Index note: page numbers in italics denote figures or illustrations.

ABS see antibiotic stewardship (ABS)	best practice 87
Achaogen, company 191	cost-effectiveness 89, 92
Acinetobacter 28	evidence of effectiveness 83
A. baumannii 74, 126, 166, 192	guidelines 86, 208
Action on Antibiotic Resistance	in hospitals 81
(ReAct) 209, 210, 214, 215,	methodology used in studies 85, 92
217, 230	antibiotic use, in humans
advertising 207, 212	effect of culture 62
Africa CDC AMR Surveillance	nonprescription 4
network (AMRSNET) 169	not targeted 156
Africa Centres for Disease Control and	reduced, due to vaccination 182,
Prevention (Africa CDC) 169	186, 195
AGP (antimicrobial growth promoters)	economic benefits 196, 198, 200
101, 103, 106, 111, 224	antibiotic use, in livestock production
agricultural sector 37, 101, 223 see	101, 210, 212, 223
also animal husbandry; farming;	in animal feed 108, 227
livestock production	decrease in 103, 105, 107
Alliance for Prudent Use of Antibiotics	growth promoters 101, 103, 106,
(APUA) 208	111, 224
aminoglycosides 27	interventions to reduce use 114,
amoxicillin 61, 190	208, 209
ampicillin 190	measuring 107
animal feed 108, 116, 117, 227	risk assessment 110
animal husbandry 102, 103, 107	antibiotics
see also farming; livestock	access to 6, 219
production	alternative therapies 129
animal products raised without routine	broad spectrum 23
use of antibiotics 15, 222, 225	commercialization of new 132, 144
animal to human transmission of	ionophore 102
resistant bacteria 104, 111, 185	last-line 2, 162, 168, 221
Antibiotic Guardian Campaign 60	market approval of 131, 143
Antibiotic Resistance Coalition (ARC) 15, 209, 228	pipeline for new 4, 125, 126, 141, 215
antibiotic stewardship (ABS) 8, 30, 31,	post-antibiotic era 2, 4, 209
212, 221 see also interventions	promotion and marketing of 208,
to tackle antimicrobial	212
resistance	prophylaxis 25, 101, 103
. ,	r · r · / == , ,

antibiotics (cont.) research and development 10, 125, 214 delinkage 11, 132, 145, 216, 217 funding 129, 215 incentives for 11, 132, 212, 217 see also market entry rewards (MERs); prizes sales of 132, 144 second-line 33 sustainability and systems thinking 228 used in both humans and animals 111, 222 wastewater contamination with 228 antibodies 129, 191 antigens 186 antimicrobial growth promoters (AGP) 101, 103, 106, 111, 224 Antimicrobial Resistance Diagnostic Challenge 139 APUA (Alliance for Prudent Use of Antibiotics) 208 aquaculture 103, 108, 186 ARC (Antibiotic Resistance Coalition) 15, 209, 228 artemisinin 6 artists 230 ASP (antibiotic stewardship programme) see antibiotic stewardship (ABS) authorisation of new antimicrobials 140 autoimmune diseases 191 avilamycin 111 awareness campaigns 54 Antibiotic Guardian 60 public health 8, 47 azithromycin 168	Bergström, Richard 215 beta-lactams 27 Bezlotoxumab 191 Bill and Melinda Gates Foundation 139, 146, 191 biomarkers 157, 159, 218 Biomedical Advanced Research and Development Authority (BARDA) 138 biosecurity measures 103, 107, 110, 114, 116 biosurveillance see surveillance programmes bloodstream infections (BSIs) 30, 71, 73, 74, 89 booklets, for patients 58, 59 broad spectrum antibiotics 23 budgets, health care 32 Burden of Resistance and Disease in European Nations (BURDEN) 71 bystander effects 182, 195, 196 campaigns 54 Antibiotic Guardian 60 public health 8, 47 Campylobacter 28, 127 cancer treatments 25, 191 Candida 28 carbapenems 2, 27, 31, 192 resistance 28, 126 CARB-X (Combating Antibiotic Resistant Bacteria Biopharmaceutical Accelerator) 136 ceftriaxone 162, 168 cephalosporins 5, 31, 72, 72 Chan, Margaret 209 chemotherapy 25 chicken farming 102, 116, 117
