Surveillance of multi-drug resistant *Klebsiella pneumoniae* (MDRKP) in Ireland, 2014-2015

Introduction

- In Ireland, annual increases in the proportion of certain bacteria that are resistant to multiple different types of antimicrobials, also termed multi-drug resistant (MDR) bacteria, have been observed concurrent with increasing national broad spectrum antimicrobial consumption
- *Klebsiella pneumoniae* are bacteria, also known as *Enterobacteriaceae,* found in the human bowel where they are part of the normal colonising flora. However, they can also cause common infections, such as urinary tract infection (UTI)/cystitis, and more serious infections, such as bloodstream infection (BSI)
- National surveillance of *K. pneumoniae* BSI has been on-going since 2006 and it is the second commonest cause of Gram-negative BSI, with up to 400 cases reported annually. Of those, most are healthcare-associated and an all-cause mortality of 20% has been reported for *K. pneumoniae* BSI in Ireland
- In Ireland, national guidelines on the control and prevention of multi-drug resistant bacteria, such as *K. pneumoniae* were first published in 2013 and updated in 2014
- In 2013, a recent increase in the proportion of *K. pneumoniae* displaying resistance to multiple classes of antimicrobials, hereafter known as MDR-*K. pneumoniae* (MDRKP) was detected both via national BSI surveillance and research conducted in NUI Galway. This prompted an outbreak control team (OCT) to be convened at the Health Protection Surveillance Centre (HPSC) in October 2013
- The OCT produced reports and issued correspondence to the acute hospitals between December 2013 and November 2014. Surveillance data indicated that MDRKP was now widely disseminated throughout acute and non-acute healthcare settings in Ireland, including primary and residential care. The OCT recommended that a national taskforce be set up, with recommended actions to be taken by the taskforce to address the threat of increasing antimicrobial resistance (AMR) in Ireland. In response, HSE established a national healthcare-associated infection (HCAI) & AMR taskforce which convened in September 2015
- This report summarises the findings of the first 24 months of enhanced MDRKP surveillance in Ireland

Background

In Q3 2013, a national increase in multi-drug resistant *Klebsiella pneumoniae* (MDRKP) was observed in isolates referred to NUI Galway, prompting retrospective study of 138 isolates from 17 Irish hospitals collected from January 2011 to July 2013. Isolates belonged to two major clonal groups. All isolates were extended spectrum beta lactamase (ESBL) producers (harbouring SHV and CTX-M genes), with resistance to additional antimicrobial classes, including ciprofloxacin and gentamicin, with five (4%) isolates also confirmed as carbapenemase-producing *K. pneumoniae*: KPC (4) and OXA-48 plus NDM (1).

In Ireland, carbapenemase-producing *Enterobacteriaceae* are commonly known as carbapenem-resistant *Enterobacteriaceae* (CRE). The HPSC also reported a contemporaneous increase in the proportion of *K. pneumoniae* BSI with the MDRKP phenotype, via data submitted to the European Antimicrobial Resistance Surveillance Network (EARS-Net).

An outbreak control team (OCT) was established at HPSC in October 2013, followed by correspondence and recommendations to the acute hospitals in December 2013 (Appendix A) and establishment of a prospective national MDRKP surveillance programme from January 2014, whereby all microbiology laboratories in Ireland were required to submit data on MDRKP detection from any specimen to HPSC, initially on a monthly basis, along with information on antimicrobial treatment and patient placement for hospitalised patients.

Further correspondence was issued by the OCT to acute hospitals in April 2014. In July 2014, national guidelines on screening patients for carriage of resistant *Enterobacteriaceae* were updated and the OCT issued further recommendations to acute hospitals in December 2014. The last formal meeting of the OCT took place in February

2015. In 2015, the HSE established a national healthcare-associated infection (HCAI) and antimicrobial resistance (AMR) taskforce with the following terms of reference:

The HSE's National Taskforce for HCAI & AMR will be a multi-disciplinary high-level group that will support and advise the Operational Divisions to:

- Reduce the incidence of multi-drug resistant organisms (MDRO) and healthcare associated infections (HCAI) through the following actions:
    - Ensuring rational antimicrobial use across all healthcare settings
    - Providing effective diagnostic support for infection
    - Improving professional education, training and public engagement to promote wider understanding of the need for appropriate use of antibiotics
    - Ensuring compliance with HIQA standards for prevention of HCAI across all healthcare settings
    - Ensuring implementation of national guidelines across all healthcare settings

Surveillance methods

Date sources

Data on MDRKP in Ireland are obtained from two sources:

- Antimicrobial resistance surveillance of *K. pneumoniae* isolates causing invasive infections, such as bloodstream infection (BSI) collected as part of EARS-Net since 2006 (Part 1)
- Prospective surveillance of MDRKP causing any infection (both invasive and non-invasive) or colonisation, captured since national MDRKP surveillance commenced in January 2014 (Part 2)

Definition of MDRKP

Two distinct phenotypes of MDRKP are defined in the surveillance programme:

- MDRKP/Non-CRE: ESBL-producers and non-susceptible to both ciprofloxacin and gentamicin
- MDRKP/CRE: Carbapenemase-producing *K. pneumoniae* (e.g. KPC, OXA-48, NDM, VIM)
- Some isolates may present with both phenotypes

Part 1. MDRKP bloodstream infections reported to EARS-Net, 2010-2015

Case definition for EARS-Net

EARS-Net collects antimicrobial resistance data on the first invasive isolate of *K. pneumoniae* per patient per quarter.

