in different environments



Globally 20–80% of antibiotics are released into the environment

Andersson & Hughes, 2014

Nature Reviews | Mic

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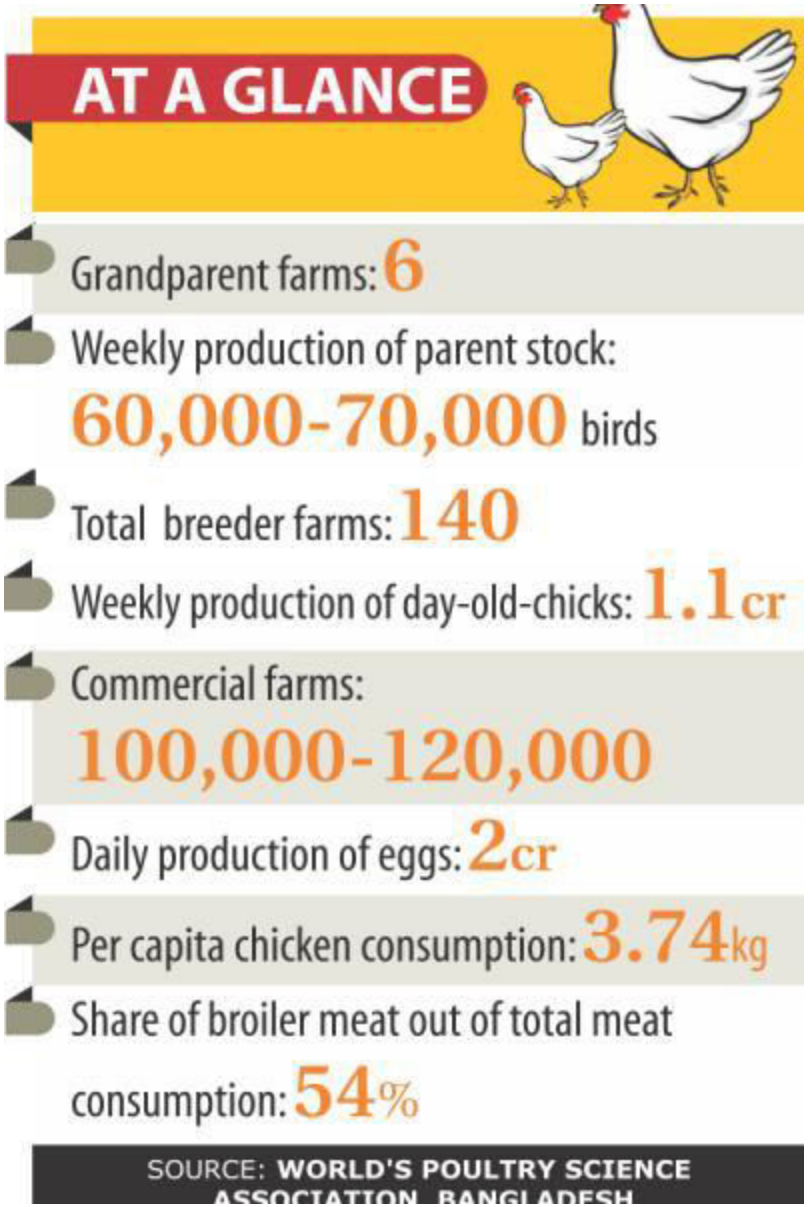
Poultry industry in BD



The annual per capita chicken consumption in Bangladesh is only 3.74 kg, which is expected to reach 8.42 kg by 2020

Bangladesh's poultry industry is expected to grow by an average of 16% a year for the next 5y

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Use of Antibiotic in Animal Feed in BD

Approximate market size of medicine and feed additive/supplements In Bangladesh

Year	Market size		Growth
	(BDT in crore)	(USD in billion)	
2012	980	12.45	6.5 %
2011	920	11.69	16.46 %
2010	790	10.04	25.4 %
2009	630	8.01	40 %
2008	450	5.72	-

Source: http://www.dumarketing.ac.bd/

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Waste management-poultry

About 3079 metric tons poultry manures are produced daily from a total of 42 million chickens in Bangladesh (Waste concern, 2005)

- ~50% of poultry waste are directly used in fish culture
- ~10% are used for fertilizer in crop production
- ~20% biogas
- ~10% is unused