bacteria eradication of 187 Gram-negative 2, 126, 128, 131 bacterial infections bacteraemia 24 secondary 195 bacteriophages 129 BARDA (Biomedical Advanced Research and Development Authority) 138	chicken farming 102, 116, 117 children 59, 195, 222 chloroquine 6 cholera 190 ciprofloxacin 162, 193, 194 civil society 15, 207 cleaning, in hospitals 74 clinical trials 11, 131, 136, 142, 170 Clostridium difficile 191 Clostridium perfringens 102 coccidiosis 102 colistin 2, 111, 192

colony-forming units 77 Combating Antibiotic Resistant	for antimicrobial resistance surveillance 164 barriers to innovation 162
Bacteria Biopharmaceutical Accelerator (CARB-X) 136	business case for 174
commercialization of new antibiotics	cost 61, 171
132, 144	decrease cost of clinical trials 170
communication, with patients 53, 58, 59, 63	efficient implementation 173 funding for 171, 172
community, prescriptions for	for malaria 6
antibiotics 7	pathogen detection 160
companion animals 113 cooperation, global 15, 16, 146	point-of-care 52, 57, 58, 144, 156 policies 172
cost	to reduce misuse of antibiotics 164
of diagnostic research and	regulatory approval 171
development 171	susceptibility testing 160
of interventions 61	using host biomarkers 157
of market entry rewards 145	diarrhoea
societal, of antimicrobial resistance	in children 193, 222
34	in piglets 102, 116
of vaccinations 198	vaccines 196
cost-effectiveness	Directorate-General for Research and
of antibiotic stewardship in hospitals	Innovation (DG-RTD) 137
89, 92	disability affected life years (DALYs) 25 disease prevention 105, 107, 110
of biosecurity in livestock production 115, 116	role of diagnostic tests 174
of infection control measures in	doctors (GPs) 46, 58
hospitals 74	Driving Reinvestment in Research and
of preventative strategies in the	Development and Responsible
community 38, 61	Antibiotic Use (DRIVE-AB) 81,
cough 58, 59 see also lower respiratory	219
tract infections	Drugs for Neglected Diseases Initiative
C-reactive protein (CRP) 57, 58, 61, 157	(DNDi) 218
cross transmission of infection 77	ear infections 34
Cross-Research Council AMR Initiative 139	EARS-Net (European Antimicrobial
cross-species resistance 210	Resistance Surveillance
culture, and antibiotic use 62	Network) 71, 78, 79, 168
	ECDC (European Centre for Disease Prevention and Control) 71, 87,
deaths, due to antimicrobial resistance	109, 110
24, 25, 35, 222	economics
decolonization 74 delayed prescribing (DP) 54, 57	of antibiotic research 132, 133 benefits of antibiotic stewardship 92
delinkage 11, 132, 145, 216, 217	benefits of vaccines 196, 198, 200
dentists 46	of biosecurity 116
development pipeline for new	burden of antimicrobial resistance 6,
antibiotics 4, 125, 126,	31, 35, 38
141, 215 see also research	health 92
and development into new	EDCTP (European and Developing
antibiotics	Countries Clinical Trial
diagnostic tests 12, 89, 218	Partnership) 136

education of clinicians 51, 58 of patients 53, 58, 173 of undergraduates 91 Effective Practice and Organisation of Care Group (EPOC) 81 EFPIA (European Federation of Pharmaceutical Industries and Associations) 137 EFSA (European Food Safety Authority) 109 EMA (European Medicines Agency) 140, 144 empirical treatment 23 enteritis, necrotic, in poultry 102, 117 Enter-net 168	ETVAX, vaccine 193 EU (European Union) 137 One Health Action Plan ix European and Developing Countries Clinical Trial Partnership (EDCTP) 136 European Antimicrobial Resistance Surveillance Network (EARS-Net) 71, 78, 79, 168 European Awareness Day 54 European Centre for Disease Prevention and Control (ECDC) 71, 87, 109, 110 European Federation of Pharmaceutical Industries and Associations (EFPIA) 137
Enterobacteriaceae 24, 31, 72, 74, 192	European Food Safety Authority
ESBL (extended spectrum beta-	(EFSA) 109
lactamase) 113	European Medicines Agency (EMA)
Enterococcus faecium 127	140, 144
environment see also One Health	European Surveillance of