Results

In the six years from 2010 to 2015, there were 146 MDRKP BSI reported by 31 healthcare facilities (30 acute hospitals and one non-acute healthcare facility). **Figure 1** displays the annual breakdown. Following an annual reduction in MDRKP BSI cases from 40 (2013) to 29 (2014), the figure further increased to 38 cases in 2015. The majority were categorised as MDRKP/Non-CRE (n=131; 90%), with all nine tertiary hospitals reporting at least six cases each over the six-year period. There were 15 BSI (10%) categorised as MDRKP/CRE reported by five hospitals (**Table 1**).

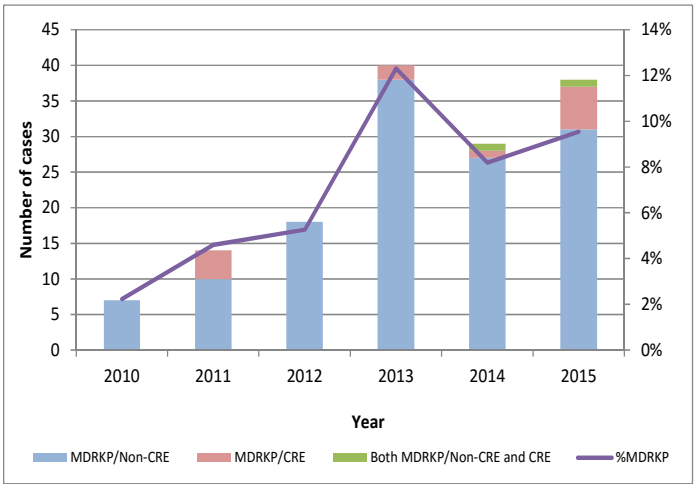

Figure 1. *Annual MDRKP BSI reported to EARS-Net, 2010 -2015*

	Annual MDRKP/CRE BSI	Carbapenemase
2010	0	Not applicable
2011	4	• OXA-48: 3 • KPC: 1
2012	0	Not applicable
2013	2	• OXA-48: 2
2014	2	• OXA-48: 1 • KPC: 1
2015	7	• OXA-48: 6 • KPC: 1

Table 1. *Annual MDRKP/CRE BSI reported to EARS-Net, 2010- 2015*

Figure 2 displays the monthly incidence of MDRKP BSI over the six-year period, with the peak incidence reported in June 2015 (n=8).

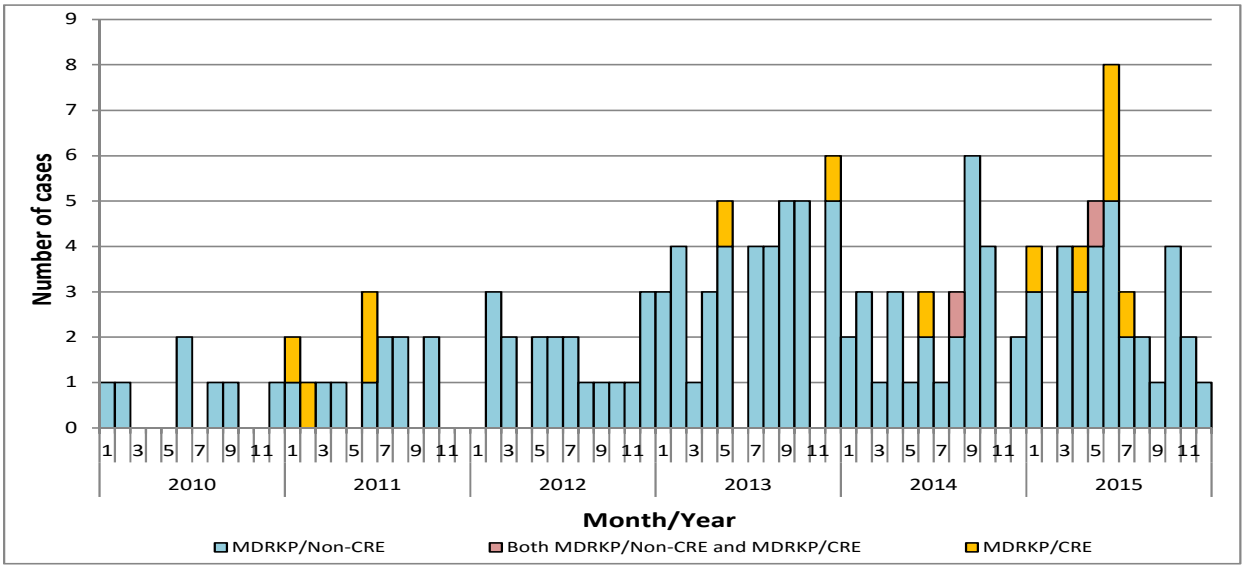

Figure 2. *Monthly MDRKP BSI Epi-curve, 2010-2015*

Part 2. Prospective national MDRKP surveillance, 2014-2015

Case definition

The first *K. pneumoniae* isolate per patient per quarter from any clinical (infection or colonisation) or screening specimen meeting the following criteria:

- **MDRKP/Non-CRE:** ESBL-producer and non-susceptible to both ciprofloxacin and gentamicin, or non-susceptible to 3rd generation cephalosporins and ciprofloxacin and gentamicin, where ESBL confirmation not routinely done

  and/or

- **MDRKP/CRE:** Carbapenemase-producing *K. pneumoniae*

Results

In the first two years of prospective surveillance, 914 MDRKP cases were reported, with a male predominance (53%) and a median patient age of 72 years (**Table 2**). Cases were reported from 50 (85%) of 59 acute hospitals in Ireland, indicating widespread geographical dissemination of MDRKP. Nine acute hospitals reported no MDRKP cases to the end of 2015. Of those, the mean number of beds ranged from 18–138, five were specialist, two were general and two were private hospitals. **Appendix 1** summarises MDRKP reported by acute hospitals and hospital groups during the first two years of prospective surveillance.