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Human exposure

Urban and peri-urban Areas

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Human exposure

Urban Areas

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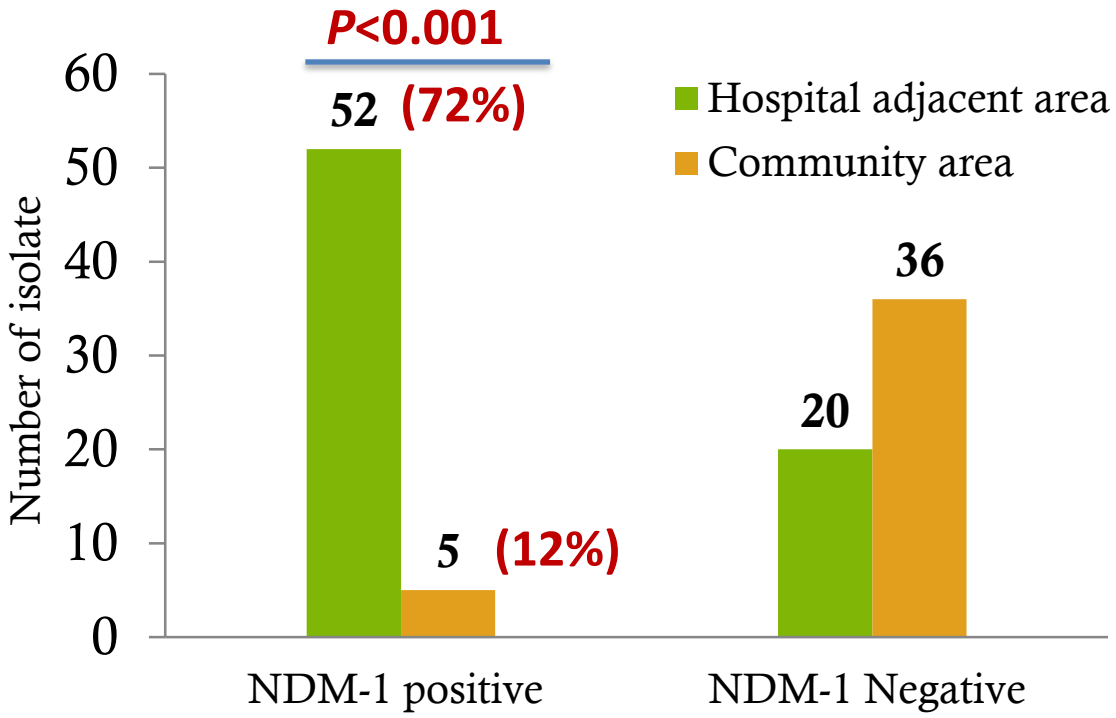
NDM-1 in waste water in Dhaka city

-Of the 113 waste water samples, 57 (50%) were positive for NDM-1-producing organisms