issues	Antimicrobial Consumption
antibiotics entering 210, 228	Network (ESAC-Net) 71
transmission of resistant bacteria	European Surveillance of Veterinary
104, 111	Antimicrobial Consumption
environmental cleaning, in hospitals 74	(ESVAC) 108, 109
EPOC (Effective Practice and Organisation of Care Group) 81	European Union <i>see</i> EU extended spectrum beta-lactamase
EQUIP project 59	(ESBL) 113, 115
eradication, of bacteria 187	extrinsic resistance 27
ESAC-Net (European Surveillance of	extrinsic resistance 27
Antimicrobial Consumption	farmers 113, 116
Network) 71	farming see also agricultural sector;
ESBL (extended spectrum beta-	animal husbandry; livestock
lactamase) 113, 115	production
Escherichia coli 2, 31, 33, 165	chicken 102, 116, 117
cephalosporin resistant 5, 36, 72	intensive 10, 102, 112, 223
colistin-resistant 111	pig 102, 114, 116
enterotoxigenic E. coli (ETEC) 193	salmon 186
extended spectrum beta-lactamase	fatality rates 24, 25, 35, 222
(ESBL) 115	FDA (US Food and Drug
uropathogenic <i>E. coli</i> (UPEC) 194 vaccines against 186, 193	Administration) 140, 144
Verocytotoxin-producing (VTEC)	feed, animal 108, 116, 117, 227
168	feedback 51 financial incentives 52
Essential Medicines List 207	FIND (Foundation for Innovative New
essential oils 116	Diagnostics) 157, 218
ESVAC (European Surveillance of	flavomycin 111
Veterinary Antimicrobial	Fleming, Sir Alexander 2
Consumption) 108, 109	fluoroquinolones 27, 195
	•

food Global Antimicrobial Resistance Collaboration Hub 12, 16, 146 animal feed 108, 116, 117, 227 foodborne infections 185 Global Antimicrobial Resistance hygiene 113 Innovation Fund (GAMRIF) transmission of resistance 113, 185 136 Food and Drug Administration (FDA) Global Antimicrobial Resistance (US) 140, 144 Surveillance System (GLASS) food animal production see also livestock production Global Challenge Research Fund 139 use of antibiotics in 9, 223 global cooperation 15, 16, 146 Global Gonococcal Antimicrobial without routine use of antibiotics 15, 222, 225 Surveillance Programme (GASP) Foodborne Diseases Active Surveillance (WHO) 168 Network (FoodNet) 169 Global Point Prevalence Survey of Foundation for Innovative New Antimicrobial Consumption and Resistance (GLOBAL-PPS) Diagnostics (FIND) 157, 218 funding 169 for antibiotic research and Global Strategy for Containment of development 129, 215 Antimicrobial Resistance 208 for diagnostic tests 171, 172 gonococcal resistance 160, 168 furunculosis 186 gonorrhoea 160, 161, 168 governing body, global 146.2 GPs (general practitioners) 46, 58 G3REC (E. coli resistant to 3rd GRACE INTRO project 58 generation cephalosporins) 72 Gram-negative bacteria 2, 126, 128, G20 summit, Hamburg 2017 146 131 GAMRIF (Global Antimicrobial grants, research 132, 142 Resistance Innovation Fund) 136 gross domestic product (GDP) 37 GARDP (Global Antibiotic Research growth promoters, antimicrobial 101, and Development Partnership) 103, 106, 111, 224 135, 218 guidelines 51, 86, 88 GARP (Global Antibiotic Resistance Partnership) 6 Haemophilus influenzae 127, 187 GASP (Global Gonococcal Antimicrobial Surveillance vaccines 190 Programme) 168 hand hygiene 73, 77 Gavi Vaccine Alliance 172, 194, 198 health GDP (gross domestic product) 37 campaigns 8, 47 general practitioners (GPs) 46, 58 economics 92 GLASS (Global Antimicrobial One Health issues ix, 15, 111, 209, 223, 228 Resistance Surveillance System) 165 Health Action International (HAI) Global Action Plan on 207, 209, 212 Antimicrobial Resistance health burden, of antimicrobial (WHO) 3, 15, 105, 155, 164, resistance 24, 27 212, 213, 221 health care budgets 32 Global Antibiotic Research and health care-associated infections Development Partnership (HAIs) 8, 71, 72 (GARDP) 135, 218 outbreak control 79 Global Antibiotic Resistance surveillance programmes 71, 78, 90,91 Partnership (GARP) 6