- The highest overall number of MDRKP cases were reported by the South/South-West (n=176) and Saolta (n=166) Hospital Groups, respectively, with the lowest number from the RCSI Hospital Group (n=97), excluding paediatric and private hospitals
- The highest number of MDRKP/CRE cases was reported from the University of Limerick Hospital Group) (n=71; 63%), with the lowest from the Dublin/North-East (RCSI) Hospital Group (n=5, or 4%), excluding paediatric and private hospitals

Information on patient location also indicates widespread dissemination of MDRKP throughout the healthcare system, with 67% either admitted to or attending a hospital, 20% attending general practice and 13% residing in a long-term care facility at the time of specimen collection.

Figures 3 and **Figure 4** display quarterly and monthly breakdown of reported cases. The peak incidence was reported in Q3 2014. There was a 4% reduction in the annual number of reported MDRKP cases from 466 (2014) to 448 (2015) and a 7% reduction in the annual number of reported patients with MDRKP from 411 (2014) to 384 (2015), as displayed in **Table 2**.

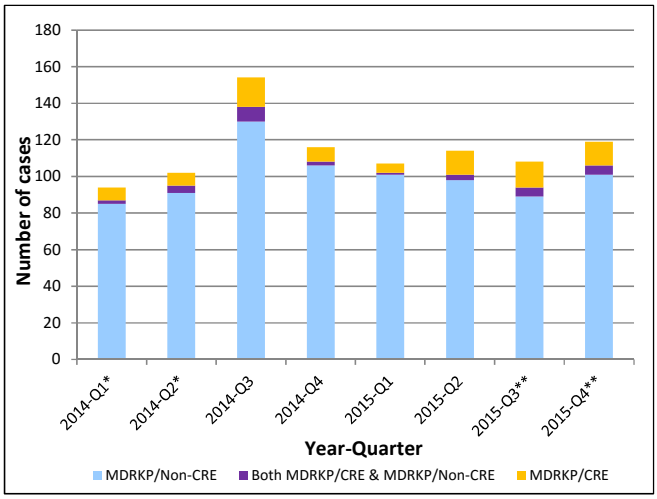

Figure 3. *Quarterly MDRKP cases, 2014-2015*
**No data from one tertiary hospital for Q1-2 2014;*
*** No data from one general hospital for Q3-4 2015*

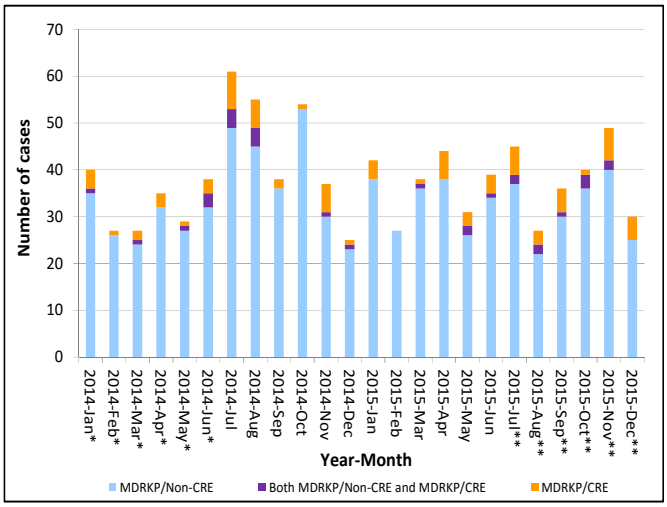

Figure 4. *Monthly MDRKP cases, 2014-2015*

Table 2. *Annual and overall summary of MDRKP (based on 1st isolate per patient per year): 2014-2015*

	TIME PERIOD						
	2014		2015		TOTAL		
	Jan-Dec		Jan-Dec		Jan 2014-Dec 2015		COMMENT ON TOTAL DATA
	n	%	n	%	n	%	
MDRKP (based on case definition of 1st isolate per patient per quarter, see Table 1 above)	466		448		914		of which 615 cases (67%) associated with 50 (of 59) acute hospitals (including outpatients)
Patients with MDRKP (based on one isolate per patient per year)	411		384		795		of which 547 cases (69%) associated with 50 (of 59) acute hospitals (including outpatients)
of which: MDRKP/Non-CRE	363	88%	333	87%	696	88%	
MDRKP/CRE	48	12%	51	13%	99	12%	54 KPC, 27 OXA-48, 18 NDM

Table 3 displays further information on reported MDRKP isolates for the first two years of prospective surveillance. The majority were MDRKP/Non-CRE (n=801; 88%), with 113 MDRKP/CRE (12%). Most CRE belonged to the KPC type (n=63; 56%). Annual MDRKP/CRE increased from 54 in 2014 to 59 in 2015. Of those, 14 (2014) and 17 (2015), respectively, also fulfilled MDRKP/Non-CRE criteria, but have been categorised as MDRKP/CRE for the purposes of this report.

Clinical specimens accounted for the majority of isolates (n=768; 84%). Overall, MDRKP detection in screening specimens was reported by 19 of 39 laboratories (49%). However, just two laboratories accounted for 60% (n=87) of all MDRKP isolated from screening specimens. While screening specimens accounted for the minority of MDRKP isolates (14%), it is noteworthy that just over half of all MDRKP/CRE (n=60; 53%) were detected from screening specimens, with just one laboratory accounting for 75% (n=45) of all MDRKP/CRE detected on screening.