-None of the 113 tap water samples were positive for NDM-1



Islam et al, 2015. ICAAC

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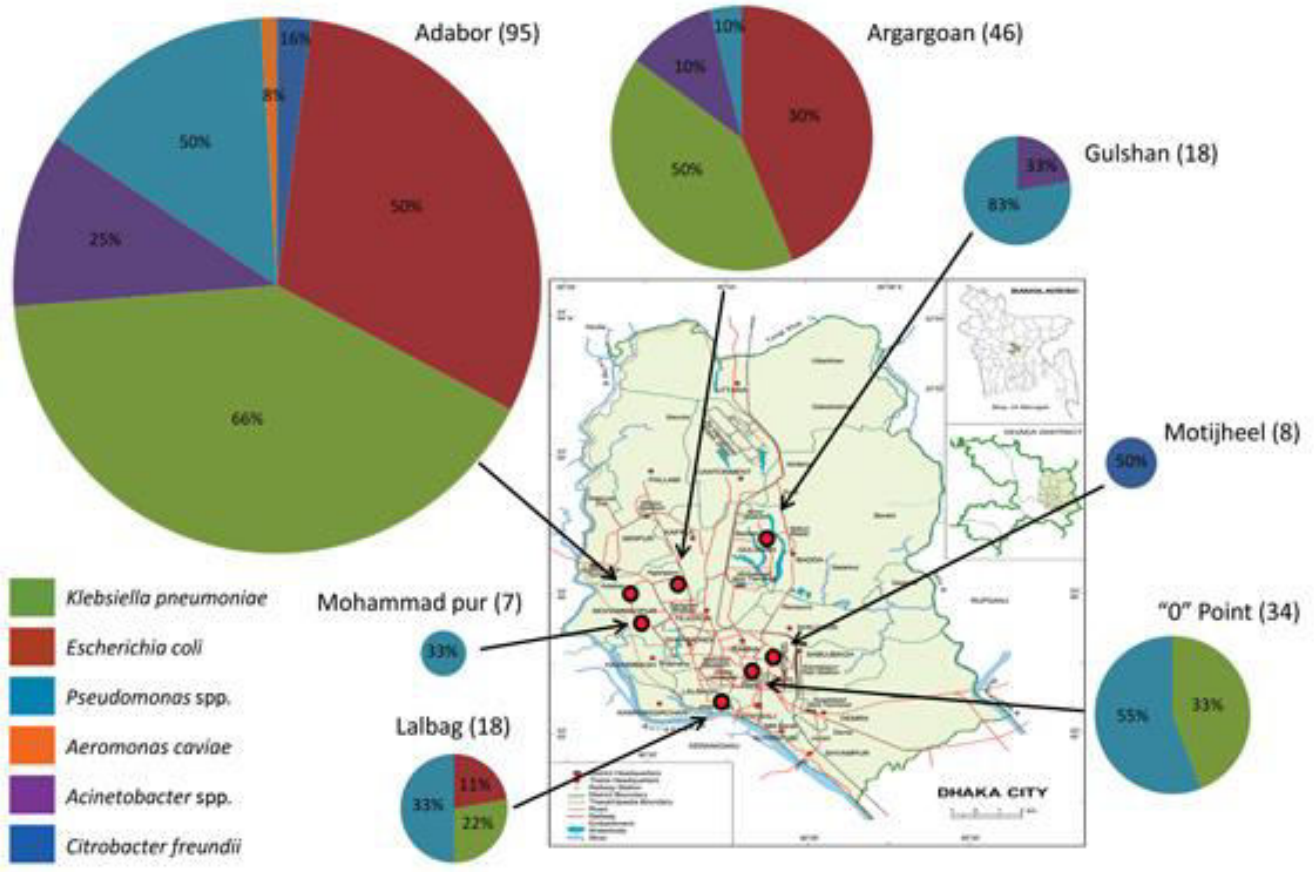
NDM-1 in surface water in Dhaka city



~62% of environmental water samples in Dhaka were positive for NDM-1

Toleman et al. 2015. EID

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Antibiotic resistant bacteria in supply water in Dhaka city

- 80% sample positive for fecal coliform (FC) bacteria (38% with >100 CFU/ml)
- 63% samples were positive for *E. coli*.
- 36% isolates (n = 84) were resistant to ≥3 classes of antibiotics and 7% were pathogenic
- 10% (n=22) of isolates were ESBL-producing:
  - -90% were positive for CTX-M-1 and CTX-M-15.
  - -32% were positive for OXA-1 and OXA-47.
  - -None were positive for NDM-1

Talukdar Prabhat et al, 2013. PlosOne

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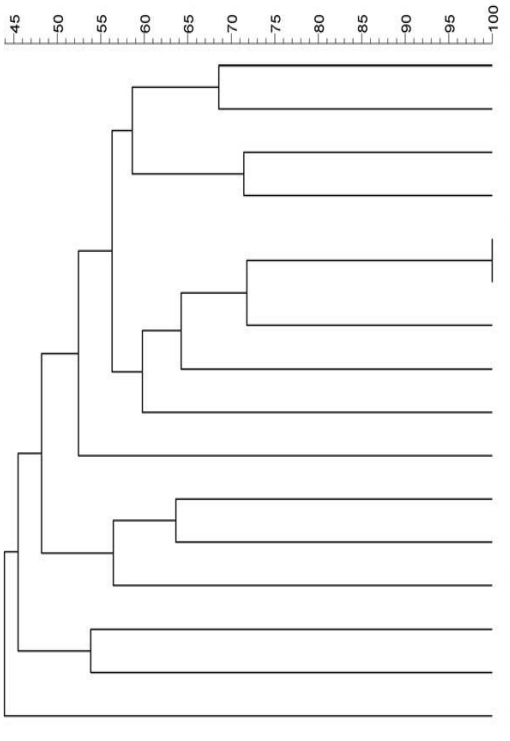
Characterization of pathogenic *E. coli*