health technology assessment (HTA)	infections
13, 172 Healthcare without Harm 222, 226,	bacterial 24, 195 bloodstream (BSIs) 30, 71, 73, 74,
229	89
Helicobacter pylori 127	ear 34.1 health care-associated infections
Heymann, Dr. David 209 HNL (human neutrophil lipocalin) 159	(HAIs) 8, 71, 72
Horizon 2020 Better Use of Antibiotics	outbreak control 79
Prize 137, 159	surveillance programmes 71, 78,
hospitals see also health care-	90, 91
associated infections (HAIs)	incidence of 26
antimicrobial resistance in 8, 113	lower respiratory tract (LRTIs) 58
blocked beds 76	reduced severity of 182
environmental cleaning 74	respiratory tract infections (RTIs)
overcrowding 77	14, 46, 52, 59
vaccines and immunotherapies for	urinary tract (UTIs) 61, 194
resistant bacteria 191	viral 46, 52, 54, 57, 195 influenza 182
waste management 229 host biomarkers 157, 159, 218	vaccines 195
host-microbe relationship 230	Innovative Medicine's Initiative (IMI)
HTA (health technology assessment)	137
13, 172, 172	InnovFin ID (Infectious Diseases
human neutrophil lipocalin (HNL) 159	Facility) 138
human to animal transmission of	intensive animal production 10, 102,
resistant bacteria 104, 111, 185	112, 223
husbandry, animal 102, 103, 107	international response to antimicrobial
see also farming; livestock production	resistance 15, 16, 146 international standards, for diagnostic
hygiene	tests 172
cleaning, in hospitals 74	interspecific effects 184
food 113	interventions to tackle antimicrobial
hand 73, 77	resistance see also antibiotic
	stewardship (ABS)
IMI (Innovative Medicine's Initiative)	clinician and patient focused 53
137	clinician focused 51
immune stimulation 129	evidence of effectiveness 83
immunocompromized patients 25	in hospitals 81 long-term impact 63
immunotherapies 191 see also	methodology used in studies 85, 92
monoclonal antibodies (mAbs);	projects 58, 59
vaccines incentives for antibiotic research and	public focused 54
development 11, 132, 212, 217	intrinsic resistance 27
see also market entry rewards	ionophore antibiotics 102
(MERs)	IPC see infection prevention and
incidence of antimicrobial resistance 29	control (IPC)
infection prevention and control (IPC)	isolation 73
8, 25, 30, 72	Italy, University hospital Modena 87
cost-effectiveness 74	T 10 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1 1
infection control measures 73	Japanese Pharmaceuticals and Medical
prevention of cross transmission 77 by vaccines 182	Devices Agency (PMDA) 141, 144
by vaccines 102	דדו

Joint Programming Initiative on market approval of antibiotics 131, Antimicrobial Resistance (IPIAMR) 135 market entry rewards (MERs) 11, 144, 217 see also prizes marketing, of antibiotics 208, 212 KFC, restaurant chain 225 McDonald's, restaurant chain 226 Klebsiella pneumoniae 2, 27, 31, 166, meat, produced without antibiotics 15, 222, 223 cephalosporin resistant 5, 36 Médecins sans Frontièrs (MSF) 209, potential vaccine 199 Korea, Republic of 227 217, 218 Krankenhaus-Infektions-Surveillancemedicines ban on advertising 207 System (KISS) 78 Essential Medicines List 207 meningitis 190 last-line antibiotics 2, 162, 168, 221 metaphylactic antimicrobial use 99, legal framework, international 16 101, 102 Limited Population Antibacterial Drug methicillin-resistant Staphylococcus (LPAD) 140 aureus (MRSA) 26, 28, 36, 72 livestock production 9, 37 see also assays for 167 agricultural sector; animal livestock-associated (LA-MRSA) husbandry; farming 113 animals raised without routine use microbe-host relationship 230 of antibiotics 15, 222, 225 Modena, University hospital 87 antibiotic use in 101, 210, 212, monoclonal antibodies (mAbs) 191 see 223 also immunotherapies decrease 103, 105, 107 