Of the 512 MDRKP cases who were known to be hospital inpatients, information was provided on the clinical significance of MDRKP for 290 (57%). Of those, 190 (66%) had already required antimicrobial treatment of MDRKP infection by the time the case was reported to HPSC. Information was provided on patient isolation within 24 hours of laboratory identification of MDRKP for 343 (67%) cases, with 284 (83%) of those reported to have been isolated. The isolation status of 169 (33%) hospitalised MDRKP cases was not provided. Therefore, it is not known whether those patients were appropriately placed after the laboratory result for MDRKP became available. Where an inpatient is newly diagnosed with MDRKP colonisation or infection, isolation in single room with *en suite* or dedicated commode with contact precautions is one of the recommendations from the OCT correspondence issued in December 2014.

Discussion

The results of the first two years of enhanced surveillance of MDRKP in Ireland indicate this organism is now widely disseminated throughout the Irish healthcare system. While there was a reduction in the annual total number of patients with MDRKP between 2014 and 2015, a contemporaneous increase in the number of MDRKP/CRE causing bloodstream infections and overall MDRKP/CRE was observed. It is concerning that at the time of MDRKP reporting, two-thirds of hospitalised patients had already required antimicrobial treatment for this multi-drug resistant organism. Data on patient outcome is not currently collected by the surveillance system. Additionally, for patients chronically colonised with MDRKP, it is likely that an additional proportion may have required antimicrobial treatment subsequent to the case being reported to enhanced surveillance.

Appendix 1 demonstrates major inter-hospital variation in the proportion of hospitalised patients who were appropriately placed within 24 hours of laboratory detection of MDRKP. Further correlation with the local availability of single *en suite* patient rooms and implementation of local infection prevention and control policies is required to better understand this variation between hospitals.

In December 2014, the national MDRKP OCT wrote to the senior management teams of acute public hospitals in Ireland with recommendations to control the spread of MDRKP (**Appendix 4**). Key recommendations included participation in enhanced surveillance, development of local MDRKP screening policies and appropriate patient placement for those colonised or infected with MDRKP.

Appendix 1 demonstrates that some hospitals have not yet been in a position to provide enhanced surveillance data on treatment and appropriate placement of patients with MDRKP. There is major inter-hospital variation in the proportion of MDRKP cases detected by active screening (either rectal swab or faeces specimen to detect carriage). That 25 hospitals reported 100% of MDRKP were detected from clinical specimens only and not from screening specimens is highly suggestive that the OCT recommendation to implement local MDRKP screening policies based on the recommendations of the 'Updated guidelines on screening for carriage of resistant *Enterobacteriaceae* in Ireland' published in July 2014 has not yet been addressed. Within those guidelines, screening is recommended for the following categories of hospitalised patients:

1. Patients epidemiologically linked to other cases of resistant *Enterobacteriaceae* infection or carriage (e.g. sharing an inpatient area with a colonised or infected patient or transferred from a unit with a known resistant *Enterobacteriaceae* outbreak)
2. Patients directly transferred/repatriated from a healthcare facility in another jurisdiction (including Northern Ireland)
3. Patients with a history of admission as an inpatient in another jurisdiction (including Northern Ireland)
4. Patients admitted to high risk areas (such as a critical care unit or neonatal intensive care unit, haematology, oncology or transplant ward), on admission and weekly thereafter
5. Patients admitted from long-term care residences
6. Patients with a history of admission to another Irish hospital should be screened, as necessary, after consideration of the source hospital history and unit/s to which the patient will be admitted. Advice should be obtained from the local infection prevention and control team
7. In particular circumstances, screening of additional patient groups may be appropriate, based on local epidemiology and guidance of the infection prevention and control team.

http://www.hpsc.ie/A-Z/MicrobiologyAntimicrobialResistance/StrategyforthecontrolofAntimicrobialResistanceinIrelandSARI/CarbapenemResistantEnterobacteriaceaeCRE/ScreeningforCREinIreland/

Table 3. *Summary of MDRKP (based on 1st isolate per patient per quarter as per case definition), 2014–2015*