Strain ID	Virulence gene	Pathotype	AB susceptibility pattern	Plasmid pattern
149C1	st	ETEC	Amp-Cip-NA	120,62,7
174fC1	st	ETEC	Amp-Cip-Cro-NA-Te	120,62
149C2	st	ETEC	All S	No plasmid
156C1	st	ETEC	Amp-Cro	120,62,27
56C3	bfp,eae	EPEC	All S	36
57C1	bfp,eae	EPEC	All S	36
149C3	st	ETEC	Amp-Cip-NA-Te	120,62,46,3
90mf3	lt	ETEC	NA	70
40C1	bfp,eae	EPEC	All S	1.5
39C3	lt	ETEC	Amp	90
185C2	lt,st	ETEC	Amp-Cro-Te	>140,100,36
90mf1	bfp,eae	EPEC	Amp-Sxt-NA-Te-Mel	62,36,5,3.1,2.7
91mf2	st	ETEC	NA	90,50
160C3	lt,st	ETEC	Amp-NA-Mel	100,30,5
190fC1	bfp,eae	EPEC	Amp-NA-Te	120,1.4
125C4	lt	ETEC	Amp-Sxt-Te	42

Talukdar Prabhat et al, 2013. PlosOne

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AMR in fresh produce in Dhaka city

~60% of fresh produce samples from Dhaka city markets were positive for ESBL-producing organisms, mostly *E. coli* and all were positive for CTX-M gene

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Antibiotic resistance in wild birds

- 59% crows foraging on waste had ESBL producing EB in their feces
- Majority were *K. pneumoniae* and *E. coli*
- Predominant ESBL genes were CTX-M-1, CTX-M-15
- *E. coli* from crows had identical sequence types with *E. coli* from human patients, including the epidemic 025b-ST131 clone

Hasan et al, 2015. CMI

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Antibiotic resistance in domestic birds

~90% *E. coli* isolates from pigeon were resistant to ≥1 critically important human antibiotics.

-5% isolates were ESBL-producing and had $bla_{CTX\text{-}M\text{-}15}$ genes.

- Pigeon E. coli shared identical clone with human E. coli

Hasan et al, 2014. Vet. Microbiol.

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Antibiotic resistance in *E. coli* from poultry feces

No. of sample tested	Organisms isolated	No (%) of MDR	No (%) ESBL	Ref
40 poultry feces	25 *E. coli*	100	100	Parvez et al., 2016
279 sick poultry feces	101 path *E. coli*	37%	0	B Hasan 2011
52 backyard poultry feces	51 *E. coli*	7 (14%)	2 (4%)	Islam et al (unpub)

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Existing policies/acts and ordinance/guidelines for animal health

- Final Draft of National Agricultural Extension Policy-2013
- Slaughter Act -2011
- Animal Feed Act -2010
- Bangladesh Zoo Act, 2009 (Draft)
- National Poultry Development Policy, 2008
- Animal Disease Rule- 2008
- Avian Influenza Compensation Strategy and Guidelines, 2008
- National Livestock Development Policy, 2007
- National Livestock Extension policy 2013 (Final Draft)
- Animal Disease Act, 2005
- Bangladesh Animal and Animal Product Quarantine Act, 2005

Existing policies/acts and ordinance/guidelines (Cont.)

The Animal Feed Act 2010

"prohibits the use of antibiotics, growth hormones, steroids or other harmful chemicals in animal feed. For violating this law, a person might face up to one year's imprisonment or up to Tk. 50,000 (~650 USD) in fine or both."