measuring 107 mortality, major causes of 192 risk assessment 110 mortality rates 24, 25, 35, 222 growth promoters, antimicrobial MRSA 26, 28, 36, 72 assays for 167 101, 103, 106, 111, 224 intensive 10, 102, 112, 223 livestock-associated (LA-MRSA) 113 interventions to reduce antimicrobial MSF (Médecins sans Frontièrs) 209, use 114, 208, 209 217, 218 productivity 105 transmission of resistant bacteria to National Institute for Health Research humans and the environment (NIHR) 139 104, 111, 185 National Institute of Allergy and livestock-associated methicillin-Infectious Diseases (NIAID) 138 resistant Staphylococcus aureus ND4BB (New Drugs for Bad Bugs) (LA-MRSA) 113 Longitude Prize 159 necrotic enteritis, in poultry 102, 117 low and middle-income countries Neisseria gonorrhoeae 28, 127, 166, (LMICs) 4, 8, 9, 139 lower respiratory tract infections Neisseria meningitidis 187, 190 (LRTIs) 58 Netherlands 88 LPAD (Limited Population neutrophil biomarkers 159 Antibacterial Drug) 140 New Drugs for Bad Bugs (ND4BB) lysins 129 137 Newton Fund 139 malaria 6, 36, 182 NIAID (National Institute of Allergy manufacturing plants 228 and Infectious Diseases) 138

NIHR (National Institute for Health efficient implementation 173 Research) 139 funding for 172 norovirus 196 pathogen detection 160 nosocomial bacterial pathogens 191 policies 172 Nunan, Cóilín 224 to reduce misuse of antibiotics 57, nurses 46 regulatory approval 171 susceptibility testing 160 OIE (World Organisation for Animal using host biomarkers 157 Health) 99, 108, 185, 214 pollution, antibiotic 228 One Health issues ix, 15, 111, 209, polymyxins 31 223, 228 post-antibiotic era 2, 4, 209 online guidelines 88 poultry, necrotic enteritis 102, 117 see opportunity cost 38 also chicken farming outbreaks of health care-associated prebiotics 116 infections 79 preclinical trials 131, 142 overcrowding, in hospitals 77 prescribing, delayed 54, 57 prescription medicines, ban on parents 59 advertising 207 patients 47, 92, 212 prescriptions, for antibiotics 7, 46, 61, educational materials for 53, 58, 59 peptides 129 audit and feedback 51 pets 113 preventative strategies 39 pharmaceutical industry 207, 210 priority pathogens list (PPL) 126 Pharmaceuticals and Medical Devices prizes 137, 159 see also market entry Agency (PMDA), Japan 141, rewards (MERs) probiotics 116, 129 pharmacists 46 procalcitonin 52, 57, 157 pig farming 102, 114, 116 productivity, in livestock sector 105 pipeline for new antibiotics 4, 125, profits, from antibiotic sales 144 126, 141, 215 see also research projects to tackle antimicrobial and development into new resistance antibiotics EOUIP 59 Plasmodium falciparum 182 **GRACE INTRO 58** pledges, to reduce antimicrobial prophylactic antimicrobial use 25, resistance 60 100, 101, 103 PMDA (Pharmaceuticals and Medical Pseudomonas aeruginosa 28, 74, 126, Devices Agency), Japan 141, 128, 192 144 monoclonal antibodies 191 pneumonia 218, 222 vaccine 191 pneumococcal conjugate vaccine public health campaigns 8, 47 14, 218 point prevalence studies 167, 169 Qualified Infectious Diseases Products point-of-care diagnostic tests (POCTs) (QIDP) 140 52, 58, 144, 156 for antimicrobial resistance surveillance 164 ReAct (Action on Antibiotic Resistance) 209, 210, 214, 215, barriers to innovation 162 business case for 174 217, 230 regulatory approval for diagnostic tests cost 61, 171 decrease cost of clinical trials 170 171

	1 1 1 1 10 404
regulatory initiatives for new	monoclonal antibodies 191
antimicrobials 140, 143, 220	vaccine 191
reminders 51, 58	stewardship <i>see</i> antibiotic stewardship
Republic of Korea 227 research and development into new	(ABS) Straptococcus transmoniae 28, 127
antibiotics 10. 125, 214	Streptococcus pneumoniae 28, 127, 166
delinkage 11, 132, 145, 216, 217	vaccine 187