	TIME PERIOD						
	2014		2015		TOTAL		
	Jan-Dec		Jan-Dec		Jan 2014-Dec 2015		COMMENT ON TOTAL DATA
	n	%	n	%	n	%	
MDRKP cases (based on case definition of 1st isolate per patient per quarter)	466		448		914		of which 615 cases (67%) associated with 50 (of 59) acute hospitals (including outpatients)
of which: MDRKP/Non-CRE	412	88%	389	87%	801	88%	
MDRKP/CRE	54	12%	59	13%	113	12%	63 KPC, 29 OXA-48, 21 NDM
Clinical vs screening							
Clinical	393	84%	375	84%	768	84%	including 53 CRE: 21 KPC, 21 OXA-48, 11 NDM
Screening	73	16%	73	16%	146	16%	including 60 CRE: 42 KPC, 10 NDM, 8 OXA-48
Source (specimen type for clinical isolates only)							
Normally sterile site (incl. tissue and pus)	33	8%	43	11%	76	10%	including 8 CRE: 6 OXA-48, 2 KPC
Urine	279	71%	258	69%	537	70%	including 29 CRE: 13 KPC, 9 NDM, 7 OXA-48
Sputum/respiratory	29	7%	38	10%	67	9%	including 9 CRE: 5 KPC, 4 OXA-48
Swab/other	52	13%	36	10%	88	11%	including 7 CRE: 4 OXA-48, 2 NDM, 1 OXA-48
Location							
Hospital*	318	68%	297	66%	615	67%	including 98 CRE: 56 KPC, 28 OXA-48, 14 NDM
Inpatient (non-ICU)	*207*	*44%*	*204*	*46%*	*411*	*45%*	*including 78 CRE: 42 KPC, 24 OXA-48, 12 NDM*
ICU	*27*	*6%*	*36*	*8%*	*63*	*7%*	*including 7 CRE: 3 KPC, 3 OXA-48, 1 NDM*
ED	*41*	*9%*	*22*	*5%*	*63*	*7%*	*including 2 CRE: 2 KPC*
Outpatient	*43*	*9%*	*35*	*8%*	*78*	*9%*	*including 11 CRE: 9 KPC, 1 OXA-48, 1 NDM*
Nursing home&LTCF/GP	148	32%	151	34%	299	33%	including 15 CRE: 7 KPC, 7 NDM, 1 OXA-48
Nursing home&LTCF	*55*	*12%*	*62*	*14%*	*117*	*13%*	*including 7 CRE: 4 KPC, 3 NDM*
GP	*93*	*20%*	*89*	*20%*	*182*	*20%*	*including 8 CRE: 4 KPC, 3 NDM, 1 OXA-48*
Demographics							
Male	238	51%	249	56%	487	53%	
Age range	*0-97*		*0-103*		*0-103*		
Median age	73		72		72		
Inter-quartile range	57-82		58-81		57-81		75% of patients are aged 57 years or older
Interventions (for in-patients only)[1]							
*Total no. MDRKP cases from inpatients***	*250*		*262*		*512*		Data collected from Feb 2014 onwards only
Case treated for MDRKP infection?							
Treated for infection	95	38%	95	36%	190	37%	
Not treated for infection	51	20%	49	19%	100	20%	
Unknown/Not answered	104	42%	118	45%	222	43%	
Isolation within 24 hours of MDRKP identified?							
Isolated within 24 hours	148	59%	*136*	52%	284	55%	
Not isolated within 24 hours	31	12%	*28*	11%	59	12%	
Unknown/Not answered	71	28%	*98*	37%	169	33%	
Heathcare-association (for all patients)[2]							
Total no. all MDRKP cases	*399*		*448*		*847*		Data collected from Mar 2014 onwards only
Heathcare-association of MDRKP?							
Healthcare-associated	186	47%	200	45%	386	46%	
Not healthcare-associated	48	12%	52	12%	100	12%	
Unknown/Not answered	165	41%	196	44%	361	43%	