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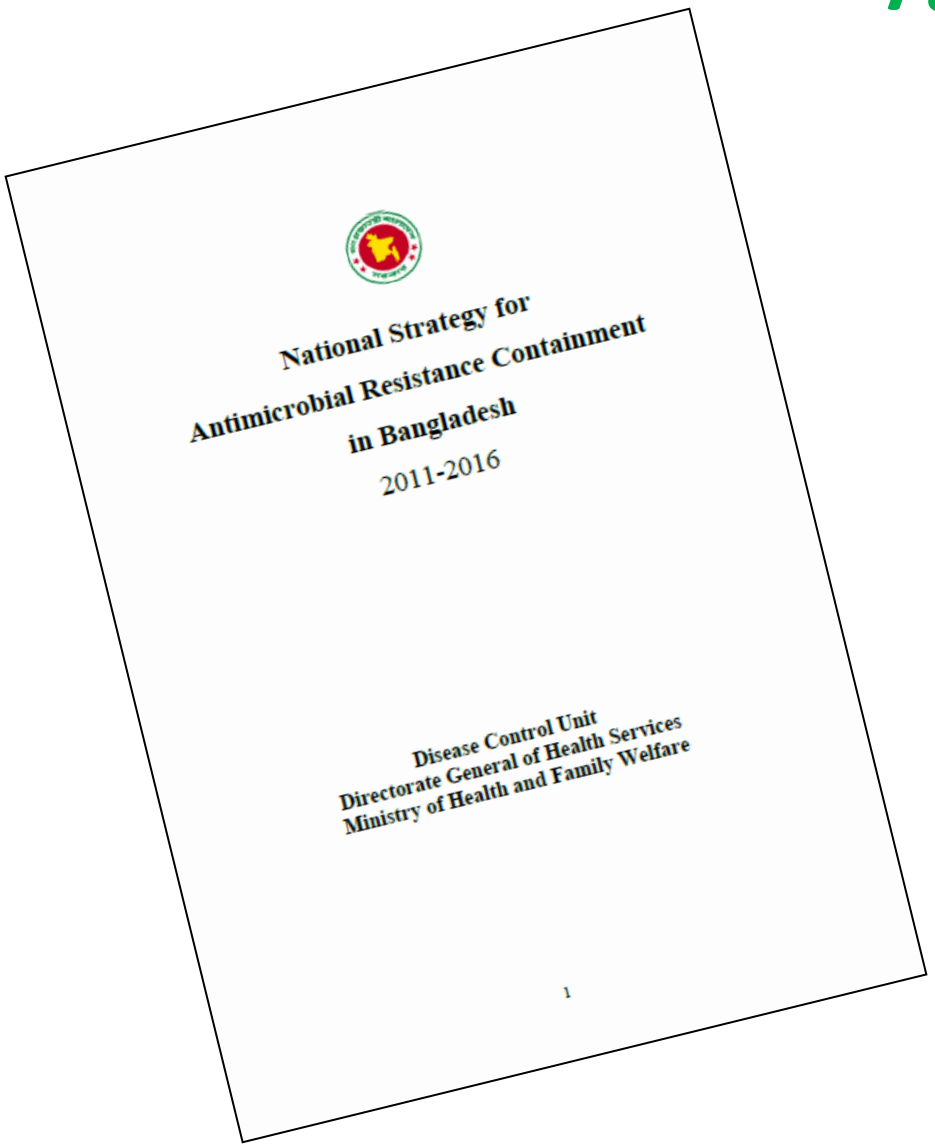
Existing policies/acts and ordinance/guidelines


National Strategy for
Antimicrobial Resistance Containment
in Bangladesh
2011-2016

Disease Control Unit
Directorate General of Health Services
Ministry of Health and Family Welfare

1

A. National Steering Committee (NSC)
B. National Technical Committee
C. Core Working Group at DGHS
D. Committee for Tertiary Level Hospital
E. District Multisectoral Committee
F. Upazilla Multisectoral Committee
G. Committees in Clinical Services Delivery setup

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National Action Plan on AMR-current status

- Core working group at DGHS
- 2 consultative workshops
- Technical committee has been formed
- Draft national Action plan
- Consultative workshop with WHO
- Revision of the draft
- By 2017 National Action Plan will be finalized

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Challenges

1. Development of national action plan and its implementation

Lack of communication and coordination among different sectors including human health, animal health and environment

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Challenges

2. Adequate surveillance and laboratory capacity

Improvements are necessary in three areas of surveillance capacity:
a) Data collection and data sources, data management, analysis and interpretation;
b) Information reporting, dissemination, communication and use.
c) Focused and targeted international cooperation

Logistic support and trained staff development are the major challenges for establishment of a reference laboratory for AMR in Bangladesh

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Challenges

3. Access control to antimicrobial medicines and rationale use of them

-Weak regulatory systems and law enforcement
-OTC sale of antibiotics
-Lack of antibiotic treatment policy for both human and animal health.

4. Awareness

-Lack of awareness among health care professionals and mass population

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Challenges

5. Infection prevention and control programmes along with supervision & monitoring of these programs

- National infection prevention and control programme
- Proper maintenance of IHR
- Strict & timely monitoring plan
- Waste management
- Biosafety and Biosecurity

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How to overcome these challenges

Need a separate body in the government who will take care of these issues and coordinate the activities with different sectors.

AMR is expected to be included as a separate OP of the DGHS, MoHFW in the next 5 years plan (2016-2021)

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Thank you

icddr,b thanks its core donors for their on-going support

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