funding 129, 215	Subway, restaurant chain 225
incentives for 11, 132, 212, 217	surgical procedures 25
see also market entry rewards	surveillance programmes
(MERs)	antibiotic consumption, in
pipeline 4, 125, 126, 141, 215	agriculture 109
research grants 132, 142	antibiotic resistance 71, 78, 90, 91,
resistance	109, 212
extrinsic 27	in developing countries 167
genes, transfer of 185	diagnostic tests 164
intrinsic 27	Africa CDC AMR Surveillance
respiratory syncytial virus (RSV) 195	network (AMRSNET) 169
respiratory tract infections (RTIs) 14,	Enter-net 168
46, 52, 59	European Antimicrobial Resistance
lower respiratory tract (LRTIs) 58	Surveillance Network (EARS-
restaurant chains 15, 225	Net) 71, 78, 79, 168
rotavirus vaccines 196	Foodborne Diseases Active
	Surveillance Network
safety, patient 92, 212	(FoodNet) 169
sales, of antibiotics 132, 144	Global Gonococcal Antimicrobial
salmon farming 186	Surveillance Programme (GASP)
Salmonella 116, 168	168
Salmonella spp. 127, 166	Global Point Prevalence Survey of
S. typhi, vaccines for 194	Antimicrobial Consumption
Schippers, Edith 227	and Resistance (GLOBAL-PPS)
screening 74	169
secondary bacterial infections 195	surveys 91
second-line antibiotics 33	sustainability and systems thinking
self-care 53	228
self-limiting symptoms 54	symptoms, self-limiting 54
shared decision-making (SDM) 53, 55	1
Shigella spp. 127, 166	therapeutic antimicrobial use 99, 101,
smallpox 187	102, 106, 224
societal costs of antimicrobial	toxicity 111, 187 Transatlantic Task Force on
resistance 34	Antimicrobial Resistance
society, civil 15, 207 specificity, of vaccines 186	(TATFAR) 141, 144, 215
standards	transmission
for diagnostic tests 172	of antimicrobial resistance by water
for licensed drugs 143	113, 185, 228
Staphylococcus aureus 33, 127, 128,	of infection in hospitals 77
166	of resistant bacteria between
methicillin-resistant (MRSA) 26, 28,	animals, humans and the
36, 72, 113, 167	environment 104, 111, 185
, , , ,	, , ,

treatment, empirical 23 for Salmonella typhi 194 trends in antimicrobial resistance rates for Staphylococcus aureus 191 for Streptococcus pneumoniae 187 tuberculosis 34, 36 for urinary tract infections 194 for Vibrio cholerae 190 Ty21a, vaccine 194 for viruses 195 ETVAX 193 UK Research and Innovation 139 pneumococcal conjugate 218 understaffing, of hospitals 77 Ty21a 194 United Kingdom (UK) 139 Vi-polysaccharide 194 United Nations (UN) 3, 214 WC-rBS 193 United States (US) 138 vancomycin resistance 111 antibiotics in food animal vancomycin-resistant Enterococci production 224 (VRE) 28 Food and Drug Administration Verocytotoxin-producing E. coli (FDA) 140, 144 (VTEC) 168 University hospital Modena, veterinary prescriptions 108 Italy 87 Vibrio cholerae, vaccines 190 urinary tract infections (UTIs) 61, 194 Vi-polysaccharide, vaccine 194 viral infections 46, 54 Vaccine Alliance, GAVI 172, 194, 198 diagnostics 52, 57 vaccines 14, 102, 103, 116, 129, 218 vaccines for 195 see also immunotherapies advantages 186 waste in animal production 185 in environment 113 cost 198 management practices of hospitals difficulties in developing 193 229 economic benefits 196, 198, 200 wastewater contamination with impact on antimicrobial antibiotics 228 prescriptions 199 water, as a means of transmission of reducing antibiotic use 182, 186, antimicrobial resistance 113, 195 185, 228 reducing antimicrobial resistance WC-rBS, vaccine 193 182, 199 websites 60 specificity of 186 Wellcome Trust 140, 147 value of 198 white blood cell count 157 for Clostridium difficile 191 World Health Organization (WHO) 2, for Escherichia coli 186, 193 155, 207, 208, 218, 221 for Haemophilus influenzae 190 World Organisation for Animal Health for Pseudomonas aeruginosa 191 (OIE) 99, 108, 185, 214 for rotavirus 196