* includes Inpatients (non-ICU), ICU, ED and Outpatients

** includes in-patient (non-ICU), ICU and ED

[1] Data from Feb 2014 onwards only; [2] Data from Mar 2014 onwards only

Appendix 1. MDRKP cases reported by acute hospitals in Ireland, 2014–2015

Hospital Group	HOSPITAL	Category	Total MDRKP	Hospitalised patients only	% of cases detected on screening	%Hospitalised cases that were treated†	%Hospitalised cases that were isolated†
Dublin Midlands	Coombe Womens and Infants University Hospital	Specialist	3	2	67%	0%	50%
Dublin Midlands	Midland Regional Hospital, Portlaoise	General	3	2	0%	0%	50%
Dublin Midlands	Midland Regional Hospital, Tullamore	General	11	5	0%	100%	25%
Dublin Midlands	Naas General Hospital	General	36	8	0%	*	*
Dublin Midlands	St James's Hospital	Tertiary	46	19	2%	94%	94%
Dublin Midlands	St Luke's Hospital, Rathgar	Specialist	2	2	0%	100%	100%
Dublin Midlands	Tallaght Hospital[1]	Tertiary	57	42	2%	78%	56%
Dublin North East (RCSI)	Beaumont Hospital	Tertiary	55	35	4%	48%	50%
Dublin North East (RCSI)	Cavan General Hospital	General	13	6	0%	100%	20%
Dublin North East (RCSI)	Connolly Hospital, Blanchardstown	General	16	8	6%	50%	80%
Dublin North East (RCSI)	Louth County Hospital, Dundalk	General	0	NA	NA	NA	NA
Dublin North East (RCSI)	Our Lady of Lourdes Hospital, Drogheda	General	12	8	8%	83%	86%
Dublin North East (RCSI)	Rotunda Hospital	Specialist	1	1	0%	0%	100%
Ireland East	Cappagh National Orthopaedic Hospital	Specialist	0	NA	NA	NA	NA
Ireland East	Mater Misericordiaie University Hospital	Tertiary	34	21	0%	*	*
Ireland East	Midland Regional Hospital, Mullingar	General	1	1	0%	100%	100%
Ireland East	National Maternity Hospital, Holles St.	Specialist	5	5	60%	40%	100%
Ireland East	Our Lady's Hospital, Navan	General	1	0	0%	NA	NA
Ireland East	Royal Victoria Eye and Ear Hospital, Dublin	Specialist	0	NA	NA	NA	NA
Ireland East	St Columcille's Hospital, Loughlinstown	General	2	2	0%	100%	100%
Ireland East	St Luke's Hospital, Kilkenny	General	2	2	50%	0%	100%
Ireland East	St Michael's Hospital, Dun Laoghaire	General	1	0	0%	NA	NA
Ireland East	St Vincent's University Hospital, Elm Park	Tertiary	73	37	14%	92%	96%
Midwest (UL)	Croom Hospital	Specialist	0	NA	NA	NA	NA
Midwest (UL)	Ennis Hospital	General	8	8	50%	100%	100%
Midwest (UL)	Nenagh Hospital	General	10	7	20%	*	*
Midwest (UL)	St John's Hospital, Limerick	General	8	7	63%	20%	80%
Midwest (UL)	University Hospital Limerick	Tertiary	106	57	42%	18%	87%
Midwest (UL)	University Maternity Hospital Limerick	Specialist	0	NA	NA	NA	NA
South/South West	Bantry General Hospital	General	1	1	0%	100%	NA
South/South West	Cork University Hospital	Tertiary	77	39	3%	100%	71%
South/South West	Kerry General Hospital, Tralee	General	38	12	5%	*	*
South/South West	Kilkreene Orthopaedic Hospital, Co. Kilkenny	Specialist	0	NA	NA	NA	NA
South/South West	Mallow General Hospital	General	2	2	0%	100%	*
South/South West	Mercy University Hospital	General	17	17	6%	50%	100%
South/South West	South Infirmary/Victoria University Hospital, Cork	General	2	1	0%	0%	100%
South/South West	South Tipperary General Hospital, Clonmel	General	6	6	17%	100%	100%
South/South West	University Hospital Waterford	Tertiary	39	32	15%	78%	100%
South/South West	Wexford General Hospital	General	8	8	63%	57%	100%
West/North West (Saolta)	Galway University Hospitals	Tertiary	115	66	25%	32%	95%
West/North West (Saolta)	Letterkenny General Hospital[2]	General	11	3	0%	100%	67%
West/North West (Saolta)	Mayo General Hospital, Castlebar	General	13	8	8%	67%	83%
West/North West (Saolta)	Portiuncula Hospital, Ballinasloe	General	7	4	14%	100%	100%
West/North West (Saolta)	Roscommon County Hospital	General	6	5	33%	100%	50%
West/North West (Saolta)	Sligo Hospital	General	14	8	21%	88%	57%
Acute Paediatric Services	Children's University Hospital, Temple St.	Specialist	1	1	0%	100%	100%
Acute Paediatric Services	Our Lady's Children's Hospital, Crumlin	Specialist	17	11	59%	33%	100%
Acute Paediatric Services	Tallaght Hospital (National Children's Hospital)	Specialist	0	NA	NA	NA	NA
Private	Aut Even Hospital, Kilkenny	Private	0	NA	NA	NA	NA
Private	Beacon Hospital, Sandyford	Private	2	2	0%	*	100%
Private	Blackrock Clinic	Private	3	3	0%	100%	100%
Private	Bon Secours Hospital, Cork	Private	6	5	0%	50%	80%
Private	Bon Secours Hospital, Galway	Private	0	NA	NA	NA	NA
Private	Bon Secours Hospital, Glasnevin	Private	5	2	0%	0%	100%
Private	Bon Secours Hospital, Tralee	Private	2	2	0%	*	100%
Private	Galway Clinic, Doughiska	Private	7	7	71%	0%	100%
Private	Hermitage Medical Clinic, Lucan	Private	2	2	0%	100%	100%
Private	Mater Private Hospital, Cork	Private	1	0	0%	NA	NA
Private	Mater Private Hospital, Dublin	Private	3	3	0%	100%	100%
Private	St Vincent's Private Hospital	Private	2	2	0%	NA	NA
Other	Other non-acute	Other	1	0	0%	NA	NA
TOTAL			**914**	**683**	**14%**	**66%**	**83%**

[1] No data from Jan-Jun 2014; [2] No data from Jul-Dec 2015

† Proportion of cases for which this information was provided; * Data not provided or insufficient data; NA, Not applicabl

Appendix 2 MDRKP OCT correspondence to acute hospitals – (1) December 2013

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

hpsc

25-27 Middle Gardiner Street
Dublin 1, Ireland

17 December 2013

Re: MDR *K. pneumoniae* outbreak

Dear colleague,

As you know colleagues in Galway, working with colleagues in Cork and with the support of isolates provided from many of your laboratories, have identified a national outbreak caused by a multiple drug resistant phenotype of *K. pneumoniae* (MDRKP). Retrospective data submitted from hospital laboratories indicate that this phenotype (ESBL positive, ciprofloxacin and gentamicin non-susceptible) is widespread among clinical samples from both inpatients and outpatient. Examination of EARS-Net data has shown that the prevalence of this phenotype among *K. pneumoniae* bloodstream isolates is increasing (see graph below).

MDR K. pneumoniae bloodstream isolates, and proportion of K. pneumoniae with MDR phenotype, reported to EARS-Net in Ireland, 2006 to Q3 2013

In response to this outbreak, an outbreak control team has been convened at HPSC, which includes microbiologists, epidemiologists and surveillance scientists. Recommendations for interventions, principally based on existing national guidelines (in particular the MDRO and hospital antimicrobial stewardship guidelines) have been drawn up and submitted to senior officials in HSE and DoH. Briefly, the recommended interventions are:

1. Surveillance of infection
2. Screening for gut colonisation
3. Enhanced infection control measures in the acute hospital sector
4. Enhanced antimicrobial stewardship
5. Priority for source isolation in the acute hospital sector
6. Reporting of outcomes
7. Communications and increased awareness
8. Rapid diagnosis and effective treatment

In view of the national and escalating nature of this outbreak we are seeking prospective data from laboratories to assess the scale of the outbreak and monitor progress. We are therefore asking you to provide data, using the attached Excel file, and to report this on a monthly basis commencing 1st January 2014. The data will initially be collected for one quarter, but we may choose to extend or modify this depending on the number of reported isolates.

The case definition for prospective reporting is:
The first isolate per patient per quarter of *K. pneumoniae* derived from any specimen type (both infection and carriage) that are (1) ESBL-producers and non-susceptible to both ciprofloxacin and gentamicin and/or (2) carbapenemase-producers, including isolates that are non-susceptible to ciprofloxacin, gentamicin and 3rd-generation cephalosporins in cases where investigations for ESBLs are not routinely carried out.

As you can see from the above, the case definition is derived from the EARS-Net case definition, to ensure consistency with EARS-Net data and to make data reporting as easy as possible for laboratories. Please note that cases of infection or colonisation with MDRKP are now considered notifiable under the Infectious Diseases (Amendment) Legislation 2011, based on the case definition for "unusual cluster or changing pattern of illness" (see Case Definitions for Notifiable Diseases, 2001, ver 1.1).

Thank you for your cooperation.

Yours sincerely,

Dr Darina O'Flanagan
Director, HPSC

Dr Robert Cunney
Consultant Microbiologist, HPSC

Appendix 3 MDRKP OCT correspondence to acute hospitals – (2) April 2014

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

[National Office for Public Health
Health & Wellbeing Division
Health Service Directorate,
Public Health Department,
Second Floor,
Mount Kennett House,
Henry Street,
Limerick

Tel: (061) 483347
Fax: (061) 464205
Website: http://www.hse.ie

15th April 2014

Re: Update on the national outbreak of multi-drug resistant (MDR)-*Klebsiella pneumoniae* (MDRKP).

Dear Colleague,

Further to correspondence from HPSC, dated 17th December 2013, effective January 1st 2014, the detection of MDR-*K. pneumoniae* (MDRKP) in any clinical specimen (whether infection or carriage) by all Irish microbiology laboratories became notifiable as an 'unusual cluster or changing pattern of illness' under the Infectious Diseases (Amendments) Legislation 2011.
Data for January-February 2014 has been supplied by 39 of 40 microbiology laboratories, with 19 reporting the detection of MDRKP (as per the case definition) from 67 patients in a variety of healthcare settings (hospitals, long-term care facilities and community).
The national outbreak control team (OCT) makes the following interim recommendations for immediate implementation by all healthcare facilities in Ireland:

Case reporting (legal requirement):

- Every microbiology laboratory in Ireland must provide a monthly report to HPSC, using the reporting Excel template, listing the number of MDRKP isolates (first isolate per patient per quarter, whether infection or carriage as per the case definition) detected by the laboratory. Where no isolates have been detected, this must also be reported

Appropriate patient placement and case finding (OCT recommendation):

- An acute hospital inpatient from whom MDRKP is detected requires contact precautions and isolation in a single room (preferably *en suite* or with dedicated commode, where *en suite* facilities are not available)
- Where MDRKP is detected for the first time from an acute hospital inpatient who is not already on contact precautions, the inpatient contacts should be screened for bowel carriage of MDRKP (rectal swab or faeces specimen)

Guidance on patient placement and screening should be sought from the local infection prevention and control team and microbiology laboratory**Preventing transmission of MDRKP [HIQA National Standards: Prevention & Control of HCAI (2009) & Safer, Better Healthcare (2012)]:**

- It is imperative that the physical environment and patient equipment in every healthcare facility (acute and non-acute) are cleaned on a regular basis and that particular attention is paid to frequently-touched surfaces in clinical areas
- It is imperative that every healthcare worker (acute and non-acute) consistently observes his/her opportunities for hand hygiene as per the 'WHO Five Moments'. The HSE has set a target of 90% for healthcare worker hand hygiene compliance in 2014

It is the responsibility of the senior management team within each healthcare facility to ensure that each of the above recommendations is fully implemented. If a deficit in the implementation of any of the above recommendations is identified, it must be reported and escalated via local risk management structures and a quality improvement plan devised and acted upon.
It is recommended that MDRKP be added as an agenda item at meetings of the senior management team and infection prevention and control team of each healthcare facility.

Thank you for your co-operation,

Dr Kevin Kelleher
Assistant National Director,
Health & Wellbeing – Public Health,
Health Service Executive
MCRN 19719

Dr Darina O'Flanagan
Director,
HSE-Health Protection Surveillance Centre
MCRN 07958

References:

1. Health Information & Quality Authority (HIQA) – National Standards for the Prevention & Control of Healthcare Associated Infections (2009)
2. HIQA – Overview Report of Inspection Activity (January 2014)
3. HIQA – National Standards for Safer Better Healthcare (2012)
4. HIQA – National Standards for Residential Care Settings for Older People in Ireland (2009)
5. HSE-HPSC – Report on Hand Hygiene Compliance in Acute Hospitals (Period 6 – October 2013). http://www.hpsc.ie/hpsc/A-Z/Gastroenteric/Handwashing/HandHygieneAudit/HandHygieneAuditResults/
6. HSE-HPSC, RCPI – Guidelines for the Prevention & Control of Multi-Drug Resistant Organisms, excluding MRSA in the Healthcare Setting (2013).

http://www.hpsc.ie/hpsc/A-Z/Microbiology/AntimicrobialResistance/InfectionControlandH&I/Guidelines/

Patient information leaflets on ESBLs and CRE are available on the HPSC website

Appendix 4 – MDRKP OCT correspondence to acute hospital managers – (3) December 2014

Feidhmeannacht na Seirbhíse Sláinte
Health Service Executive

National Office for Public Health
Health & Wellbeing Division
Health Service Directorate,
Public Health Department,
Second Floor,
Mount Kennett House,
Henry Street,
Limerick

Tel: (061) 483347
Fax: (061) 464208
Website: http://www.hse.ie

12th December 2014

Re: Update on the national outbreak of multi-drug resistant (MDR)-*Klebsiella pneumoniae* (MDRKP).

Dear Colleague,

Further to the last correspondence dated 15th April 2014, the national outbreak of MDRKP continues, with a total of 358 cases reported by 33 microbiology laboratories serving 41 acute hospitals from January to September 2014, inclusive. While reported cases were predominantly from acute hospital patients (67%), namely inpatients, outpatients or emergency department attendees, the remainder were reported from residential care settings and primary care. Where information was available for patients who were admitted to hospital, almost half 48% were deemed to be healthcare-acquired MDRKP and patient isolation occurred within 24 hours of MDRKP detection in just 61% of cases. It is of particular concern that 44 of the 358 MDRKP cases (12%) were also carbapenem resistant (CRE), with extremely limited treatment options in the setting of infection.

The national outbreak control team (OCT) requests the senior management team within every acute hospital ensure that each of the recommendations to control the spread of MDRKP, as displayed in the table below is locally implemented as a matter of priority.

A strategic local implementation plan should be devised by April 2015. Where an implementation deficit for any recommendation is identified, it must be reported and escalated via local risk management structures and a quality improvement plan devised and acted upon.

Thank you for your co-operation,

Dr Kevin Kelleher
Assistant National Director,
Health & Wellbeing – Public Health,
Health Service Executive
MCRN 19719

Dr Darina O'Flanagan
Director,
HSE-Health Protection Surveillance Centre
MCRN 07958

	Recommendation	Explanation	Monitoring method
1	**Case reporting** **(legal requirement)**	Every microbiology laboratory in Ireland must continue to provide a monthly report on the number of MDRKP isolates (first isolate per patient per quarter, whether infection or carriage as per the case definition) detected by the laboratory. If no isolates detected, this must also be reported	Data returned by each laboratory monthly, collated at HPSC, with monthly update on reported MDRKP cases provided to OCT
2	**Enhance infection control measures**	**a) Strengthen staff hand hygiene compliance using WHO multi-modal approach – HSE 2014 target = 90% compliance** **b) Ensure adequate infection prevention and control (IPC) resources** **c) Prioritise resource allocation to ensure clinical areas are adequately cleaned**	Local hand hygiene compliance audit and report Local gap analysis of existing IPC resources Local hygiene audit with focus on frequently-touched surfaces
3	**Education**	a) **Staff:** Ensure that staff who have contact with patients receive education on antimicrobial resistance in *Enterobacteriaceae*, understand the terms: MDRKP, ESBLs & CRE and the importance of antimicrobial stewardship, hand hygiene as part of standard precautions and the recommended contact precautions to prevent transmission of resistant *Enterobacteriaceae* b) **Corporate:** Ensure data related to MDRKP surveillance, outbreak and control recommendations are on meeting agendas of national, regional and local senior management committees and clinical directorates c) **Patients & relatives:** Provide educational materials for patients and their relatives	Educational material for staff are available on the HPSC website (See next page for weblink) Add MDRKP as standing agenda item for relevant corporate management meetings Information leaflets for patients & relatives are available on the HPSC website (See next page for weblink)
4	**Antimicrobial stewardship**	Ensure there is an active local antimicrobial stewardship programme, based on the 'SARI Guidelines for Antimicrobial Stewardship in Hospitals in Ireland' (2009) Ensure there is a local system to restrict use of carbapenems and to ensure the prescription of carbapenems is discussed with a clinical microbiologist or infectious diseases physician	Local monitoring and reporting of antimicrobial use and carbapenem use Periodic audit of carbapenem prescriptions for prudent use and reporting of findings
5	**Local surveillance of cases of MDRKP colonisation and infection detected by the laboratory, treatment and outcome**	There should be ongoing local surveillance and monthly reporting, stratified by patient location For inpatients, a record should be maintained on whether or not the patient required treatment for MDRKP infection and the 30 day patient outcome	Local monitoring of weekly, monthly and quarterly cases of MDRKP among inpatients e.g. through local infection prevention and control governance and reporting structures
6	**Ensure the local microbiology laboratory has capacity to detect resistant *Enterobacteriaceae*, including MDRKP from both screening and clinical specimens**	Ensure the laboratory has a locally-validated method which can detect MDRKP in screening and clinical specimens Ensure the laboratory has a standardised reporting method to alert staff when MDRKP is detected in specimens	Local standard operating procedures, monitoring of volume of screening specimens processed, turnaround times etc.

7	**Screen for gut colonisation with resistant *Enterobacteriaceae* in selected hospitalised patients**	Devise a local screening policy, in accordance with the July 2014 'Updated guidelines on screening for carriage of resistant *Enterobacteriaceae* in Ireland'	Periodic audit of compliance with the local screening policy and reporting of findings
8	**Appropriate precautions for patients with MDRKP colonisation or infection**	Where a patient already known to have MDRKP is admitted, isolation in single room with *en suite* or dedicated commode with contact precautions upon admission is recommended Where an inpatient is newly diagnosed with MDRKP colonisation or infection, isolation in single room with *en suite* or dedicated commode with contact precautions is recommended	Local monitoring and reporting of % of MDRKP inpatients not isolated within 24 hours of diagnosis